

## Screening and diagnosis chronic disease by dry chemistry in Arar city, Northern Borders Region, Saudi Arabia

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**Abstract:** In KSA, non-communicable diseases are estimated to account for 71% of all deaths. Point-of-care testing (PoCT) provides timely information to medical teams to improve patient outcomes in critical care settings. **Aim of this study:** to diagnose chronic disease in early stage and validate the Reflotron plus in detection of these diseases. **Subject and methods:** A cross sectional survey included 200 participants randomly selected from governmental institutions in Northern borders region from both sexes aged from 30-40 years old. **Results:** 27% of samples had elevated blood glucose level, lipid profile showed that 21% for Cholesterol, 12% for TG and 30.5% for LDL, 26% had raised blood pressure, 22% were classified as being obese, the sensitivity in DM, Cholesterol, TG and LDL was 92.6%, 90.5%, 91.7% and 90% respectively, while Specificity was 95.9%, 87.9%, 94.02% and 89.9% respectively. **Conclusion:** non-communicable diseases represents a major clinical and public health problem in northern borders region. Reflotron plus is good as screening test.

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### 1. Introduction:

Non Communicable Diseases (NCD) deaths are projected to increase by 15% globally between 2010 and 2020. The greatest increases will be in Africa, the Eastern Mediterranean, and South-East Asia, where they will increase by over 20%<sup>(1)</sup>. A total of 57 million deaths occurred in the world during 2008; 36 million (63%) were due to NCDs, principally cardiovascular diseases, diabetes, cancer and chronic respiratory diseases<sup>(2)</sup>. In KSA, non-communicable diseases are estimated to account for 71% of all deaths<sup>(3)</sup>. Behavioral risk factors including tobacco smoking, alcohol drinking, physical inactivity, sedentary behavior, and obesity are major determinants of adult chronic diseases morbidity and mortality.<sup>(4,5)</sup>

Point-of-care testing (PoCT) has been defined as those analytical patient-testing activities provided within the institution, but performed outside the physical facilities of the clinical laboratories<sup>(6)</sup>. There has been a growing interest in point-of-care testing (PoCT) because of its advantages over standard laboratory procedures, it provides timely information to medical teams, facilitating rational, time-critical decisions, and has been demonstrated to improve patient outcomes in critical care settings<sup>(7)</sup>.

### Aim of the work:

The aim of this study is to diagnose chronic disease in early stage, detect of hyperlipidemia, diabetes mellitus, renal impairment by point care of testing, and validate the Reflotron plus in detection of these diseases, the data collected will be used in reducing chronic disease through encouraging and supporting healthy behaviors and early detection services.

### 2. Subject and methods:

A cross sectional survey included 200 participants randomly selected from governmental institutions in Northern borders region from both sexes, aged from 30-40 years old to detect DM, hyperlipidemia, renal diseases in early preclinical phases of these diseases. Blood samples from the participants was analyzed by special apparatus (Reflotron plus) to measure fasting blood glucose, lipid profile, some of renal function tests.

Early detection of DM by measuring the fasting blood glucose, early detection of hyperlipidemia by measuring cholesterol, HDL and LDL.

All blood samples were taken by needle prick from thumb and then analyses by Reflotron plus apparatus. The Reflotron Plus is an *in vitro* diagnostic device which works on the principle of reflective photometry to determine blood chemistry results

using Reflotron test strips. The Reflotron can be utilized in a clinical health screening setting through to a sports science laboratory; it provides a rapid and intuitive system of testing & results generation with minimal human intervention. Steps such as calibration, sample pre-treatment and calculation of results are all taken care of in this low-maintenance system. The three key steps in a Reflotron test are:

1. Collect blood and apply sample to the reagent strip
2. Insert the reagent strip in the instrument.
3. Read the result, obtained between two and three minutes.

Reflotron has its own separate keyboard through which the sample is assigned to the patient. The instrument saves the result together with the patient data. It can use its own onboard printer to print the result along with date, time and patient name or number.

The results of Reflotron were compared by results of the Dimension apparatus which was used to confirm results of the same samples.

Detection of body mass index by measuring the weight and height of the participants.

### Statistical analysis:

Data was analyzed using SPSS program version 20, qualitative data was expressed in number and percent, Pearson correlation coefficient was also used, Sensitivity, Specificity, positive predicted value (PVP) and negative predicted value (NVP) were used to assess the validity of Reflotron plus.  $P < 0.05$  is considered statistically significant.

### 3. Results:

Table 1 shows blood glucose levels of 200 blood subjects from Northern Borders region. 146 (73%) of the samples had normal blood glucose level whereas, 54 (27%) samples had elevated blood glucose level.

**Table 1:** Distribution of fasting blood glucose level of the study group

	Number	%
Normal	146	73
Elevated blood glucose level	54	27
<b>Total</b>	200	100

**Table 2:** Blood lipid profile of the study group

	Normal level		Border line raised level		Abnormally raised level	
	Number	%	Number	%	Number	%
Cholesterol	91	45.5	67	33.5	42	21
TG	117	58.5	59	29.5	24	12
LDL	79	39.5	60	30	61	30.5

Table 2 shows that 200 blood samples were analyzed from male population of the Northern Borders region. It was found that 91 (45.5%) samples had normal values for Cholesterol, 117 (58.5%) samples had normal values for TG and 79 (39.5%) samples had normal values for LDL. It was also found that 67 (33.5%) samples showed borderline elevation of Cholesterol values, 59 (29.5%) showed borderline elevation for TG values and 60 (30%) samples showed borderline elevation for LDL values. Abnormally raised values were 42 (21%) for Cholesterol, 24 (12%) for TG and 61(30.5%) for LDL.

Table 3 shows that out of 200 subjects 148 (74%) had normal blood pressure while 52 (26%) had raised blood pressure.

Table 4 shows that out of 200 subjects based on BMI values, 2 (1%) were classified as underweight, 54 (27%) were classified as having normal weight, 94 (47%) were classified as being overweight, 44 (22%) were classified as being obese and 6 (3%) were classified as suffering from morbid obesity.

Table 5 summarizes the correlation between fasting blood glucose level and lipids. There was significant positive correlation between fasting blood glucose level and Cholesterol, TG and LDL while there was significant negative correlation between fasting blood glucose level and HDL.

Table 6 summarizes the correlation between lipid levels and BMI. There was significant positive correlation between BMI and Cholesterol, TG and LDL while there was significant negative correlation between BMI and HDL.

Table 7 summarizes the assessment of validity of Reflotron plus in different measurement categories, the sensitivity in DM, Cholesterol, TG and LDL was 92.6%, 90.5%, 91.7% and 90% respectively, while Specificity was 95.9%, 87.9%, 94.02% and 89.9% respectively.

**Table 3:** Classification of the study subjects according to blood pressure values

	No.	%
Normal	148	74
Raised blood pressure	52	26
<b>Total</b>	200	100

**Table 4:** Distribution of BMI values of the study group

	Number	%
Underweight	2	1
Normal	54	27
Overweight	94	47
Obesity	44	22
Morbid obesity	6	3
<b>Total</b>	200	100

**Table 5:** Correlation between fasting blood glucose and lipid profile

	R	P
Cholesterol	0.68	<0.05
TG	0.56	<0.05
LDL	0.65	<0.05

**Table 6:** Correlation between Body Mass Index (BMI) and lipid profile

	R	P
Cholesterol	0.74	<0.05
TG	0.64	<0.05
LDL	0.68	<0.05

**Table 7:** Assessment the validity of Reflotron plus in detection of some chronic diseases:

	Sensitivity	Specificity	PVP	NPV
<b>DM</b>	92.6%	95.9%	89.3%	97.2%
<b>Cholesterol</b>	90.5%	87.9%	77.6%	95.2%
<b>TG</b>	91.7%	94.02%	75.6%	98.2%
<b>LDL</b>	90%	89.9%	77.1%	95.9%

#### 4. Discussion:

The World Health Organization (WHO) reports NCDs to be by far the leading cause of death in the world, representing over 60% of all deaths<sup>(8)</sup>. Early detection of these diseases may help in reducing the complications and the death rate from them. The aim of this study is early diagnosis of chronic disease by point care of testing.

In this study, elevated blood glucose level was found in 27% of the study group, many studies showed the prevalence of diabetes all over the world, worldwide it is expected to show an increase of 42% between the years 2003 and 2025<sup>(9)</sup>. Studies reported prevalence data from the Gulf region revealed high rates in Bahrain (25.7%) and Oman (16.1%)<sup>(10,11)</sup>, Khalid *et al.*,<sup>(12)</sup> showed increase in the prevalence

of diabetes mellitus in Saudi Arabia to 30% which is approximated to our results.

Our study revealed that hypercholesterolemia (HC), Hypertriglycemia and increased level of LDL occurred in 21%, 12% and 30.5% respectively, this is slightly lower than Al-Nozha *et al.*,<sup>(13)</sup> who studied Hyperlipidemia in Saudi Arabia and stated that The prevalence of HC was 54%, Hypertriglycemia prevalence was 40.3% this difference may be due to that the northern borders region is slightly primitive community in relation to many other parts in Saudi Arabia,

In this study person with elevated blood pressure constituted 26% of the study population, this is in agreement with Al-Nozha *et al.*,<sup>(14)</sup> who studied Hypertension in Saudi Arabia and showed that the

prevalence of hypertension was 26.1% in crude terms.

We stated that overweight and obesity (determined by Body Mass Index (BMI)) were 47% and 25% respectively; this is in agreement with many other studies done in Saudi Arabia<sup>(3, 15, and 16)</sup>.

This study revealed that there was significant positive correlation between blood glucose, BMI and Cholesterol, TG and LDL, this is in agreement with Sánchez *et al.*,<sup>(17)</sup> but partially in agreement with Shamaï *et al.*,<sup>(18)</sup> who stated that there was non-significant correlation between BMI and TG which was an unexpected finding that requires further investigation.

In assessment of the validity of Reflotron plus in lipid profile the highest sensitivity was in detection of TG and the least one was in LDL, and as regards specificity the highest was also TG measurement and the least was in detection of cholesterol. This is in agreement with Donal *et al.*, who found that the Coefficient of variation for TG and LDL-C were calculated at 7.51% and 7.71% respectively<sup>(19)</sup>. In detection of blood glucose in our study, the sensitivity was 92.6% and the specificity was 95.9%, this is agreed with Holtzinger *et al.*, who found that Within-run precision for each glucose meter was less than 5% at 39 to 47 mg/dL of glucose<sup>(20)</sup>.

### Conclusion

The prevalence of DM, HTN, Obesity and high lipid profile is high among the Saudi population in northern borders regions and represents a major clinical and public health problem. Reflotron plus is good as screening test. Continued screening and early intervention are recommended to decrease complications of non-communicable diseases.

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