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The impact of the level of education and paid work on HbA1c concentrations
in patients with type 1 diabetes – preliminary findings

Wpływ poziomu wykształcenia i pracy zarobkowej na stężenie HbA1c u chorych na cukrzycę typu 1 – doniesienie wstępne

INTRODUCTION

The progressive increasing prevalence of diabetes is observed among working-age adults. It has been estimated that about 33% of individuals born in the year 2000 will develop diabetes in their life [13, 14]. In diabetes mellitus, good metabolic control is crucial in preventing long-term diabetic complications. Numerous factors influence the results of diabetes treatment. They are difficult to assess because of a lot interrelations among them. Several studies have investigated the impact of different factors such as age, gender, duration of diabetes and insulin regimen on metabolic control [1–4, 7, 9, 10]. One of the most frequently identified and potent predictors of chronic diseases including diabetes are socioeconomic and educational status. A low educational level and a poor socioeconomic status were associated an with increased risk for diabetes and other chronic diseases [2–4, 7]. In a number of studies [1–4, 6, 7, 10] it was demonstrated that multiple socioeconomic factors were closely associated with diabetes metabolic control. Patients' level of education and performance of paid work can have an impact on the effects of type 1 diabetes treatment. People with childhood-onset diabetes may experience disadvantage in employment, and have a lower income in adulthood, although diabetic complications appear to be the most important determinant of social consequences in later life [2, 4, 7, 10].

The aim of this study was to establish, based on own research, the impact of education and paid work on the level of metabolic control in patients with type 1 diabetes as indicated by HbA1c levels.

MATERIAL AND METHODS

The studied group included 44 patients, 26 female and 18 male, aged 20–59 (mean 37.4±12.2) years. The duration of diabetes was 0.5−29 (mean 13.7±9.2) years. Only 4 patients (2 female and 2

male) had primary education, 26 (i.e. 59%; 16F and 10M) had secondary education and 14 (i.e. 32%; 8F and 6M) had higher education. Fifteen (34%) patients (8 female and 7 male) performed paid work, including 9 (64%) subjects (6 female and 3 male) with higher and 6 persons (23%, 2 women and 4 men) with secondary education.

All patients were treated with insulin, most of them using intensive insulin treatment (35, i.e. 79.5% patient, 22 women and 13 men) and only 9 (4 women and 6 men) using the classic method with only 2 or 3 injections of insulin mixes.

The subjects were classified according to their level of education into group 1 (higher education) and group 2 (secondary education) and according to their employment status into group 3 (employed) and group 4 (unemployed). Patients with elementary education were excluded as their number was not high enough.

The data on the level of education and employment were obtained in a survey designed by the authors of this study. In each, the patient's level of education, employment, age, BMI and the duration of the disease were considered. HbA1c level was measured by DCA 2000+ analyzer with latex immunoagglutination inhibition assay. Statistical analysis was conducted using Student's test for nonparametric data. Differences of $p < 0.05$ were considered statistically significant.

RESULTS

A comparison of selected clinical features and HbA1c levels in patients with higher (group 1) and secondary (group 2) education is shown in Table 1. A comparison of HbA1c levels in groups patients with secondary and high education in the employed (group 3) and unemployed (group 4) groups of diabetic patients is shown in Table 2.

The mean HbA1c for the entire group was $7.7 \pm 1.9\%$ ($7.02 \pm 1.9\%$ for males and $8.2 \pm 1.8\%$ for females). It was higher and statistically significant ($p < 0.05$) in the group of women. No significant differences were found between the groups of patients with higher and secondary education with respect to age, diabetes duration and BMI. The group of employed patients was characterized by a lower mean age (NS), shorter diabetes duration ($p < 0.05$) and lower BMI (NS).

Table 1. Comparison of HbA1c, age, diabetes duration and BMI in type 1 diabetic patients with higher (group 1) and secondary (group 2) education and in employed (group 3) and unemployed (group 4) patients (mean ± SD)

	Number of patients	HbA1c	Age	Duration of diabetes	BMI
Group 1	14 (8F;6M)	7.3±2.0*	37.4±12.1*	13.4±10.6*	24.5±3.9*
Group 2	26(16F;10M)	7.8±1.9*	37.2±12.5*	13.8±8.9*	24.1±5.3*
Group 3	15 (8F;7M)	7.8±2.2*	36.0±10.6*	9.1±8.3**	23.6±3.9*
Group 4	25 (16F;9M)	7.5±1.8*	38.0±13.2*	16.2±9.1**	24.6±3.4*
Entire group	44(26F;18M)	7.7±1.9	37.4±12.2	13.7±9.2	24.4±4.1

* US; ** $p < 0.001$

Table 2. Comparison of HbA1c in employed and unemployed patients in groups with higher and secondary education (mean ± SD)

	Employed		Unemployed		Entire group	
	Number of patients	HbA1C %	Number of patients	HbA1C %	Number of patients	HbA1C %
Higher education	9(6F;3M)	8.2±1.9**	5(3F; 2M)	5.7±1.9**	14(9F;5M)	7.3±2.0*
Secondary education	6(2F;4M)	7.3±2.6*	20(14F;6M)	7.9±1.6***	26(16F;10M)	7.8±1.9*
Entire group	15(8F;7M)	7.8±2.2	25(17F;8M)	7.5±1.8	40(25F;15M)	7.7±1.9

** HbA1c in employed and **HbA1c in unemployed with higher education = p<0.05

* US **HbA1c unemployed with higher education and ***HbA1c in unemployed with secondary education = p<0.02

Lower HbA1c levels were found in patients with higher education (group 1) and the unemployed (group 4), but the differences were statistically non-significant. In patients with secondary education (group 2) and in the entire group of employed persons mean HbA1c levels were higher, but also statistically non-significant. The results (Table1) suggest that education and employment do not have a significant impact on the level of metabolic control in our group of patients with type 1 diabetes.

The lowest and highest mean HbA1c levels were found in employed and unemployed subgroups of patients with higher education. They were statistically significant (p<0.05), which could indicate a negative impact of the performance of paid work on the level of metabolic control in this group of patients.

Within the group of patients with secondary education the mean HbA1c levels were higher in unemployed persons than in those employed and were not statistically significant. A small number of employed persons among those with secondary education (Fig. 1) did not allow for an unequivocal interpretation of the influence of employment on HbA1c levels in this group.

The percentage of employed and unemployed diabetic patients in groups with higher and secondary education is illustrated in Fig. 1. Patients with higher education performed paid work almost three times as often as patients with secondary education.

Higher education   Secondary education

36%   64%   23%   77%

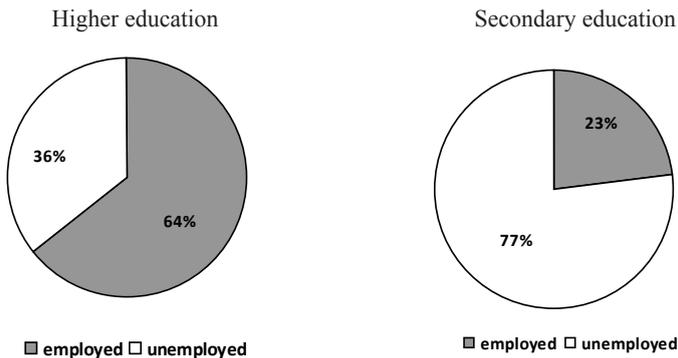☐ employed ☐ unemployed   ☐ employed ☐ unemployed

Fig. 1. Comparison of the percentage of employed and unemployed diabetic patients in groups with higher and secondary education

DISCUSSION

Type 1 diabetes is usually diagnosed at a time in patients' lives when they pursue education and a career and for this reason it has a considerable impact on the level of education they achieve and on their chances of being employed in the future [2, 4, 7, 10].

The performance of paid work, the level of education and economic status can have a positive or negative impact on the quality of life of diabetic patients and, as a result, on the level of metabolic control [1, 2−7, 10]. Satisfaction with treatment and quality of life are positively associated with employment and a higher income. People with a lower educational level and unemployed persons have, in general, a lower satisfaction with life and are less satisfied with diabetes treatment, as well as having worse metabolic control [1, 2, 4, 7, 10].

The association between education and health is well-established. Literacy may be an important explanatory variable in the relationship between education and health. "Health literacy" has been defined as a measure of an individual's ability to perform basic reading and numerical tasks required to optimally function in the health care environment. Inadequate literacy has been found to be associated with demographic characteristics and markers of socioeconomic status, such as older age, lower educational level and income [9].

Taking into consideration the data above, the Polish Diabetes Association recommends that patients with type 1 diabetes try to get as high an education as possible [8]. Over 90% of our patients had at least secondary education and within that group one in three had higher education, and 70% of those employed had higher education.

As type 1 diabetes becomes more prevalent in the population, its effects on employment and work productivity request more attention and pressing action for society. Several studies have found negative associations between diabetes and employment [6, 11−13].

Diabetes causes work limitations and can affect employment and professional activity in many ways. Diabetes complications may prevent working entirely or increase absenteeism. Individuals with diabetes are at increased risk of functional disability, miss more days from work for health reasons and have reduced earnings from employment. Work productivity may also be impaired and may induce employment discrimination [5, 6, 11−13].

Work stress may influence diabetes through effects on behaviors as well as through direct effects on metabolic regulation [5]. Stress activates the hypothalamic-pituitary-adrenal axis and the sympatho-adrenal-medullary axis, which increases blood pressure and blood glucose. Hypercortisolism that occurs with chronic stress results in abdominal accumulation of body fat and insulin resistance and can impact on metabolic control [5,6].

The studied groups of type 1 diabetic patients with higher and secondary education, as well as those employed and unemployed did not differ significantly in the level of metabolic control as indicated by HbA1c concentrations.

Significant differences showed only in employed patients, once their education level was taken into account, and were the most prominent in the group with higher education, where the highest HbA1c concentrations were found. Similarly to other authors [6, 11−13], we think that this may be due to the negative impact of working conditions on metabolic control and to work-related chronic stress.

CONCLUSIONS

In patients with type 1 diabetes higher education was linked with better metabolic control which became considerably worse due to the performance of paid work.

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SUMMARY

Patients' level of education and performance of paid work can have an impact on the level of type 1 diabetes metabolic control. The aim was to establish, based on own research, the impact of education and paid work on the level of metabolic control in patients with type 1 diabetes as indicated by HbA1c levels. 44 patients (26F; 18M) aged 20−59 (mean 37.4±12.2) years. The duration of diabetes was 0.5−29 (mean 13.7±9.2) years. Only 4 patients (2F; 2M) had primary education, 26 (i.e. 59%; 16F and 10M) had secondary education and 14 (i.e. 32%; 8F and 6M) had higher education. 15 (34%) patients performed paid work, including 9 (64%) subjects with higher and 6 (23%) with secondary education. The data on the level of education and employment were obtained in a survey designed by the authors of this study. In each case the patient's age and the duration of the disease were considered. The subjects were classified according to their level of education into groups 1 (higher education) and 2 (secondary education) and according to their employment into groups 3 (employed) and 4 (unemployed). The mean HbA1C for the entire group was 7.7±1.9% (M − 7.02±1.9%; F − 8.2±1.8). No significant difference was found between the groups of patients with higher and secondary education with respect to age, the diabetes duration and BMI. Mean HbA1C in groups 1 and 2 were: 7.3±2% and 7.8±1.9% (NS) respectively. The group of employed patients was characterized by a lower mean age, diabetes duration and BMI. Mean HbA1C levels in groups 3 and 4 were: 7.8±2.2% and 7.5±1.8% (NS) respectively. The lowest and highest mean HbA1c levels were found in subgroups of patients with higher education: they were 5.7±1.3% in unemployed persons and 8.2±1.9% in employed persons (p<0.05). Within the group of patients with secondary education the mean HbA1c levels were 7.9±1.6% in unemployed persons and 7.3±2.6% in those employed (NS). In patients with type 1 diabetes higher education was linked with better metabolic control which became considerably worse due to the performance of paid work.

Key words: type 1 diabetes, education level, employment, glycosylated hemoglobin (HbA1C)

STRESZCZENIE

Wykształcenie pacjentów oraz wykonywanie pracy zarobkowej mogą wpływać na uzyskiwany przez nich poziom wyrównania metabolicznego cukrzycy. Celem pracy było ustalenie, w oparciu o badania własne, wpływu poziomu wykształcenia oraz wykonywania pracy zarobkowej na mierzony stężeniem HbA1c poziom wyrównania gospodarki węglowodanowej u chorych na cukrzycę typu 1. Materiał stanowiło 44 chorych (26K;18M) w wieku od 20 do 59 (śr. 37,4±12,2) lat. Czas trwania cukrzycy wynosił 0,5−29 (śr.13,7±9,2) lat. Tylko 4 osoby (2K i 2M) miały wykształcenie podstawowe, 26 [59%] (16K; 10M) – średnie, 14 [32%] (8K; 6M) – wyższe. 15 (34%) osób pracowało zarobkowo, w tym 9 (64%) osób z wykształceniem wyższym i 6 (23%) z wykształceniem średnim. Dane dotyczące wykształcenia i zatrudnienia uzyskano w oparciu o opracowaną przez autorów ankietę. U każdego chorego uwzględniono wiek i czas trwania cukrzycy. Badanych podzielono zależnie od poziomu wykształcenia (grupa 1 – wyższe; grupa 2 – średnie) oraz zatrudnienia (grupa 3 – pracujący; 4 – niepracujący). Średnia HbA1C dla całej grupy wynosiła 7,7±1,9% (M–7,02±1,9%; K–8,2±1,8). Grupy chorych z wykształceniem wyższym i średnim nie różniły się istotnie wiekiem, czasem

trwania cukrzycy i BMI. Średnie HbA1C dla grupy 1 i 2 wynosiły odpowiednio 7,3±2% i 7,8±1,9% (NS). Całą grupę osób pracujących charakteryzowały niższe średnie wieku, czasu trwania cukrzycy oraz BMI. HbA1c dla grupy 3 i 4 wynosiły odpowiednio 7,8±2,2% i 7,5±1,8% (NS). Najniższą i najwyższą średnią HbA1c stwierdzono w podgrupach chorych z wyższym wykształceniem: 5,7±1,3% u osób niepracujących i 8,2±1,9% u osób pracujących (p<0,05). W grupie chorych z wykształceniem średnim niepracujący mieli HbA1c – 7,9±1,6%, a pracujący 7,3±2,6% (NS). U chorych na cukrzycę typu 1 wyższe wykształcenie wiązało się z lepszym wyrównaniem cukrzycy, które w istotnym stopniu wpływało na wykonywanie pracy zarobkowej.

Słowa kluczowe: cukrzyca typu 1, poziom wykształcenia, zatrudnienie, hemoglobina glikowana HbA1C