Original Research

METABOLIC DISEASES

Self-efficacy, stress levels and daily style of living among older patients with type 2 diabetes in a rural primary care setting: a cross-sectional study

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Abstract

Aims. To identify to what extent stress and self-efficacy may be associated with specific features in the elderly with type 2 diabetes, such as lifestyle habits, multimorbidity, sleep quality and duration, and treatment regimen.

Methods. A cross-sectional study of 92 out of 103 recruited patients ≥65 year old with a diagnosis of type 2 diabetes was conducted at a rural primary care unit in Northern Greece. The General Self-Efficacy Scale (GSES), the Short Anxiety Screening Test (SAST) and an original questionnaire to assess health habits and disease monitoring information were completed after structured personal interviews.

Results. In the multiple linear regression analysis, patients with higher education, with more night sleeping hours and physical exercise weekly had a higher GSES score than their counterparts ($p<0.05$). Stress levels assessed with SAST were shown mostly associated with poor sleep quality, fewer days of meat and legumes consumption, increased body mass index and multi-morbidity ($p<0.05$), as emerged from the multiple linear regression analysis. Glycemic control in the elderly does not have a significant correlation with stress levels or general self-efficacy.

Conclusions. Self-efficacy and stress levels are not predictors for glycemic control, but can indirectly be seen as co-determinants, contributing to the overall daily life quality among patients with diabetes. Mental health well-being, expressed by higher self-efficacy and less stress scale rating, showed positive interferences with eating, sleep and daily life attitudes among elderly with diabetes.

Keywords: type 2 diabetes, glycemic control, elderly, self-efficacy, stress

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Background and aims

Due to the increase in terms of life expectancy, demographic aging of the population combined with obesity, changes in dietary patterns and lifestyle have led to an escalating prevalence of type 2 diabetes mellitus (T2DM) in the elderly. In the USA, one of four elderly people suffers from diabetes [1], with mortality rates in the geriatric population being four times higher than in those without diabetes [2]. Estimates from the American Diabetes Association refer to a consistent increase of cases by 2050, with one third of them being in the age group of 65-79 years [3]. Elderly with T2DM form a heterogeneous group with high risk of using long-term geriatric care units, needing individualized, person-centered and holistic care [4]. In addition, elderly with cognitive or mood disorders are more likely to face particular difficulties with self-management, due to the complex self-care routine [5]. Diabetes self-care includes all those tasks which patients should perform on a daily basis, including self-monitoring of blood glucose, proper medication intake, regular physical activity, healthy eating and clinical laboratory tests at regular intervals [6]. Therefore, identifying and understanding the barriers that can adversely affect rational self-management and adequate self-care are shown as early steps in ensuring that the standards of diabetes care can be prospectively achieved. A number of different factors such as educational level, knowledge about the disease, motivation, therapeutic compliance, attitudes, beliefs, perceptions, behaviors and other personal features, such as self-esteem and self-efficacy, may affect the optimal self-care [6].

Self-efficacy is the belief that an individual can cope with new, difficult, or innovative tasks, in a wide range of stressful or specific demanding situations [7]. It is also a predictor of intentions and adaptations in various areas of human activity, by achieving a personal health behavior as goal [8]. Effective diabetes management requires significant behavioral changes aimed at boosting self-esteem and psychological empowerment [9]. Higher self-efficacy levels have been associated with better glycemic control, fewer diabetes complications and sufficient motivation in disease self-care behaviors [10-16].

In the elderly, physical and various cognitive and psychosocial limitations can significantly affect behavior [17]. However, the level of self-efficacy can be maximized when clear instructions and focused training are provided as learned skills that promote the desired behavior [18]. This is evidenced by recent studies in patients with diabetes, which have shown significant improvements in self-care, after improving self-efficacy through various intervention programs [19-21]. Moreover, identification of low levels of self-efficacy in the elderly may be helpful; if older persons feel unable to change their behavior, then they may need more motivation to enhance such ability and try the change [13].

On the other hand, diabetes-related distress can be defined as a series of emotional responses and reactions related to both treatment regimen and requirements of self-management [22]. It is also known that patients with T2DM are more susceptible to anxiety disorders [23]. At least one-third of patients with diabetes suffer from clinically relevant anxiety and/or depressive disorders and it is two-fold more likely to be diagnosed with anxiety or depression compared to those without the disease [23,24-26]. Additionally, more than half of patients with diabetes report disease-related stress which is associated with lower levels of treatment adherence, higher rates of poor glycemic control and diabetes-related complications, poor clinical outcomes and impaired quality of life [27-30].

The aim of the study was to identify to what extent stress and self-efficacy may be associated with specific features in the elderly with T2DM, such as diet, physical exercise, Body Mass Index (BMI), multi-morbidity, sleep quality and duration, and treatment regimen.

Methods

Setting and sample

The study took place at the primary health care setting of Alonakia, in a semi-rural area of Western Macedonia, Northern Greece. This primary health care unit is operated by a General Practitioner (GP) and serves seven village communities. The total population is about 2.000 inhabitants and the economy of the area is mainly based on agriculture and animal husbandry. The unit has early adopted an electronic medical record application, with 1400 recorded patient files, allowing deposit and monitoring of clinical information for each visit registered.

Research tools

Two translated and validated research tools were used [7,31-33]. The General Self-Efficacy Scale (GSES) [31] for self-efficacy assessment and the Short Anxiety Screening Test (SAST) [33] for stress detection. Also, an original questionnaire sheet of 10 questions was created to collect data regarding diabetes duration, current therapeutic regimens and lifestyle patterns. Socio-demographic data were also tabulated.

The General Self-Efficacy Scale (GSES)

The GSES [7,31] is a ten-item psychometric scale aiming to assess a broad and stable sense of personal ability of an individual, to effectively address a variety of difficult and stressful demands in life. Each of the ten items has the following response options with the corresponding scoring: "not at all true" (1 point), "little true" (2 points), "quite true" (3 points) and "absolutely true" (4 points). The scores of the ten items are added to produce a final sum which can range from 10 to 40. A higher total sum indicates greater overall self-efficacy.

Short Anxiety Screening Test (SAST)

The SAST [32,33] is a ten-question tool based on a self-assessment scale that can be easily used at a primary care environment to accurately and reliably detect anxiety symptoms in the elderly. Each item is scored on a four-point rating scale and the sum creates scores between 10 and 40. Possible answers include the options: "rarely or never", "sometimes", "often" and "always". The total score is calculated from the sum of the individual scores of all questions. A score of $\geq$24 is the threshold for stress detection.

Data collection and ethics

Data were collected, during an eight week period (November-December 2019). All patients over 65 years old with a diagnosis of T2DM were invited to participate through the electronic medical record system. Those suffering from severe motor, cognitive, visual and auditory limitations or speech disorder were excluded from the study. Data were collected by a GP after a scheduled appointment in the context of regular follow-up for diabetes. All patients who agreed to participate in the study gave their signed written informed consent. Study approval was obtained from the Scientific Council of the Third Health Region of Macedonia, Greece (Protocol No. Δ3β/2327).

Each patient's somatometric data, comorbidities and the last glycosylated hemoglobin (HbA1c) value measured in the first semester of 2019 were recorded. Also, all participants received an electronic referral for a second HbA1c measurement, with the recommendation to be carried out in the same with the previous laboratory setting. The last two values of HbA1c were used as variables of glycemic control. As acceptable glycemic control in this population sample was set the level value of HbA1c ≤7.5% [34].

Statistical analysis

Descriptive statistics were used for the analysis of demographic characteristics, disease data and health habits. Univariate comparisons were made between the GSES and SAST with all demographic characteristics and health habits. Independent-samples T-Test were used in cases of binary variables, one-way Anova in cases of categorical variables with >2 categories, while Pearson's correlation coefficient was also used in cases of continuous variables. Furthermore, multiple linear regression models were performed with dependent variables the scales GSES and SAST and independent variables those that were found to be significant of univariate analysis. Multiple logistic regression with dependent variable HbA1c levels (high vs low) and independent variables GSES, SAST and medication (anti-diabetic tablets vs anti-diabetic tables and insulin) was performed. The level of statistical significance was set to α=0.05. Data were analyzed using the IBM SPSS 24 software.

Results

One hundred and three patients aged ≥65 years with a diagnosis of T2DM were registered in the electronic medical record. The study included 92 participants, while five patients refused to participate and six patients did not meet the inclusion criteria. No questionnaires with missing values were found. The mean age of participants was 76.7 (±7.1) years (range 65-94 years). Demographic characteristics, disease data and lifestyle habits are shown on table I.

The number of chronic concomitant diseases was recorded at 3.5 (±1.5) with hypertension, dyslipidemia and ischemic heart disease being the most common. The average value of the BMI was found to be at 30.8 Kg/m^2 (±5.3). Mean HbA1c value of the first measurement was recorded at 7.26 (±1.26), while the analysis of the second measurement showed a similar mean value 7.26 (±1.12). The GSES mean value for the whole sample was measured at 26.3 (±6.5), while the mean value of the SAST was estimated at 20.9 (±4.5).

According to the univariate analysis, men appeared to have a higher score of the overall GSES (28.8 ±5.3, p=0.002) compared to women (24.5±6.9). Those of higher education showed higher scores (31.0 ±3.6, p<0.0001), followed by those of secondary education (30.6±5.5), while patients with primary education (26.1±6.3) and those who had received some training (19.6±4.8) recorded the lowest scores. Single people had the highest levels of general self-efficacy (33.5±2.1, p=0.016), followed by married (27.5±5.7), and divorced (27.0±5.7), while the lowest levels were detected in those in widowhood (23.4±7.4). Moreover, patients who did not engage in any physical activity showed the lowest levels of GSES (23.4±6.2, p=0.01), in contrast to those who exercised once or twice a week (29.5±4.2).

Multiple linear regression showed that education levels and the amount of sleep and exercise were statistically significant factors in predicting the GSES, showing all three a positive correlation (coefficients B>0) (Table IIa). Gender, was not a statistically significant predictor of overall self-efficacy scoring, with women having a tendency for reduced levels (B=-2.2, p=0.080).

Univariate comparisons for SAST revealed that women had statistically significant higher scores (21.7±4.4, p=0.044), compared to men (19.8±4.5). Also, patients on treatment exclusively with antidiabetic tablets had a higher SAST score (21.1±4.4, p=0.045), compared to those receiving a triple combination with injectable GLP-1, insulin and anti-diabetic tablets (21.0±4.2) or double combination therapy with anti-diabetic tablets and insulin (19.5±4.3). Additionally, those who self-assessed their sleep quality as poor, recorded the highest SAST scores (26.1±4.4, p<0.0001), followed by those who described a moderate sleep quality (22.0±3.8). On the contrary, positive self-assessment of sleep quality was associated with statistically significant lower SAST ratings (19.6±4.4, p<0.0001).

Multiple linear regression (Table IIb) showed that BMI, number of chronic diseases and poor sleep quality were statistically significant and positively associated with high scoring of the SAST scale (B>0 and p-value <0.05) for all the above variables. On the other hand, the number of days with consumption of meat and legumes were inversely associated with high scores of the SAST scale (B<0 and p-value <0.05).

Moreover, the Pearson's correlation coefficient test for the continuous variables of the SAST with selected variables, indicated that days of meat and legumes consumption was inversely associated with SAST levels, as it was shown that patients who scored higher on the stress scale reported fewer days of meat and legumes consumption (p=0.024 and p=0.047 respectively). Additionally, BMI levels and the number of chronic diseases were positively correlated with SAST scores (p=0.025 and p=0.037 respectively). Finally, patients with high SAST scores had lower levels of overall general self-efficacy (p<0.0001) (Table III).

Table I. Descriptive characteristics of participants, disease data and lifestyle patterns.

Variable	Characteristics	n (%)
Demographic characteristics		
Gender	Male	40 (43.5%)
	Female	52 (56.5%)
Marital Status	Married	59 (64.1%)
	Single	2 (2.2%)
	Widow	29 (31.5%)
	Divorced	2 (2.2%)
Educational level	None	9 (9.8%)
	Primary Education	66 (71.7%)
	Secondary Education	14 (15.2%)
	University	3 (3.3%)
Disease data		
Duration of the disease (in years)	0-5	21 (22.8%)
	6-10	24 (27.2%)
	11-15	16 (17.4%)
	>15	30 (32.6%)
Treatment regimen	Diet / Exercise	0 (0.0%)
	Antidiabetic tablets	71 (77.2%)
	Insulin	1 (1.1%)
	Antidiabetic tablets and insulin	18 (19.6%)
	Other injectable drugs	0 (0.0%)
	Other injectable drugs and antidiabetic tablets	0 (0.0%)
	Other injectable drugs and insulin	0 (0.0%)
	Other injectable drugs and insulin and antidiabetic tablets	2 (2.2%)
Lifestyle patterns and health habits		
Consumption days / week	Fruits / Vegetables	5.7 (±1.8)
	Meat	2.1 (±1.2)
	Fish	1.2 (±0.7)
	Pasta, bread, flour	5.2 (±2.3)
	Sweets	1.3 (±2.0)
	Legumes	1.5 (±0.7)
Exercise days / week	None	33 (35.6%)
	1-2	12 (13.0%)
	3-5	10 (10.9%)
	Daily	37 (40.2%)
Hours of night sleep	Less than 3	3 (3.3%)
	4-5	23 (25.0%)
	6-8	51 (55.4%)
	More than 8	15 (16.3%)
Sleep quality	Good	68 (73.9%)
	Moderate	34 (37.0%)
	Poor	6 (6.5%)
Presence of dreams in sleep	Yes	68 (73.9%)
	No	24 (26.1%)
Use of anxiolytics / antidepressants	Yes	22 (23.9%)
	No	70 (76.1%)
Use of tobacco products	Never	82 (89.1%)
	Occasionally	1 (1.1%)
	<10 cigarettes / day	3 (3.3%)
	10-20 cigarettes / day	5 (5.4%)
	>20 cigarettes / day	1 (1.1%)
Frequency of alcohol consumption	Never	69 (75.0%)
	Occasionally (social drinker)	14 (15.2%)
	3-4 times /week	3 (3.3%)
	Daily (1-2 drinks)	6 (6.5%)
	Daily (> 2 drinks)	0 (0.0%)

Table II (a, b). Multiple linear regression prediction of GSES and SAST scores.

Table IIa. Multiple linear regression and GSES score.

Factor	B	p-value	95% confidence interval
Gender	-2.260	p=0.080	-4.794 to 0.273
Educational Level	3.133	p=0.004	1.046 to 5.221
Hours of sleep	7.384	p=0.028	0.837 to 13.931
Days of physical exercise	3.462	p=0.007	0.986 to 5.937

F-Anova 9.434, on df.4, p<0.0001, adjusted R^2=0.27

Table IIb. Multiple linear regression and SAST score.

Factor	B	p-value	95% confidence interval
Body Mass Index	0.169	p=0.042	0.006 to 0.331
Number of chronic diseases	0.603	p=0.025	0.078 to 1.128
Duration of the disease	1.425	p=0.132	-0.439 to 3.289
Poor Sleep Quality	3.826	p=0.035	0.276 to 7.376
Days of eating meat	-0.950	p=0.005	-1.597 to -0.303
Days of eating legumes	-1.468	p=0.014	-2.632 to -0.302

F-Anova 60.42, on df.6, p<0.0001, adjusted R^2=0.299.

Table III. Univariate analysis of the SAST scale with determinants.

Factor	SAST (coef. Pearson, p-value)
Age	0.035 (p=0.739)
Days of eating fruits - vegetables	-0.106 (p=0.314)
Days of eating meat	-0.235 (p=0.024)
Days of eating fish	-0.004 (p=0.970)
Days of eating pasta - bread - flour	0.144 (p=0.170)
Days of eating sweets	-0.121 (p=0.251)
Days of eating legumes	-0.207 (p=0.047)
Body Mass Index Kg/m^2	0.330 (p=0.025)
HbA1c (previous recorded measurement)	0.022 (p=0.832)
HbA1c (current measurement)	0.040 (p=0.702)
Number of chronic diseases	0.218 (p=0.037)
Self-efficacy	-0.470 (p<0.0001)

Scoring of GSES and SAST did not differ significantly between patients with HbA1c value ≤7.5 or HbA1c >7.5 (Table IV). In contrast, medication intake is a statistically significant variable, with patients treated both with insulin and anti-diabetic tablets having a 1.7-fold increased risk of presenting high HbA1c (Table V).

Table IV. Univariate analysis of the General Self-Efficacy Scale and SAST with HbA1c categories (≤7.5% and >7.5%).

Dependent variable	Scale (mean value, ± standard deviation)
HbA1c	General Self-Efficacy Scale
HbA1c ≤7,5	26.6 (± 6.4)
HbA1c >7,5	25.9 (± 6.9)
p-value	0.643
HbA1c	SAST
HbA1c ≤7,5	20.9 (± 4.3)
HbA1c >7,5	21.0 (± 5.1)
p-value	0.886

Table V. Multiple logistic regression with dependent variable value HbA1c (≤7.5% or >7.5%) and independent variables the scores of GSES, SAST and medication (n = 89).

Factor	Odds ratio	p-value	95% confidence interval
General Self-Efficacy Scale	0.982	0.665	0.905 to 1.066
SAST	0.001	0.997	0.884 to 1.132
Medication with insulin and antidiabetic tablets	1.711	0.003	1.807 to 16.934

Chi-square 9.646, on df.3, p=0.022, adjusted R^2=0.103.

Discussion

We have detected some elements that significantly influence the scores of the two scales. These determinants could potentially have an effect on the daily lives of patients with diabetes, but not directly affecting their glycemic control. Higher educational level and adequate sleep seem to have a clear positive interaction with GSES, while on the contrary the lack of physical activity is negatively associated with self-efficacy levels in the elderly. A correlation of high levels of stress with low self-efficacy ($p<0.0001$) has been found robust. This finding is aligned with the notion that people with low self-efficacy tend to experience increased stress levels and be overwhelmed by feelings of low self-confidence, self-esteem and pessimism when faced with situations of high risk and increased task requirements [35]. These people may be more ‘sensitive’ to stress and vulnerable to emotional fluctuations.

The levels of general self-efficacy in this population group study are higher than average and a greater self-efficacy is reflected as a trend in patients with better glycemic control (HbA1c ≤7.5%). This finding is in line with the results of other studies which have shown that although self-efficacy significantly affected therapeutic compliance, there were mixed findings in terms of clinical outcomes [36-38]. Patient compliance clearly drives clinical outcomes but drug intake contributes to the adequate control of glycemia and is related to the effectiveness of the chemical substance, rather than the patient’s self-efficacy or stress levels when a patient receives treatment properly.

SAST values do not appear to differ, not even as a sub-descriptive trend, between patients with good or poor glycemic control. This is in line with the findings of a recent study, in which although stress levels in patients with T2DM were elevated, they did not appear to be directly and independently correlated with glycemic control [39]. Also, Bazelmans et al. found that poor or worsening levels of glycemic control were not associated with increased diabetes-related discomfort and anxiety [40]. An interesting, but treated with caution, finding of this study is the increased stress levels in those taking exclusively antidiabetic tablets, compared to those having injectable medication. A possible explanation is that those patients having orally treatable diabetes, may have different expectations. For this reason, they may make greater compliance efforts regarding dietary measures and daily self-care, which exacerbates their anxiety. Moreover, one of erroneously perceived but solid beliefs, in many patients with diabetes when receiving *per os* treatment is to try to avoid the threshold of insulin therapy initiation.

Furthermore, there seems to be a strong association between stress and women, a fact that has been documented also in other studies [39,41]. One possible explanation stems from a sociological approach that the role of women remains influenced by gender inequality, especially in rural and isolated societies. This role often drives women to be more introverted, while the gradual decrease of estrogens with age leads to loss of well-being and may exacerbate stress or emotional fluctuations [39].

Also, poor sleep quality was associated with increased stress levels. Several studies have highlighted the negative correlation between stress and sleep quality in diabetes [39,42]. Moreover, geriatric patients clearly have more reasons to suffer from sleep disorders, as changes in the “architecture” of sleep are known to be part of the normal aging process. Another noteworthy observation is the low consumption of meat and legumes among those with higher levels of stress. This could be related to the preparation effort required for meat and legumes, in terms of time consumption, and planning, which may place a burden on people with high stress levels. On the contrary, preparing dishes or consuming food that do not require much effort and time, such as pasta, may be perceived as more easy by anxious persons. A study by Naicker et al. found that women with diabetes and increased stress levels were more likely to consume larger amounts of fresh vegetables, exercise less and consider daily management of diabetes a difficult task [43]. This finding shows an interconnection between food choice, exercise and diabetes management.

Strengths and limitations

The limitations of the study include the small sample of patients from a specific rural area, which means that the results cannot be generalized to all older people. Also, services offered by one physician may raise issues of bias. Another limitation of the study is that compliance was not investigated, neither as a parameter driving different treatment regimens (oral or injectable), nor as a factor associated with behavioral loops and multi-morbidity.

Medication intake showed a significant association, with patients treated with both insulin and antidiabetic tablets, having a 1.7-fold increased risk of presenting higher HbA1c, compared to those taking only antidiabetic tablets, paying attention to the wide range of the 95% confidence interval detected (Table V). As the study sample was limited and 95% confidence interval expanded we have no any intention to focus on this finding.

The strength of this study is the digital clinical information recording of patients with chronic diseases which is not a systematic clinical practice in the Greek environment. This discussion becomes more interesting if one considers that this project, took place in a rural area of Northern Greece, with limited human and technical-material health resources. The chosen methodological approach supports feasibility for similar research initiatives in the future. Satisfactory matching of clinical practice and research evidence can be obtained despite limitations of resources or capacity. In the past, several studies have attempted to correlate various aspects of daily life with self-efficacy, stress and diabetes [44-47], but as new variables with a psycho-social content may be added for research purposes, the need to focus on small community style of living becomes triggering.

Conclusions

This research initiative is one of the interesting attempts to investigate the relationship between general self-efficacy, stress and lifestyle in a well-studied rural geriatric population group with T2DM. Self-efficacy and stress levels are not predictors for glycemic control and HbA1c value measurements, but can indirectly be seen as co-determinants, contributing to the overall daily life quality among patients with diabetes. It also seems that a good level of self-efficacy and at the same time lower levels of stress may be related to the living conditions of patients with T2DM, such as specific eating habits, exercise, quantity and quality of sleep.

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