



# EFFECTS OF HYPERGLYCEMIA AND IRON DEFICIENCY ON KIDNEY AND HEART FUNCTION IN TYPE 2 DIABETES DISEASE

BELMA AŠČIĆ-BUTUROVIĆ<sup>1\*</sup>, BEĆIR HELJIĆ<sup>1</sup>

1. Clinic of Endocrinology, Diabetes Mellitus and Metabolic Diseases, University Clinical Center of Sarajevo, Bolnička 23, 71 000 Sarajevo, Bosnia and Herzegovina.

\* Corresponding author

## ABSTRACT

Untreated anemia can cause significant cardiac and kidney damage. The aim of this study was to investigate the efficiency of anemia and hyperglycemia treatment in type 2 diabetes and their impact on kidney and heart impairment. The study is clinical retrospective and prospective and it was conducted in Clinic of Endocrinology, Diabetes Mellitus and Metabolic Diseases, University Clinical Center of Sarajevo. Prior to the study all patients were taking oral hypoglycemic drugs including sulfonylureas and biguanides. These subjects were put on 2 times daily fix mix insulin and biguanides after lunch. Each day, subjects received Iron tab 1x100 mg/day, and C vitamin 1x100 mg/day. The results of our study are showing that effective treatment of glycaemia and anemia in patients with diabetes, reduces blood pressure, urine albumin secretion and pulse rate, diminishing cardiovascular damage and improving kidney function.

**KEY WORDS:** anemia, diabetes mellitus, heart failure, kidney failure

## INTRODUCTION

Anemia is associated with macrovascular morbidity. People with diabetes have suffered from anemia for a number of years before receiving treatment. Untreated anemia can cause significant cardiac and kidney damage. Heart has to work harder to pump blood around the body due to the limited amount of oxygen – carrying hemoglobin through the blood stream, what can deteriorate a high risk of coronary heart disease in people with type 2 diabetes (1, 2, 5,6). Patients with chronic kidney disease and anemia experience an 80% increased risk of stroke compared to patients without chronic kidney disease. Anemia therapy in patients with heart failure may reduce the risk of subsequent hospitalization, and anemia therapy in patients with chronic kidney disease not on dialysis may reduce the risk of progression of chronic kidney disease (2,3).

## OBJECTIVE

Our aim was to investigate the efficiency of anemia and hyperglycemia treatment in type 2 diabetes and their impact on kidney and heart impairment.

## PATIENTS AND METHODS

This study was conducted in Clinic of Endocrinology, Diabetes Mellitus and Metabolic Diseases, University Clinical Center of Sarajevo. Thirty subjects with type 2 diabetes were enrolled in this study, during 12 weeks. There were treated in outpatients department of the hospital. Prior to the study all patients were taking oral hypoglycemic drugs included sulfonylureas and biguanides. These subjects were put on 2 times daily fix mix insulin and biguanides after lunch. Each day, subjects received Iron tab 1x100 mg/ day, and C vitamin 1x100 mg/day. HbA1c levels, BMI, Hct, Hgb, MCH, urine albumin secretion (after 8 h of rest, 2 urine samples, urine was sterile, in non- ketotic patients (ketostix reaction less than ++), blood pressure, pulse rate were monitored prior and after 12 – week study. Criteria of good diabetes control were done by using fasting blood sugar (3,1 – 6,1 mmol/l), urinary sugar negative, urine albumin secretion negative, HbA1c <6%, blood pressure < 130/80 mmHg, Hct (0,37 – 0,47 L/L) Hgb(120-160 g/l) MCH (27,0 – 31,0 pg), serum iron. These subjects were put on 2 times daily fix mix insulin and biguanides after lunch.

## RESULTS

Prior to the study these subjects had mean HbA1c level 9,28%, BMI 26,64 kg/m<sup>2</sup> and Hct 0,35 L/L, Hb 125,2 g/L, MCH 28,5 pg, mean albumin secretion in urine 0,493 g/dl (after 8 h of rest, 2 urine samples, urine was sterile, in non- ketotic patients (ketostix reaction less than

++) mean blood pressure 149,2/91,7 mmHg and mean pulse rate 96/min. After 12 weeks of switching subjects on insulin and biguanides therapy, and receiving Irons tablets, mean HbA1c level was significantly reduced ( $p < 0,01$ ) to 7,62 % (S.D.= 0,5), BMI was decreased to 25,7 kg/m<sup>2</sup> ( S.D.= 0,5), mean blood pressure was significantly reduced ( $p < 0,01$ ) to 133,9/85,5 mmHg ( S.D.= 0,5) and urine albumin secretion was significantly reduced ( $p < 0,05$ ) to 0,16g/dl ( S.D.= 1,4). HCT 0,40 L/L (S.D. 1,22)  $p < 0,006$ , Hgb 139,6, (S.D.= 2,5)  $p < 0,01$  and MCH 29,4 (S.D.= 0,46) levels were improved. Patients stop to complained of tiredness and depression. Mean pulse rate was improve to 84/min. For statistical analyses we used student T – test to prove significant differences with  $p < 0,05$ , comparing parameters prior and after the study.

## DISCUSSION

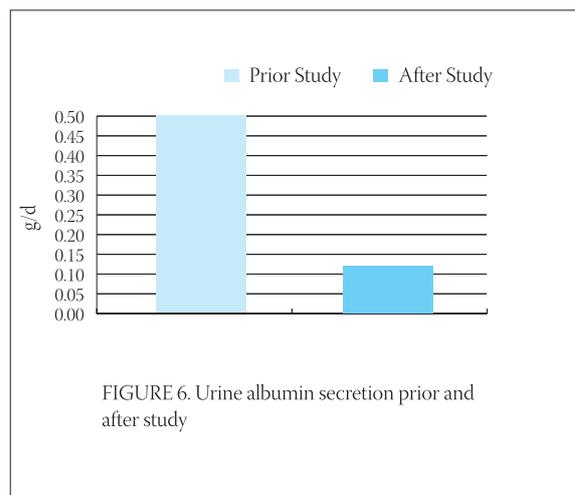
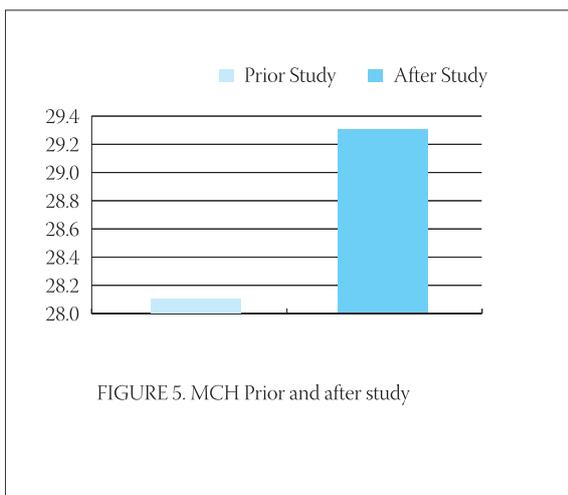
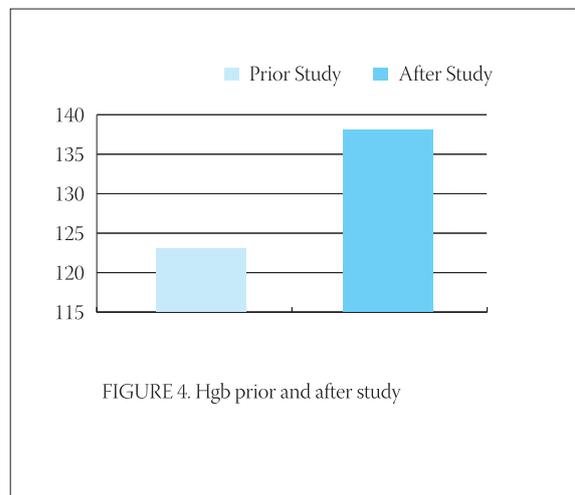
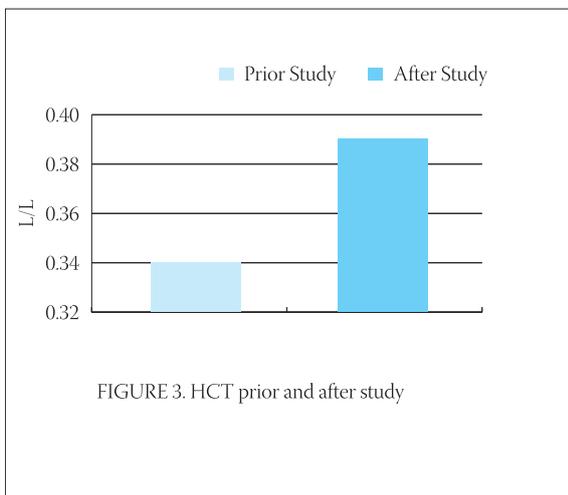
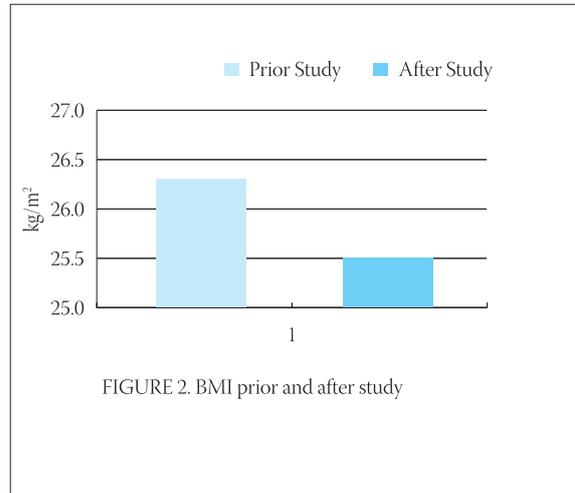
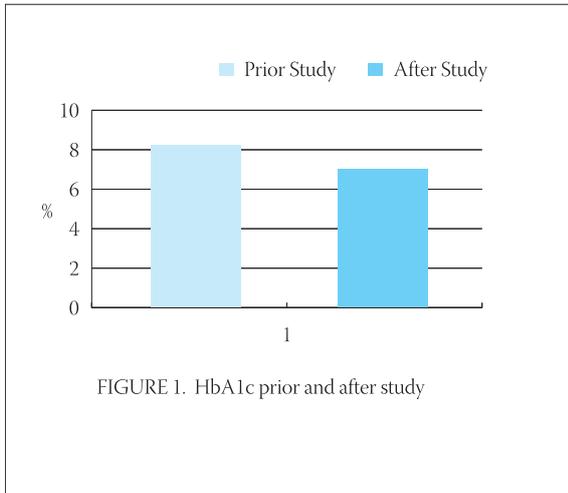
The erythrocyte function is to deliver oxygen to the tissue, so the main consequence of anemia is tissue hypoxia. Anemia may be an independent predictor of adverse cardiovascular events. Anemia is a common consequence of chronic kidney disease. Chronic kidney disease and anemia have independent pathways through which they lead to elevate risk of macrovascular events (3, 4, 5, 6). Anemia is associated with myocardial ischemia, although it is not known whether anemia also facilitates cerebral ischemia. In the heart, pathophysiologic adaptations associated with anemia can lead to left ventricular hypertrophy in the long – term, especially when they take place in the presence of chronic kidney disease. (6, 7, 8, 9, 10) During the treatment of diabetic patients at the Clinic of Endocrinology, diabetes mellitus and metabolic diseases in Sarajevo, we noticed a big number of patients with anemia. We decided to follow up above mentioned parameters in this population before and after treatment of anemia. After three months of treatment we

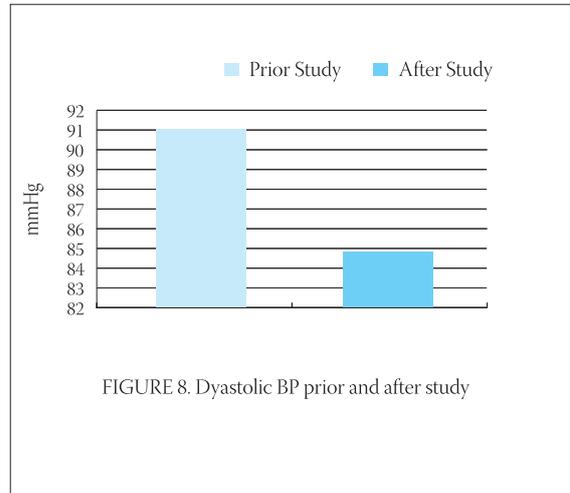
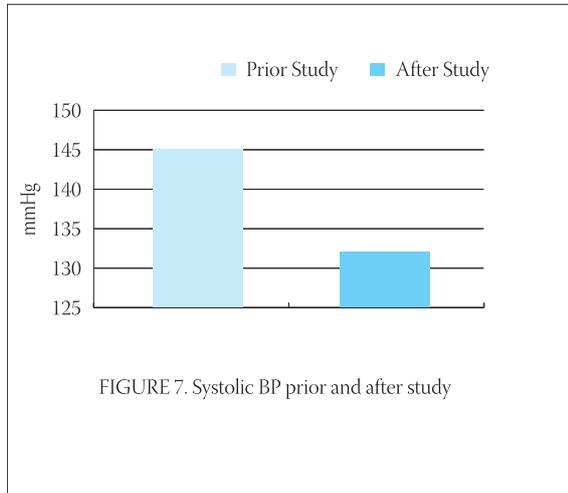
PARAMETERS	REFERENT VALUES	PRIOR STUDY	AFTER STUDY
HbA1c	< 6 %	9,28	7,62
BMI	19 – 24 kg/m <sup>2</sup>	26,64	25,7
HCT	0,37 – 0,47 L/L	0,35	0,4
Hgb	120 – 160 g/L	125,2	139,6
MCH	27 – 31 pg	28,5	29,4
Albumins	< 0	0,49	0,16
Blood Pressure Systolic	130 mmHg	149,2	133,9
Blood Pressure Diastolic	89 mmHg	91,7	85,5
Pulse Rate	80/min	96	84

TABLE 1. The result of treatment diabetes type 2 patients with anemia

improved glycaemia control, the values of hemoglobin, hematocrit, blood pressure and urine albumin secretion

rate. Mean pulse rate was improved. We observed that patients stop to complained of tiredness and depression.





## CONCLUSION

People with diabetes type 2 should be checked and appropriately treated for anemia in early stage of the disease. Effective treatment of glycaemia and anemia in patients with diabetes, reduces blood pressure, urine albumin secretion and pulse rate, diminishing cardiovascular damage and improving kidney function.

ABBREVIATIONS: BMI - Body Mass Index; Hct - Hematocrit, Hgb, MCH; Hgb - Hemoglobin; MCH - Mean Cell Hemoglobin; BP - Blood Pressure

## REFERENCES

- (1) Sarnak M.J., Tighiouart H., Manjunath G. et al. Anemia as a risk factor for cardiovascular disease in The Atherosclerosis Risk in Communities (ARIC) Study. *J. Am. Coll. Cardiol.* 2002; 40:27 – 33
- (2) Al-Ahmad A., Rand W.M., Manjunath G. et al. Reduced kidney function and anemia as risk factors for mortality in patients with left ventricular dysfunction. *J. Am. Coll. Cardiol.* 2001;38: 955 -962
- (3) Levin A. Prevalence of cardiovascular damage in early renal disease. *Nephrol. Dial. Transplant.* 2001;16: 7 – 11
- (4) Parfrey P. Anaemia in chronic renal disease: Lessons learned since Seville 1994. *Nephrol. Dial. Transplant.* 2001;16: 41 – 45
- (5) Silverberg D.S., Blum M., Agbaria Z. et al. The effect of intravenous iron alone or in combination with low – dose erythropoietin in the rapid correction of anemia of chronic renal failure in the predialysis period. *Clin. Nephrol.* 2000; 55: 212 – 219
- (6) Kleinman K.S., Schweitzer S.U., Perdue S.T. et al. Anemia in predialysis patients and its effect on renal function double blind placebo control trial. *Am J Kidney Dis.* 2003; 41 (Suppl 3): S26 – S30
- (7) National Kidney Foundation: Kidney Dialysis Outcomes Quality Initiative clinical practice guidelines for the treatment of anemia of chronic renal failure. *Am. J. Kidney Dis.* 1997;30 (Suppl 3): S 192 – S 240
- (8) Valderbrabano F., Horl W.H., Macdougall I.C. et al. Pre – dialysis survey on anemia management. *Nephrol. Dial. Transplant.* 2003;18: 89 –100
- (9) Valderbrabano F., Horl W.H., Jacobs C. et al. European survey on anemia management. *Nephrol. Dial. Transplant.* 2000;15 (Suppl 4): S1 – S 76
- (10) Moreno F., Sanz – Guajardo D., Lopez–Gomez M. et al. Increasing the hematocrit has a beneficial effect on quality of life and is safe in selected hemodialysis patients. Spanish Cooperative Renal Patients Quality of Life Study Group of the Spanish Society of Nephrology. *J. Am. Soc. Nephrol.* 2000;11: 335 – 342