

## IS GLYCEMIC CONTROL IN PATIENTS WITH TYPE-2 DIABETES IN RAWALPINDI IMPROVING?

Dilshad Ahmed Khan, Mariam Saeed, Farooq Ahmad Khan

Department of Pathology, Army Medical College, National University of Science and Technology, Rawalpindi, Pakistan.

**Background:** Glycaemic control is critical for managing diabetes and related complications. Considering high prevalence of Diabetes in Pakistan, our study aimed to assess the status of glycaemic control in Type-II Diabetics by measurement of HbA1c from 2005–2007 at Rawalpindi. We also evaluated changes in its trends in relation with sex and age. **Methods:** It was a retrospective analysis of data from Clinical Pathology Laboratory, Army Medical College, Rawalpindi during 2005–2007. A total of 2875 patients, aged 24–70 years, taking oral hypoglycaemic agents, were included. HbA1c was measured by using Human kit. International Diabetes Federation guidelines,  $\leq 6.5\%$ ,  $6.6\%–8.4\%$  and  $\geq 8.5\%$  were used to classify patients into good, fair and poor control categories. **Results:** The number of patients ( $n=2875$ ) tested for HbA1c increased from 904,974 to 997 during 2005–2007. The patients had an age of  $48\pm 13$  years and comprised of 54% males and 46% females. Improvement in patient's glycaemic control among the three categories during 2005 to 2007 was as follows: good (41% vs 47%), fair (38% vs 40%) and poor (21% vs 13%) respectively. The average HbA1c values improved from 7.25 % in 2005 to 6.69% in 2007 ( $p<0.05$ ). Overall, males (45%) and youngest age group (53%) patients had good diabetic control. **Conclusion:** Glycaemic control improved in diabetic patients from 41% to 47% during 2005–2007 at Rawalpindi. Males, especially the youngest patients comprised majority of good control population. For effective disease management and optimal HbA1c values, a combined effort by the patient and physician is required.

**Keywords:** Diabetes, Glycaemic Control, HbA1c, IDF guidelines, Pakistani population

### INTRODUCTION

Diabetes is rapidly emerging as a global health care problem that threatens to reach pandemic levels by 2030, with the most notable increase occurring in developing countries.<sup>1</sup> Glycaemic control remains the major therapeutic objective for prevention of acute and chronic complications related to the disease.<sup>2</sup> Haemoglobin A1c (HbA1c) has become the gold standard for monitoring long term glycaemic control; lowering it by proper diabetes management reduces the risk for complications<sup>3</sup>; higher values have been associated with higher ten year trends for the development and progression of cardiovascular complications<sup>4</sup>. Each percentage point increase in HbA1c causes a 10% increase in mortality from all forms of heart disease and stroke and also significantly increases the medical care costs.<sup>5,6</sup>

Optimal target HbA1c levels have therefore been recommended by international organizations such as International Diabetes Federation (IDF) and American Diabetes Association (ADA) for control of diabetes.<sup>7,8</sup> However, numerous studies have shown that achievement of these target values remains a problem in most clinical settings in the world. The patients with glycated Hb values above the recommended range vary from as high as 85.7% in Malaysia; 72% in Philippines to a low range of 42% in Europe and 28 % in Spain.<sup>9–12</sup> According to the WHO, 11% of the Pakistani population suffers from diabetes.<sup>13</sup>

Previously conducted studies have reported poor diabetic control ranging from 47% to 81% with high rate of diabetic complications in our population.<sup>14–16</sup> However, no study has been conducted to see if any improvements have taken place in the diabetic control over the years in our clinical setting with increasing awareness about the disease pathogenesis. Our study, therefore aimed to assess the improvement in the status of glycaemic control over a period of three years from 2005–2007 at Rawalpindi, by measurement of HbA1c in type 2 diabetics and to evaluate changes in its trends in relation with the patient's age and sex.

### SUBJECTS AND METHODS

The study was conducted after approval by the institutional ethical committee in the Clinical Pathology Laboratory (CPL) at Army Medical College, Rawalpindi. It was a retrospective analysis of data obtained from Chemical Pathology Laboratory database from 2005 to 2007 periods. A total of 2,875 patients of either sex aged 24–70 years, were included. All were previously diagnosed type II diabetic patients and taking oral hypoglycaemic agents for last three months. Demographic and clinical details were recorded. HbA1c values were measured by following Human kit (Germany) procedures, based on fast ion exchange resin separation method on Microlab (Merck, Netherlands). Using IDF guidelines<sup>8</sup>, three limits,  $\leq 6.5\%$ ,  $6.6\%–8.4\%$  and  $\geq 8.5\%$  were used to assess

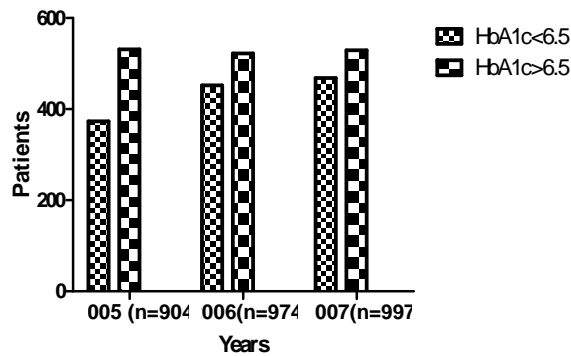
the diabetic control of patients and to classify them into good, fair and poor control categories respectively. Patients excluded from the study were those with type I diabetes mellitus, gestational diabetes, and haemolytic anaemia.

Data was analysed on SPSS 16. Descriptive stat, mean and SD were calculated. ANOVA was applied for comparison of data for the three years 2005–2007. Post hoc comparison was done by application of Turkey’s test. Pearson correlation was applied. A *p*-value <0.05 was considered significant.

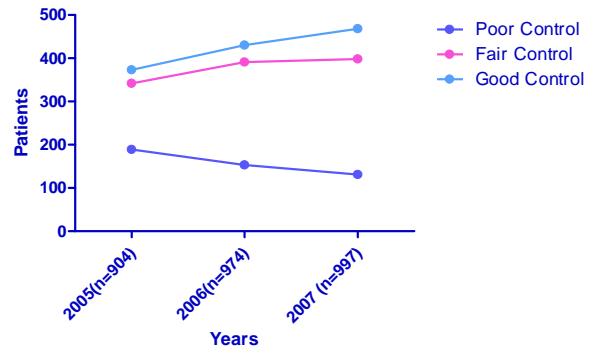
**RESULTS**

The number of patients referred to our lab for HbA1c measurement increased from 904, 974, to 997 from 2005–2007. Of the 2875 patients included, 1536 were males and 1339 females with a Mean±SD age of 48±12.92 years. Improvements in glycaemic control were observed from 2005 to 2007. IDF recommended HbA1c values <6.5% was observed in 41% of patients in 2005. The numbers of patients in this category increased gradually to 47% in 2007 (Figure-1). Classifying our study population into good, fair and poor control revealed that the patients who had poor glycaemic control (21%) in 2005 declined to 16% in 2006. In 2007, the number dropped further to 13%, with a corresponding increased in the good control patients (Figure-2). The patients in the fair control group also increased over the three years period. This trend in the improvement of glycaemic control was consistent with the significant (*p*=0.001) drop in average HbA1c levels from 7.25% in 2005 to 6.97% in 2007 (Figure-3).

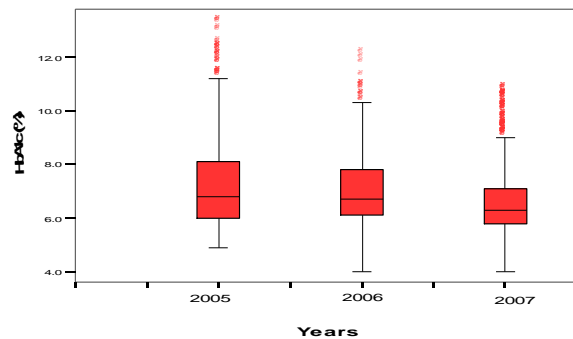
Females had relatively poor diabetic control (55%) compared to males (Figure-4). The youngest patients between 20–30 years had better HbA1c values than the older group of patients. Highest percentage of poor controlled value >8.5% was seen in patients between 41–50 years Figure-5).



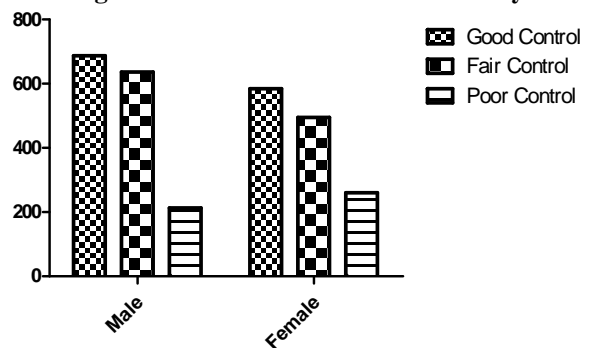
**Figure-1: Glycaemic control improvement shown by increasing number of patients having IDF recommended level of HbA1c <6.5% from 2005-2007. (n=2875)**



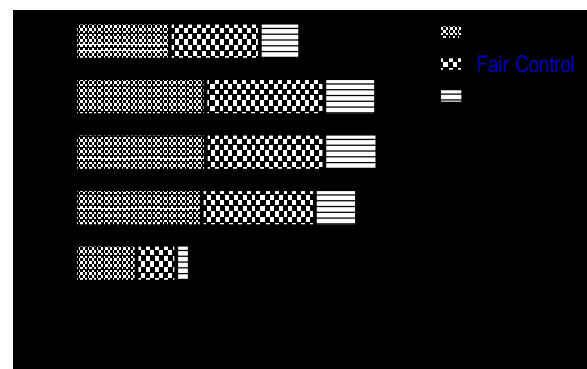
**Figure-2: Distribution of patients in to good, fair & poor control categories from 2005–2007 (n=2875).**



**Figure-3: Box plot showing Improvement in average HbA1c values seen over the three years**



**Figure-4: Comparison of glycaemic control between males and females diabetic patients (n=2875).**



**Figure-5: Distribution of glycaemic control in different age groups of type-II diabetic patients (n=2875).**

## DISCUSSION

The goal of diabetes management is to keep blood glucose levels as close to normal as safely as possible, while avoiding blood glucose levels that are too high (hyperglycaemia) or too low (hypoglycaemia). The results of our study show that of the total study population, only 41% of the patients have acceptable HbA1c values of <6.5%. The remaining 59% have values above the recommended cut off and hence an undesirable diabetic control status. These results are in agreement with the results of other studies previously conducted around the country. Using HbA1c value of 7.5% as the cut-off for good diabetic control, studies conducted in Karachi and Rawalpindi found that 81.3% and 46.7% of the study population respectively, had values exceeding this cut-off indicating poor control of the disease.<sup>14,15</sup> Khalid Mehmood and A.H Amir in Peshawar used HbA1c of 8.2% as the cut-off for poor control and reported 51.43% patients with poor control.<sup>17</sup> These results have important implications clinically. The Diabetes Control and Complications Trial (DCCT) in 1993, conclusively showed that intensive glucose control delayed the onset and progression of retinal, neural and nephropathic complications by 35% to more than 70%. In fact, it demonstrated that *any* sustained lowering of blood glucose was beneficial, irrespective of previous glycaemic control.<sup>18</sup> Undesirable control of the disease reflected in the majority of our patients can be attributed to a number of factors, the principle one being lack of adequate knowledge about the disease, as evidenced by a study conducted in Peshawar which demonstrated that 58% of the patients lacked appropriate education for disease management. This group also had the highest levels of HbA1c of 9.98%.<sup>19</sup> Financial burden imposed on the patients accounts for the majority of the patients with suboptimum HbA1c levels. Inaccessibility to health care facilities, psychosocial influences and non adherence to treatment are other limiting factors for developing countries like Pakistan. Similar trends have been observed in other south Asian countries. Chuang *et al* showed that 55% of the patients from South Asian countries had HbA1c values exceeding 8%.<sup>20</sup> This pattern has also been reflected in other parts of the world. A retrospective analysis of data from 1998–2002 in UK found that >60% of the patients had poorly controlled disease regardless of the cut-off used to determine good control<sup>21</sup>, while a Canadian study demonstrated HbA1c of 7.7% for 78% of the patients tested<sup>22</sup>. The average HbA1c for patients in Australian population was 7.3±1.<sup>23</sup> A decline in the HbA1c values, similar to ours, was reported in United States from 1999 to 2004. The

percentage of the overall population with HbA1c <7.0% increased from 36.9% in 1999–2000 to 49.4% in 2001–2002 and to 56.8% in 2003–2004.<sup>2</sup> Improved Glycaemic control was also observed in Japan where only 20% of the population had values <6.5%.<sup>24</sup>

These findings suggest the need for more intensive efforts to bring the HbA1c of patients within a permissible range. The fact that the youngest patients had majority of patients with acceptable values is particularly encouraging as they are the ones at the greatest risk for developing subsequent complications because of their greater life expectancy. This is particularly important as adolescents with poorer HbA1c values have been shown to maintain them even as adults.<sup>25</sup> The ADVANCE study in 2008 has demonstrated that lowering the glycated Hb value to <6.5% leads to a 10% relative reduction in the risk for major micro and macro vascular events.<sup>26</sup> This is reasonable target for many but not all patients; more intensive treatment to bring the target HbA1c within the normal range may increase the mortality but nonetheless, maintains its beneficial effects.<sup>27</sup> Therefore the target value should be tailored according to every individual patient's requirements.

The presence of a greater number of females in the poor control group points to another important aspect of the disease. Women in Pakistan have a lower literacy rate as compared to males and have been shown to be less aware of their disease.<sup>28</sup> They tend to spend less<sup>29</sup> and are less physically active with regard to their disease control than men.

The cross sectional design of our study had limitations, it assessed the glycated Hb level of patients at a single point in time, and the patients could not be followed up to see if their HbA1c values rose or fell with time. Moreover, the factors responsible for the HbA1c values could not be accounted for. These points at the need for further studies to be conducted in the future so these factors can be identified. Moreover, intensive treatment strategies from which patients with poorly controlled disease can benefit need to be investigated.

## CONCLUSION

It is concluded that glycaemic control improved in diabetic patients from 41–47% during 2005–2007 at Rawalpindi. Males, especially the youngest patients comprised majority of good control population. For effective disease management and optimal HbA1c values, a combined effort by the patient and physician is required.

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**Address for Correspondence:**

**Dr. Dilshad Ahmad Khan**, Department of Pathology, Army Medical College, Abid Majeed Road, Rawalpindi, Pakistan. Tel: +92-300-5147938, Fax +92-51-5529988

**E-mail:** dilshad56@yahoo.com, dilshad@nuest.edu.pk