



## Assessment of Procalcitonin (PCT) Level Among Type-2 Diabetic Mellitus with septic foot

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### Abstract

**Introduction:** Procalcitonin (PCT) is marker of inflammatory response, stimulated by bacteria products endotoxins and cytokines [IL.1, IL.2, IL.6 and TNF alpha].

**Aim:** to assess PCT level and to investigate diagnostic value as an early marker for septic foot among type 2 DM.

**Material and Methods:** In cross-sectional hospital based study (n 40) septic foot patients (age ranged from 41 to 78 years old) and (n 40) DM without septic foot as control group were enrolled. Specimen were collected from Zeenam Specialized center, Khartoum State during the period from June to July 2017. Serum PCT levels were measured using ICROMA<sup>®</sup> instrument.

**Results:** Analyses of frequency showed that, septic foot was common in female 58% than male 42%, while the majority are obese 70% followed by 13% overweight and 17% normal weight. Moreover poor control septic foot patients account 1.5:1 fold. Comparison revealed significant increase of PCT in diabetic septic foot when compared with control (p-value 0.000). Dotblot regression showed PCT correlate positively with age R=0.153 P=0.0347, while correlated with HbA1c R=0.368, P=0.020. Moreover, inverse correlation was observed between PCT, duration of disease and BMI (R=0.413, P=0.008 and R=0.458, P=0.003) respectively.

**Conclusions:** The data that, septic foot is common in obese DM Sudanese female. PCT is significantly higher in DM septic foot patients. Thus could be useful an early diagnostic marker for septic foot.

**Key words:** PCT, septic foot, type-2 DM, obese, Sudan.

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**Introduction:** Diabetes mellitus is a defect on carbohydrate metabolism some patients may experience acute life threatening hyperglycemic episodes such as sepsis and septic shock (1). Prevalence of diabetic mellitus is unknown because of missing non-diagnosed subject, but the diagnosed cases according to world health organization (WHO) in 2017 are 422 million adult. Diabetes are also at risk of developing wounds and sores that do not heal well, they are at high risk of developing infection. Moreover, again because of the diabetes, the infections can get severe quickly. When infection overwhelms the body, the body can respond by developing sepsis and going into septic shock. Sometimes called blood poisoning, sepsis is the body's often-deadly response to infection or injury. Sepsis kills and disables millions and requires early suspicion and rapid treatment for survival. Sepsis is a life-threatening condition that arises when the body's response to infection injures its own tissues and organs (2). It is from the micro vascular complications, the loss of a limb or foot is

he most feared complications of diabetes and still, the foot problems is neglecting and remain one of the commonest reasons for diabetic patients to hospitalize. Diabetic foot ulcers are common in diabetic patients has incidence rate 25% of patient with diabetic became infected. These minor routine lesions can be the harbinger of infections and diabetic foot ulcers and eventually lead to complications. Diabetic foot ulcers precede almost 85% of amputations, (3).

Procalcitonin (PCT) is acute phase reactant that stimulated by bacteria endotoxins and cytokines [IL.1, IL.2, IL.6 and TNF alpha, PCT 116 amino acid, produce by C. cell of thyroid gland. Where PCT can be produced by several other cell types from wide range of organs in response to inflammation. The level of PCT in the blood stream of healthy individual is blow the limit of detection (0.01ng/l) of clinical assays (4). PCT was raised in response to proinflammatory stimulus especially of bacterial origin. PCT has half-life 25 to 30 hours and increase in plasma 3 to 6 hours of stimulus (5).situation in Sudan, aim of this study.

**Materials and Methods:** This is analytical cross-sectional hospital based study carried out in Khartoum state [Zeenam specialized center] during the period from June to July 2017. Eighty DM type 2 patients were enrolled in this study, (n 40) DM with septic foot as case and (n 40) DM without septic foot as control group.

**Ethical Consideration:**Ethical clearance approved from local Faculty committee of Sudan international university. Verbal inform consent was obtained from each participant before enrollment in the study.

### **Sampling collection and processing:**

Venipuncture (3 ml) was collected under septic conditions from each participants. Serum has obtained after centrifugation at 3000-4000 RPM for 10 min, then serum separated in new containers and stored at  $-20^{\circ}\text{C}$  until analyzed. Serum PCT level measured by using ICROMA<sup>®</sup> instrument. In addition, HbA1c measured by using MISBA-i2 instrument.

**Data analysis:** Data was analyzed using SPSS version 21. Mean $\pm$ SD of all the variables was determined. Independent *t*-test was applied to compare the significance of difference of parameters between two groups. Pearson's correlation coefficient was determined to evaluate correlation between different parameters *p*-value  $\leq 0.05$  was considered as significant.

**Results:** Distribution of the gender among the case group shows that female 1.4 and male 1 fold, (Figure 1).

Frequency of Wight was 70% were obese, 13% over weight and 17% are normal, (Figure 2).

The result show that poor control was 60% and good control 40% 1.6 to 1 fold of control, (Figure 4).

The result of independent T-test show that, the mean of PCT levels significantly increased in septic foot ( $1.49\pm 0.96\text{ng/ml}$ ) as compared to control ( $0.18\pm 0.11\text{ng/ml}$ ) with *p*-value 0.000, presented in (Table1).

Correlation showed that, the HA1c levels in septic foot was correlated with PCT levels ( $R=0.368$ ,  $P=0.020$ ), (figure 4).

PCT levels was inversely correlated with duration of the septic foot ( $R=0.413$ . $P=0.008$ ), (Figure 5).

PCT level was inversely correlated with BMI positively correlated with age ( $R=0.153$   $P=0.347$ ) ( $R=0.458$ ,  $P=0.003$ ) (Figure 3.6). In addition, (Table 3.2).

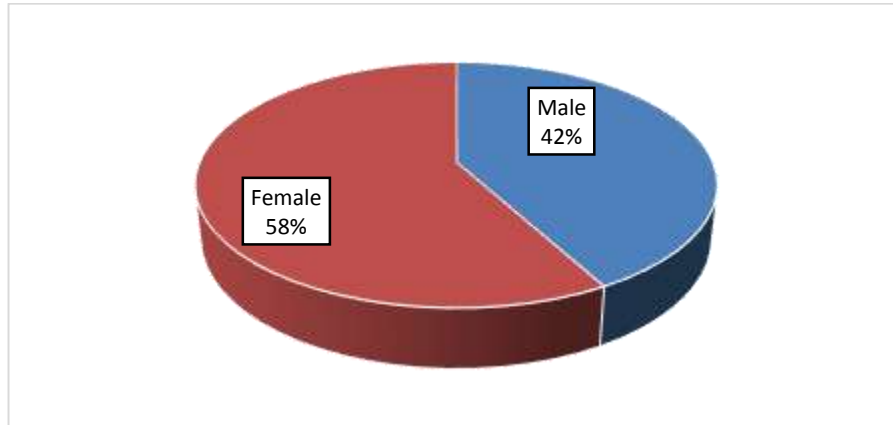


Figure1: Shows the gender distribution among case group.

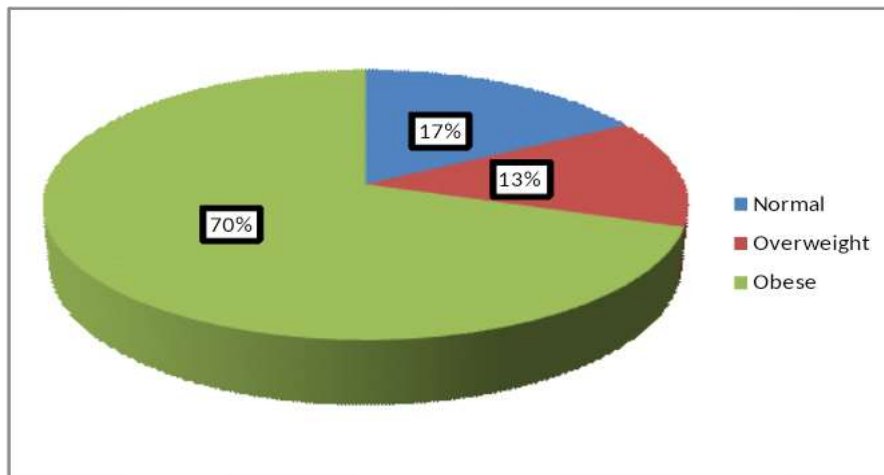


Figure2: Shows the frequency of the septic foot among BMI.

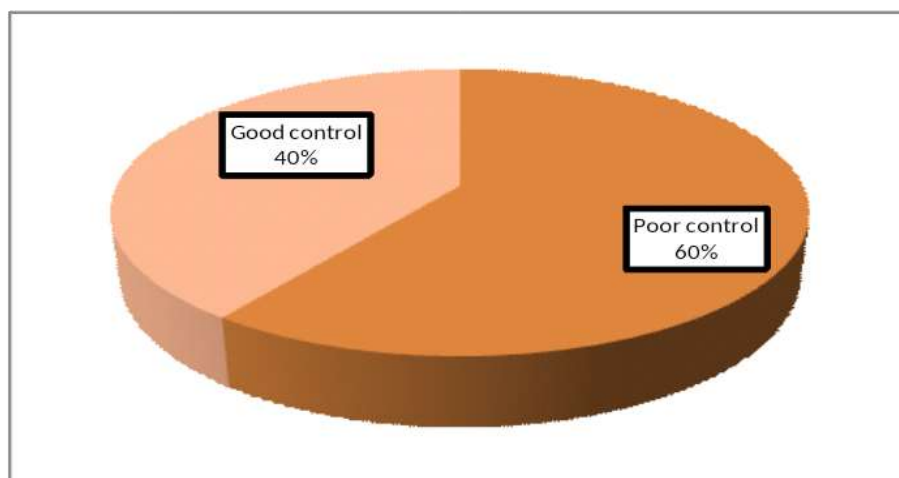
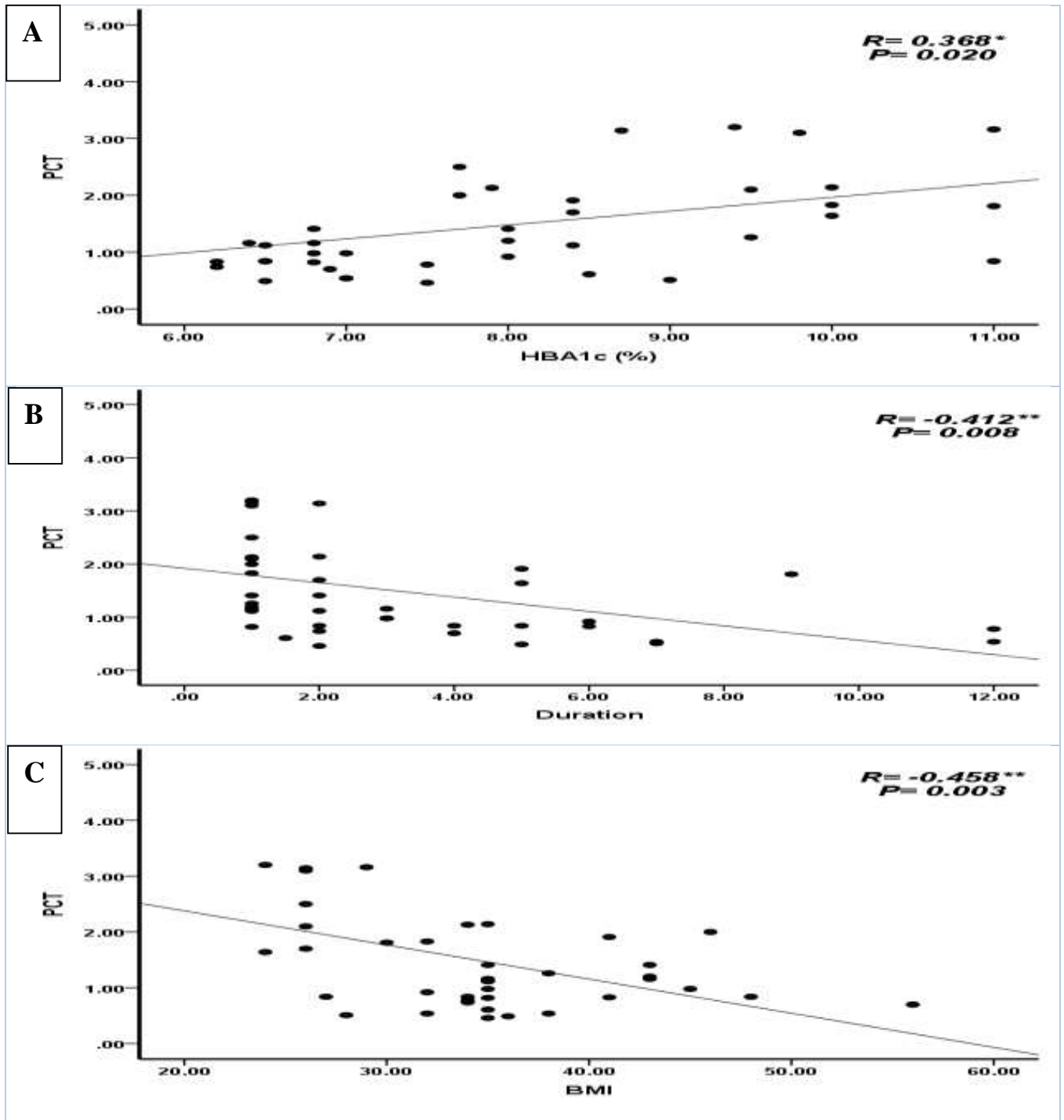


Figure3: Shows the frequency of diabetic good control and poor control.

**Table 1:** Mean concentration comparison of PCT levels among the study groups:

Parameters	Case (Mean ±SD)	Control (Mean ±SD)	P-value
PCT	1.49±0.96	0.18±0.11	0.000
HBA1c (%)	8.03±1.45	8.99±1.63	0.031
BMI	34.6±7.20	34.6±7.57	0.988
Age	58.8±10.2	55.8±11.1	0.215



**Figure 4.** Dotplot regression showed A: correlation between PCT and HbA1c, B: PCT and duration and C: PCT and BMI. R= positive or negative correlation, P= strength of correlation.

**Discussion:** Diabetes mellitus is diseases that affect glucose metabolism that can cause serious complications, such as septic foot. Previously researchers investigate the association of PCT and DM septic foot as inflammatory marker.

In fact that, age and sex have globally identified as risk factors for diabetic mellitus (6, 7). Therefore, the present study revealed that, the percentage of diabetes septic foot is more common in female 58% than male 42%. Therefore, in agreement with and that previous finding that, there are more women with diabetic than male (6, 7), thus justified by men were more physically active than women were, and this probably could have enhanced the improved insulin sensitivity in men than women of the same age group advantage (8).

Frequency analyses also found that, more of our population were obese 70% followed by 13% over weight and 17% normal weight. Indeed obesity increase risk to develop DM that fat is deposit on the cell membrane that affect receptor sensitivity to insulin (1). Therefore obese DM patient susceptible to septic more than non-obese DM. In addition to that, 1.5:1 fold of our population was poorly control 60% and 40% was good control. Since concurrent with previous state that, poor control are more susceptible to devolved diabetic septic foot (9).

Independent t-test analyses provide experimental evidence that, mean PCT level was significantly increased in DM septic foot patients when compared with control  $p= 0.000$ . This finding in agreement with study noted that, PCT increase in septic foot diabetic disease (10). In fact that, PCT level is marker of bacterial infection in septic foot ulcer, due to inflammatory response (11). Indeed

the diagnosis of sepsis is challenge thus assessment is unreliable because many culture sample do not yield microorganisms in these patients (10).

Interestingly our results revealed positive correlation between PCT and HbA1c  $R= 0.368$ ,  $P= 0.020$ ), which indicate that, poor control are more vulnerable to septic foot. Moreover dot blot regression showed that, PCT levels inversely correlated with duration of sepsis  $R= 0.413$ ,  $P=0.008$ . Researchers reported that, PCT is acute phase hormone that appear in early infection in response of various cytokines such as IL-1, IL-6, and TNF, and it became detectable within 3-4 horse and peak 6-24 hours (12,13). In addition PCT level was inversely correlated with MBI  $R= 0.458$ ,  $P= 0.003$ .

**Conclusions:** The study concludes that, septic food is common in obese DM Sudanese female. PCT is significantly higher in DM septic food patients and positively correlate with HbA1c. Thus could be useful predictor and early diagnostic marker for septic food.

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