

## ANAEMIA AND OXIDATIVE STRESS IN LONG STANDING DIABETES MELLITUS PATIENTS

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The association between anaemia and diabetes mellitus in the Sri Lankan population, however, is unknown. Diabetes results in increased oxidative stress contributing to the development and progression of its complications. There is a need to continue to explore the relationship between oxidative stress, anaemia, diabetes and its complications. The present study was conducted to determine the association of anaemia and oxidative stress in long standing diabetes mellitus in relation to age, duration of diabetes, body mass index, fasting blood glucose, HbA1c and albuminuria.

The study group comprised of 50 female and male patients with diabetes mellitus for more than five years and age between 20 – 65 years and 30 apparently healthy subjects as controls. Heights and weights were measured to estimate the body mass index. Fasting venous blood and morning urine sample were collected for analysis of fasting blood glucose (FBG), glycated haemoglobin (HbA1c), haemoglobin (Hb) concentration, total antioxidant capacity (TAC), protein thiols, thiobarbituric acid reactive substances (TBARS) and urine microalbumin to creatinine ratio (UMA/UCr). Statistical analysis was done using MINITAB version 16.0.

BMI, FBG, HbA1c, UMA/UCr and TBARS values were significantly ( $P < 0.001$ ) higher in the diabetic patients ( $25.8 \pm 2.2 \text{ kg/m}^2$ ;  $164.6 \pm 71.4 \text{ mg/dL}$ ;  $8.4 \pm 1.4 \%$ ;  $249 \pm 1107 \text{ mg/g}$ ;  $2.22 \pm 1.58 \text{ } \mu\text{mol/L}$  respectively) than the control subjects ( $22.5 \pm 2.2 \text{ kg/m}^2$ ;  $91.0 \pm 7.5 \text{ mg/dL}$ ;  $5.1 \pm 0.5 \%$ ;  $1.26 \pm 1.53 \text{ mg/g}$ ;  $1.21 \pm 0.60 \text{ } \mu\text{mol/L}$  respectively). Age, duration of diabetes, FBG, HbA1c and TBARS values were higher in microalbuminuric than normoalbuminuric patients and more severe in proteinuric patients. Hb ( $P < 0.001$ ), TAC ( $P = 0.008$ ) and protein thiols ( $P < 0.001$ ) were significantly lower in the diabetic patients ( $12.1 \pm 1.4 \text{ g/dL}$ ;  $875.2 \pm 144.2 \text{ } \mu\text{mol/L}$ ;  $485.3 \pm 60.1 \text{ } \mu\text{mol/L}$  respectively) than the control subjects ( $14.4 \pm 1.5 \text{ g/dL}$ ;  $975.1 \pm 163.4 \text{ } \mu\text{mol/L}$ ;  $598.1 \pm 49.2 \text{ } \mu\text{mol/L}$  respectively) and the lowering was more severe in patients with proteinuria. Overall prevalence of anaemia was 58% in diabetic patients. Prevalence of anaemia was 39.4% in normoalbuminuric ( $n=13$  out of 33), 92.3% in microalbuminuric ( $n=12$  out of 13) and 100% in proteinuric patients ( $n=4$ ). Haemoglobin had a significant negative correlation with age ( $r = -0.410$ ,  $P < 0.01$ ), duration of diabetes ( $r = -0.673$ ,  $P < 0.001$ ), FBG ( $r = -0.443$ ,  $P = 0.001$ ), microalbuminuria ( $r = -0.457$ ,  $P < 0.01$ ), TBARS ( $r = -0.445$ ,  $P < 0.01$ ) and significant positive correlation between urine creatinine ( $r = 0.346$ ,  $P < 0.05$ ), TAC ( $r = 0.580$ ,  $P < 0.001$ ) and protein thiols ( $r = 0.558$ ,  $P < 0.001$ ) in diabetic patients. There was a significant positive correlation between microalbuminuria and duration of diabetes ( $r = 0.697$ ,  $P < 0.001$ ), FBG ( $r = 0.454$ ,  $P = 0.001$ ), and TBARS ( $r = 0.417$ ,  $P < 0.05$ ) in diabetic patients. TAC values showed significant negative correlation with duration of diabetes ( $r = -0.706$ ,  $P < 0.001$ ), FBG ( $r = -0.480$ ,  $P < 0.001$ ) and microalbuminuria ( $r = -0.398$ ,  $P < 0.05$ ). Strong positive correlation was observed between FBG and HbA1c ( $r = 0.733$ ,  $P < 0.001$ ).

Weight, height, HbA1c, FBG, Hb, UMA and UMA/UCr were significantly ( $P < 0.05$ ) higher in males compared to females patients. Compared with the controls and controlled diabetic patients, Hb concentration, urine creatinine, TAC and protein thiols were lower in the uncontrolled diabetic patients. Compared with the controls, FBG, HbA1c, urine albumin to creatinine ratio and TBARS values were higher in controlled diabetic patients and more severe in the long term uncontrolled diabetic patients. In conclusion, anaemia and oxidative stress is associated with long standing diabetes mellitus and the derangement is higher in proteinuric patients.