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Research Article

**A CROSS-SECTIONAL RESEARCH ON POOR BLOOD
SUGAR CONTROL AND HIGHER LEVELS OF C-REACTIVE
PROTEIN (CRP) IN THE DIABETES MELLITUS (DM)
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Background: Globally Diabetes Mellitus (DM) is the most harmful public health disorder & diabetic foot is known to be as the most often occurring cause of non-traumatic amputation of lower limbs in Pakistan. The level of interest is quite popular in many inflammatory markers. And also, their relation with several chronic complications of diabetes mellitus. In Pakistani population, here is a scarcity of data on the subject.

Methods: In this research, hundred patients were studied under cross-sectional study. The patients were admitted to a General Surgery Department of Services Hospital, Lahore (January - November, 2017). For statistical analysis, CRP level & plasma glucose level & fasting were thought as the relevant variables.

Results: In the final analysis, a total number of hundred patients were included. With Wagner's grade, the proportion of subjects was found as grade one to grade five ulcers as 48 %, 27 %, 16 %, 3 % & 6 % respectively. Out of the population sampling, 73 % of patients had CRP value greater than forty & 27% of patients had CRP value less than forty. With Higher CRP level, the proportion of subjects greater than forty indicated increasing inclination with increasing level of fasting blood sugar & post prandial blood sugar in samples under study. The percentage of people who suffered amputation was 27.5 % in people with CRP value greater than forty. It was found just 6.85 % of people with CRP value less than forty. The association among CRP values & amputation was statistically important. (P value 0.046).

Conclusions: In the under-research samples, the research has proved a strong positive link between poor blood sugar control & higher CRP levels. This research has also showed a positive link among amputation & higher CRP levels.

Keywords: Diabetic foot, Diabetes mellitus (DM), Amputation, C-Reactive protein.

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INTRODUCTION:

In the atherosclerotic disease pathogenesis, inflammation has been found to be an indispensable cause [1, 2]. An acute-phase response protein is high sensitivity C-reactive protein (CRP) which is thought a marker of inflammation & also an independent predictor of cardiovascular disease (CVD). It includes stroke, sudden cardiac death, peripheral arterial disease & myocardial infarction in seemingly vigorous people [3, 5]. Inhibiting prostacyclin synthesis in endothelial cells & promoting adhesion molecule expression, CRP may also act directly on atherosclerosis. It results in endothelial dysfunction [6, 9]. Increasing evidence showed that diabetic individuals have higher concentrations of CRP as compare to nondiabetic individuals. It suggests an enlarged part of inflammation in the accelerated atherosclerosis observed in these patients [10, 14]. Growing exponentially across the world, Diabetes is a harmful public health problem. The danger of CVD is 2 to 4 times more in type two diabetics & greater than fifty % of all diabetic patients who expire due to CVD [15]. Diabetic foot is one of the common complications of long term diabetes. [December 2017] Vol. Bacterial infections are the most often found foot infections of patients with diabetes in clinical practice [16]. Such infections along with their sequelae make large disability. It mostly become the reason for lower limb amputation [17].

Some patients need to undergo major amputation or a limb salvage operation even along with suitable cure [18]. Owing to physical impairment, such operations are a big emotional & social pressure to the patients. They are also a financial burden on patients [19]. Prolonged hyperglycaemia can initiate active micro inflammation systemically according to our hypothesis. It was shown by an increase in CRP levels & this type of inflammation could be linked with several complications of the diabetic foot.

To judge the link between glycaemic control & serum CRP levels in patients with type two Diabetes mellitus presenting with diabetic foot were the aims of this research. Furthermore, it was aimed to correlate the level of CRP with sequelae of diabetic foot in the samples under research.

METHODS:

In this research, hundred patients were studied under cross-sectional study. The patients were admitted to a General Surgery Department of Services Hospital,

Lahore (January - November, 2017). Seriously ill patients were excluded from the study. Institutional Human Ethics committee approved the research. Informed consent was taken from all eligible participants in black and white.

Every participant underwent thorough clinical examination, after taking informed consent. Venous blood in the quantity of five ml was drawn under aseptic conditions. This blood was sent to laboratory for routine blood inquiries. Blood sugar values including fasting, post prandial & C-reactive protein levels were examined in all patients. As per the hospital protocol, patients underwent appropriate evaluation & were properly managed. Plasma glucose levels, CRP levels & fasting were taken as the relevant variables for statistical analysis.

With Higher CRP level greater than forty, the proportion of subjects showed increasing trend. With increasing level of post prandial blood sugar in study population from 11.11 % in people with PPBS 200 to 240 to 61.54 % in people with PPBS greater than 360.

For quantitative variables, descriptive analysis was done by mean & standard deviation. For categorical variables, descriptive analysis was done by frequency and proportions. Using standard cut-off values, the values were grouped into categories. Chi square test was used to check link between blood sugar levels and CRP levels & it was done by cross tabulation & comparison of %ages. IBM SPSS statistical software was used to analyse data.

RESULTS:

In the final analysis, a total of hundred patients were included. The range of fasting blood sugar value was from 127 to 225 & minimum value is presented 127 & maximum value 225. In the table below, patients are divided into 5 groups to find the distribution. The rate of subjects with fasting blood sugar was 21 % 27 % & 22 % respectively for the ranges between 126 to 146, 147 to 166, 167 to 186. With increasing level of fasting blood sugar in study population, the proportion of subjects with Higher CRP level greater than forty showed increasing trend. Ranging between 126 to 146 g m / dl, it was only 14.29 % in people with fasting sugar level. It was increased constantly & was 61.54 % in people with fasting blood sugar level greater than 206 mg/dl. The link between CRP values & fasting blood sugar level was statistically important (p value 0.020).

Table – I: Descriptive analysis of fasting blood sugar in study population

Wagner’s Grade	No of Cases	Percent
One	48	48
Two	27	27
Three	16	16
Four	3	3
Five	6	6
CRP Value	No of Cases	Percent
< 40	73	73
> 40	27	27
Outcome	No of Cases	Percent
Amputated	9	9
Healed	91	91

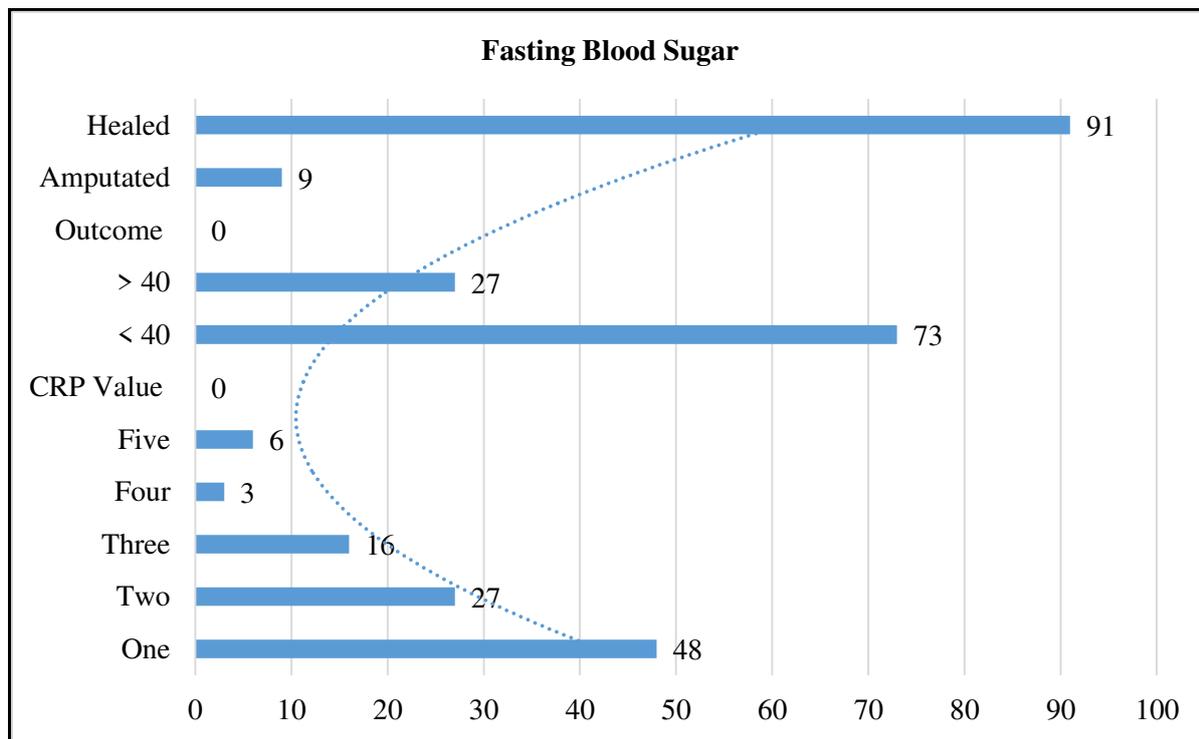


Table – II: Descriptive analysis of Wagner’s grading in study population

Parameters	Number of Cases
Fasting blood sugar	
126 - 146	21
147 - 166	27
167 - 186	22
187 - 206	17
> 206	13
Post-prandial blood sugar	
200 - 240	18
241 - 280	31
281 - 320	23
321 - 360	15
> 360	13

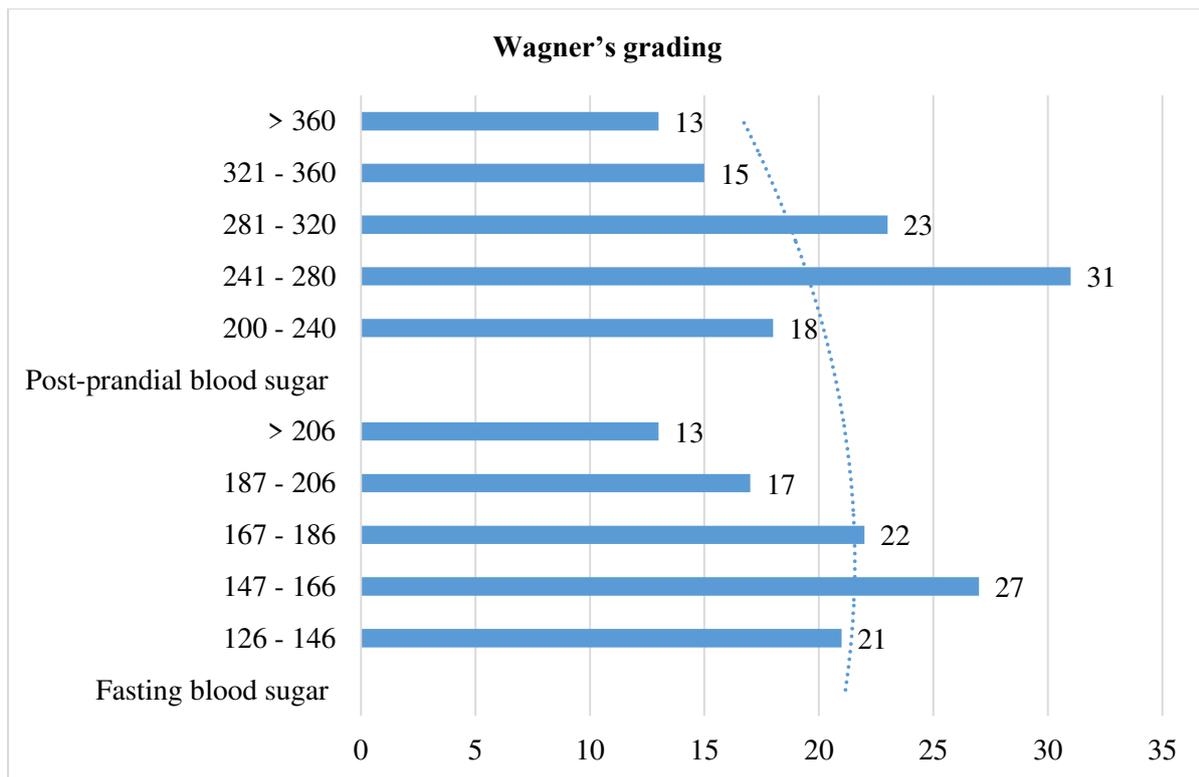


Table – III: Association between sugar levels and CRP values in the study population

Parameters		No of Cases	CRP Above 40		CRP Under 40		Chi-Square Value	P-Value
			Number	Percent	Number	Percent		
FBS (Fasting blood sugar)	126 – 146	21	3	14.29	18	85.71	11.561	0.02
	147 – 166	27	5	18.52	22	81.48		
	167 – 186	22	5	21.74	18	78.26		
	187 – 206	17	6	35.29	11	64.71		
	Above 206	13	8	61.54	5	38.64		
PPBS (Post prandial blood sugar)	200 – 240	18	2	11.11	16	88.89	12.702	0.012
	241 – 280	31	6	19.35	25	80.65		
	281 – 320	23	5	21.74	18	78.26		
	321 – 360	15	6	40	9	60		
	Above 360	13	8	61.54	5	38.46		

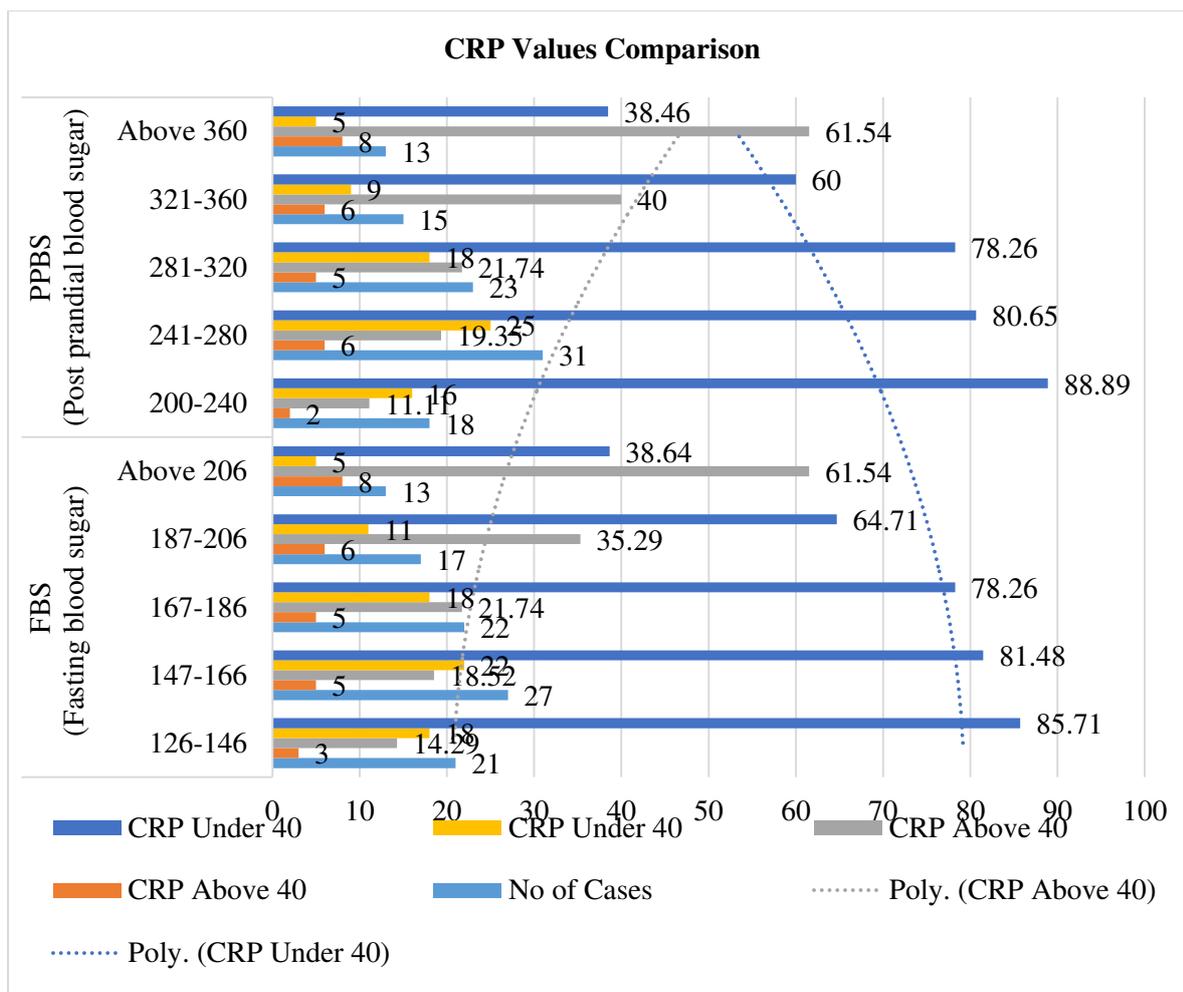
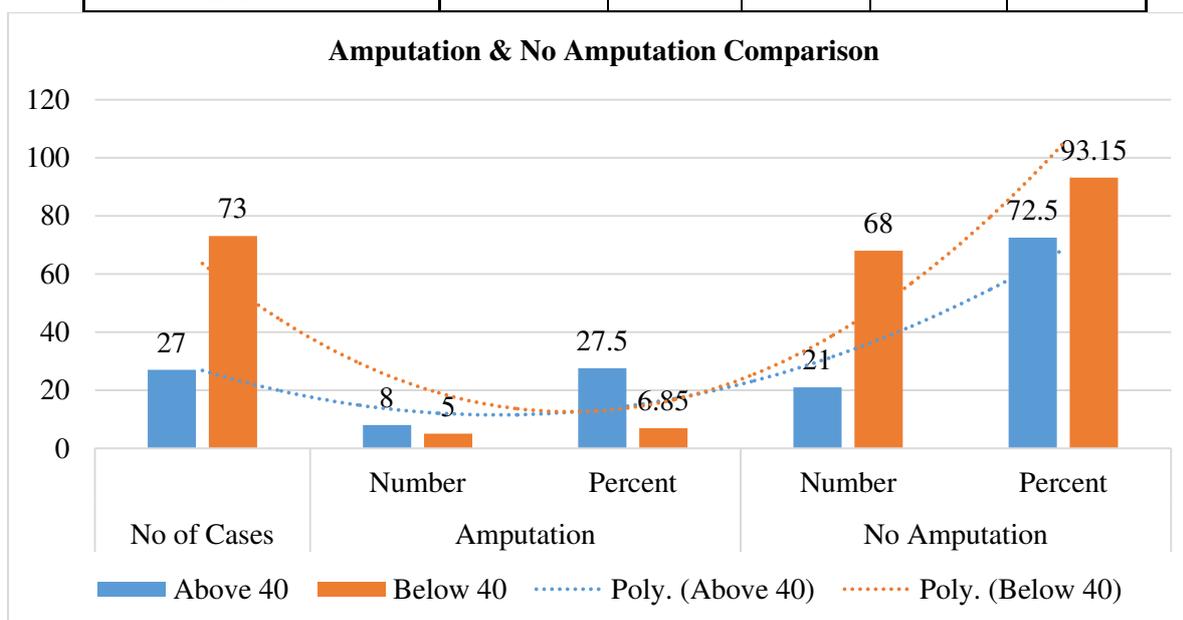


Table – IV: Association between CRP value and amputation in study population

Value of C-Reactive Protein (CRP)	No of Cases	Amputation		No Amputation	
		Number	Percent	Number	Percent
Above 40	27	8	27.5	21	72.5
Below 40	73	5	6.85	68	93.15



The fasting blood sugar levels were 187 to 206 among 17 % under research population. Furthermore, 13 % of the subjects had fasting glucose greater than 206 g m / dl. Based on the post prandial blood sugar values, patients are divided into 5 groups.

Maximum sugar level 394 & minimum was 203. The divisions are presented in the table shown above. With blood sugar level ranging between 200 to 400, the proportion of subjects was 18 %. Almost 31 % & 23 % of the subjects had post prandial blood sugar ranging between 241 to 280 & between 2821 to 320 g m/ dl. The percentage with post prandial sugar level above 360 & ranging between 321 to 360 were 23 % & 15 % respectively (Table – I).

The link among PPBS & CRP values was statistically important (p value 0.012)

With Wagner's grade, the proportion of subjects was found as grade one to grade five ulcers as 48 %, 27 %, 16 %, 3 % & 6 % respectively. Out of the population sampling, 73 % of patients had CRP value greater than forty & 27 % of patients had CRP value less than forty. From hundred patients, 13 % got amputated & 87 % patients wound healed without complications (Table – II).

The percentage of people who suffered amputation was 27.5 % in people with CRP value greater than forty. It was found just 6.85 % of people with CRP value less than forty. The association among CRP values & amputation was statistically important. (P value 0.046) (Table – IV).

DISCUSSION:

One of the major reasons of death is diabetes & its complications. Spread of Diabetes globally is about two hundred & fifty-two million. Presence of diabetes in Pakistan is forty-two million & age ranging from middle & old people. Over a period of time, there is twenty percent danger of increasing diabetic ulcer in diabetic patients. CRP is one of the oldest revealed biomarkers employed to identify infection [20]. A common but serious complication in lower extremity with (15% – 25%) is diabetic foot. These are likely to experience such ulcers during their lifetime [21]. High pressure in soles, autonomic neuropathy & poor glycaemic control are the factors which are responsible to the development of ulcer. These are also one of the big reasons of nontraumatic amputation of lower limb. In terms of wound healing & amputation, the research shows an important level of correlation among glycaemic control CRP level & outcome.

With diabetic foot, out of hundred patients, twenty-seven had CRP levels greater than forty. Only nine out of these had their foot amputated. After surgical treatment the wounds of others were healed. After

analysing ninety diabetic foot, Lin C W *et al.* concluded that reduced c reactive protein level (< 50 mg / l) shows good prognosis in diabetic foot patients. Of Dokuz Eylul university hospital (2003 – 2008), Baris A Kinci examined 165 ulcer patients. He reached at the result that post treatment CRP values were strongly related to amputations.

With Higher CRP level greater than forty, the rate of subjects showed increasing trend with increasing level of fasting blood sugar in the under-research population. The link among CRP values & fasting blood sugar level was statistically important (p value 0.020).

With Higher CRP level greater than forty, the percentage of subjects showed increasing trend with increasing level of post prandial blood sugar in study population from 11.11%. It was shown in people with PPBS 200 to 240 to 61.54% & in people with PPBS more than 360. The link among CRP values & PPBS was statistically important. (p value 0.012). Timely identification & proper treatment are therefore indispensable to avoid amputation.

CONCLUSION:

In the under-research samples, the research has proved a strong positive link between poor blood sugar control & higher CRP levels. This research has also showed a positive link among amputation & higher CRP levels. To recognise the exact role of CRP & its link with complications of diabetes, there must be a study on greater scale on the subject. The further research must be independent of the potential confounding variables.

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