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Research Article

The Relationship of Diabetes Mellitus Risk with Well-Being, and Physical Activity among Young Adults

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ABSTRACT

Background: The growing prevalence of diabetes mellitus poses a worldwide health risk for young adults.

Objective: To investigate the risk of diabetes mellitus, well-being, and physical activity in university students.

Materials and Methods: This cross-sectional study was conducted with 925 university students. Personal Information Form, Finnish Diabetes Risk Score - Type 2 Diabetes Risk Assessment Form, The Well Star Scale, and The International Physical Activity Questionnaire-Short Form have been used in the study.

Results: All the students were classified in a low-risk group for diabetes. Examining lifestyle behaviours among the students, 52.8% did not have regular and balanced dietary habits and 66% did not exercise regularly. In the study, increased levels of physical activity promoted overall scores for well-being. Increased physical activity decreased the risk of diabetes. Significant differences were found in terms of well-being, physical activity, and Finnish Diabetes Risk Score scores among students who had regular and balanced eating habits in comparison to those who did not ($p<0.05$).

Conclusion: The students' levels of well-being have increased, and the risk of diabetes has reduced as their physical activity levels increase. On the contrary, those who did not exercise regularly and did not have a regular dietary habit have an increased risk of diabetes mellitus. There is a need for more studies investigating diabetes risk levels and related variables in young adults.

KEYWORDS

Diabetes Risk, Well-being, Physical Activity

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Introduction

Diabetes Mellitus (DM) is a major public health problem affecting millions of people worldwide [1]. According to the International Diabetes Federation (IDF), as of 2019, one out of every 11 adults (463 million people) between the ages of 20-79 has diabetes, it is estimated that by 2045 this number will increase to about 630 million [2]. Therefore, making pre-diabetic blood tests, a lifestyle change in terms of weight control, diet, and BMI control is very important [3].

In the literature, the concept of well-being is expressed as "a way of life in which the individual's functioning in all physical, mental and spiritual dimensions is intended to be improved" [4,5]. Although there are many definitions related to well-being [7-9], the most notable for the emphasis that the state of well-being is a way of life, hence a process [6]. The main causes of death, especially in middle age and above, are chronic diseases such as cardiovascular diseases and cancer. Genetic factors have a significant share in the emergence of these diseases, as well as psychological and social factors. In a more explicit expression, what is meant by psychological and social factors is the maintained lifestyle [4,7].

Especially the young adulthood period is very important for individuals to make changes in their lifestyle. The fact that young people acquire and maintain healthy lifestyle behaviours during this period may eliminate the potential risks they will face in the future related to health [8]. The aim of this study is to evaluate the risk of DM and the variables, which affect the lifestyle, such as well-being, and physical activity among university students who are in their adulthood periods.

Research Questions

1. What are the diabetes risk, well-being, and physical activity levels of young adults?
2. Is there a correlation between the well-being level of young adults and the level of physical activity with diabetes risk?
3. Is there a correlation between diabetes risk level and the level of physical activity?
4. Is there a correlation between young adults' nutritional behaviors and their level of well-being, physical activity level, and diabetes risk?
5. Is there a correlation between young adults' physical exercise behaviors and their level of well-being, physical activity level, and diabetes risk?

Materials and Methods

Study Design

This study is a descriptive, correlation and cross-sectional study.

Sample

Due to the fact that the study had a limited population, the sample selection was not carried out, the entire population was tried to be reached. Between the dates of the study, 1932 students enrolled in the Faculty of Health Sciences of a Health Sciences University in one of the cities in Turkey created the universe of the research. However, the data of the current study was based on 925 voluntary students who met inclusion criteria for the study and, thus, 47.8% of the students enrolled in above- mentioned university were included. The current study included participants with no chronic diseases such as DM, High blood pressure, Heart Diseases, Neurological and Orthopaedic diseases, not using any medication from the Faculty of Health Sciences of one of the Health Sciences Universities in Turkey. Participation was voluntary based. On the other hand, Students with diagnosed diabetes or any chronic diseases, the ones on continuous medication, and unwilling to participate were excluded from the study.

Data Collection

Data was collected through the Personal Information Form, FINDRISC Type 2 Diabetes Assessment Form, The Well Star Scale (WSS), and International Physical Activity Questionnaire - Short Form (IPAQ- SF). The Finnish Type 2 Diabetes Risk Score (FINDRISC) is a risk stratification tool developed by Finnish authors Lindström and Tuomilehto and was first published in 2003 [9]. The FINDRISC questionnaire was translated into Turkish by the Society of Endocrinology and Metabolism of Turkey (TEMD) and recommended its use in our country [10,11]. The eight variables included in the survey that are correlated with the risk of diabetes are age, body mass index, waist circumference, current use of antihypertensive- hypertensive medication, dietary consumption of fruit and vegetables, physical activity, personal history of high blood glucose, and family history of diabetes. Variables are scored according to the risk that they may pose, resulting in a range of 0–21 total points, divided into five risk categories, ie, low (<7 points) slightly elevated (7–11 points), moderate (12–14 points), high (15–20 points), and very high (>20) [11,12]. In the light of the literature, the FINDRISC scoring value was accepted as ≤7 in this study, and 'slightly elevated risk' was defined if the total score was ≤7; while >7 was considered as 'low risk' in terms of Type 2 diabetes. In this study, a total FINDRISK score of 7 and above was considered as a "mild-moderate" level of risk in terms of Type 2 diabetes, and a "low" risk if it was below 7.

The Well Star Scale (WSS) was developed by Korkut-Owen et al. (2016) to use with the Turkish population [13]. The Scale includes a total of 24 items consisting of five domains which assess 'The Quest for Meaning in Life and Being Goal-oriented (7 items), Cognitive Aspect (4 items), Emotional Aspect (5 items), Physical Aspect (4 items) and Social Aspect (4 items). All five domains use a five-point Likert type (1- t doesn't reflect me at all, 2- It doesn't reflect Me, 3- Sometimes, 4- It reflects me, and 5- It totally reflects me). The minimum total score of the scale was 24 and the maximum score is 120. The internal consistency coefficient for the total of the scale is r=0.84 (p <0.01). Coefficients gathered from the subscales are 0.83; 0.72, 0.60, 0.57 and 0.65 respectively [13].

The International Physical Activity Questionnaire, developed by Booth [14], is a reliable and valid instrument [15]. Turkish version of the IPAQ-SF, proved to be reliable and valid, comprises a set of 4 domains and a total of seven questions [16]. The IPAQ asks about

physical activity (PA) performed for at least 10 minutes in the past seven days. The items in the IPAQ form have been structured to provide separate scores on the duration (minutes) and frequency (days) of walking, moderate-intensity and vigorous-intensity activities over the previous week. The last question is about the time spent sitting or lying down etc… Calculating the total score includes the sum of the duration (minutes) and the frequency (days) of walking, moderate-intensity and vigorous-intensity activities. The energy required for the PA is calculated by MET-minutes. A MET-minute is calculated by multiplying the MET score by the minute of the activity performed [16].

Statistical Analyses

The data analysis was performed using Statistical Package for the Social Sciences 22.0 (IBM SPSS Corp.; Armonk, NY, USA). Data were mainly presented as percentages, mean, standard deviation (SD), and variance analysis. The conformity of numerical variables to normal distribution was assessed by the Shapiro-Wilk test. The comparison of numerical data for two independent groups was performed using the Mann Whitney U test. Differences in numeric variables for three independent groups were tested by Kruskal-Wallis H tests. Correlation between variables was analysed by Spearman's rho test [17]. The statistical significance level was set at $p<0.05$.

Ethical Considerations

All the participants gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Scientific Research Ethics Committee of Afyon Kocatepe University of Health Sciences in Turkey (Ref. No: 2011-KAEK-2, 2020/281).

Results

Among 925 participants, 75.4% (n=696) were females. Of all the participants, 31.6% were enrolled in the Department of Physical Therapy and Rehabilitation; 29.5% in the department of Nursery; 25.3% in the department of Health Institutions Administration, and 13.6 % in the department of Nutrition and Dietetics. The mean age, height, and weight of the students were 20.94 ± 2.84, 166.96 ± 9.07, and 62.03 ± 12.55 respectively. The study showed that the students were predominantly of normal weight (72.4%), while 22.3% of them were overweight and 5.3% were categorized as obese. When the lifestyle behaviours of the students were assessed, 52.8% of the students were not inclined to have regular and balanced dietary habits;71.8% did not use tobacco and 84.6% did not consume alcohol; 66% of them were found not to perform regular physical activity.

The participants had an average FINDRISC score of 5.45 ± 3.06 where 57.3% had a low risk of developing diabetes; 37.2% had a slightly elevated risk of diabetes; 3.1% had a moderate risk of diabetes, and 2.4% had a high-to-very high risk of developing diabetes. These findings indicate that the majority of the students are classified in a low-risk group for diabetes. No significant difference was found between the mean FINDRISC score in terms of gender variable ($p>0.05$). The students had an average The Well Star Scale score of 86.54 ± 12.63 (min: 24, max: 120). The mean scores of the subscales of the quest for meaning in life and being goal-oriented, cognitive aspect, affective aspect, the physical aspect, and social aspect were 25.84 ± 4.61, 15.46 ± 3.61, 16.48 ± 3.27, 12.43 ± 3.78, and 15.32 ± 4.28 respectively. The mean emotional subscale score of the scale is significantly higher in male students ($p=0.012$). Examining the subscale of the social aspect, the mean score was statistically higher for the female students ($p=0.0001$). The participants had an average physical activity score of 1556.12 ± 469.3. The average physical activity scores of male students (2041.60 ± 553.3) were significantly higher than the average scores (1390.88 ± 451.0) of female students ($p=0.0001$). The same pattern was observed in the average scores of walking, moderate-intensity physical activity, and vigorous-intensity physical activity of male students ($p=0.009$, $p=0.002$, $p=0.0001$ respectively).

The Correlation among the Level of Well-being and Physical Activity, Diabetes Risk

There was a significant positive correlation between the total scores of the Well Star Scale and PA ($r=0.166$, $p= 0.000$). This finding indicates that the level of physical activity increases as the level of well-being increases (Table 1). No correlation was found between overall scores of the Well Star Scale and FINDRISC scores of male students. In contrast, a significant negative correlation was observed between overall scores of the Well Star Scale and FINDRISC score of female students ($r=-0.085$, $p=0.009$), which indicates that when the level of wellbeing in female students increases, diabetes risk decreases (Table 1).

The Correlation between Diabetes Risk and the Level of Physical Activity

The findings of this study indicate a significant negative correlation between overall scores of physical activity and FINDRISC scores (Females $r=-0.101$, $p= 0.002$; Males $r=-0.131$, $p=0.000$). The diabetes risk decreases as the level of physical activity increases. Similarly, there was a significant negative correlation between vigorous PA scores and FINDRISC scores (Females $r=-0.091$, $p= 0.005$; Males $r=-0.111$, $p=0.001$). This finding shows that diabetes risk decreases when the level of vigorous PA increases (Table 2).

The Correlation between Dietary Behaviours and the Levels of Wellbeing and Physical Activity, Diabetes Risk

The Well Star Scale scores ($p=0.0001$) and physical activity levels ($p=0.019$) were higher among those having regular and balanced dietary habits (Table 3). When assessing DM risk in terms of dietary habits, it has been found that FINDRISC mean scores are relatively low among the students who established regular and balanced dietary habits compared to those who did not (Females $p= 0.001$, Males $p= 0.003$) (Table 3).

The Correlation between Physical Exercise Behaviours and the Levels of Wellbeing and Physical Activity, Diabetes Risk

When mean scores of the scale based on regular exercise were

Table 1: The correlation among the level of wellbeing and physical activity, diabetes risk.

The Well Star Scale and Subscales		Vigorous PA	Moderate PA	Walking PA	Total PA	FINDRISC-Female	FINDRISC-Male
The quest for meaning in life and being goal-oriented	r	**0.068***	**0.090***	**0.101***	**0.131***	-0.046	-0.014
	p	0.035	0.005	0.002	0.000	0.161	0.676
	N	925	925	925	925	696	229
Cognitive aspect	r	0.019	**0.116***	**0.076***	**0.097***	-0.029	-0.015
	p	0.557	0.000	0.018	0.003	0.367	0.635
	N	925	925	925	925	696	229
Emotional aspect	r	**0.103***	**0.102***	0.061	**0.126***	-0.049	-0.040
	p	0.002	0.002	0.060	0.000	0.131	0.215
	N	925	925	925	925	696	229
Physical aspect	r	**0.203***	**0.150***	**0.069***	**0.199***	**-0.176****	**-0.158****
	p	0.000	0.000	0.034	0.000	0.000	0.000
	N	953	953	953	953	696	229
Social aspect	r	0.013	0.051	0.057	0.061	-0.014	0.010
	p	0.679	0.117	0.080	0.061	0.670	0.767
	N	925	925	925	925	696	229
WSS total	r	**0.112***	**0.134***	**0.099***	**0.166***	**-0.085****	-0.058
	p	0.001	0.000	0.002	0.000	0.009	0.072
	N	925	925	925	925	696	229

*WSS: Well Star Scale, PA: Physical Activity, FINDRISC: The Finnish Type 2 Diabetes Risk Score, r: Spearman's rho test. * Represents positive correlation. **Represents negative correlation.*

Table 2: The correlation between PA and FINDRISC scores based on gender.

Correlations			
		FINDRISC-Female	FINDRISC- Male
Vigorous PA	r	**-0.091****	**-0.111****
	p	0.005	0.001
	N	696	229
Moderate PA	r	-0.059	**-0.075****
	p	0.069	0.020
	N	696	229
Walking PA	r	-0.052	**-0.074****
	p	0.110	0.022
	N	696	229
Total PA	r	**-0.101****	**-0.131****
	p	0.002	0.000
	N	696	229

PA: Physical Activity, FINDRISC: The Finnish Type 2 Diabetes Risk Score, r: Spearman's rho test.
***represents negative correlation.*

Table 3: Comparison of wellbeing, physical activity, and FINDRISC mean scores based on regular and balanced dietary habits.

		Do you have a regular and balanced dietary habit?						Mann-Whitney U test		
		N	Mean	Median	Minimum	Maximum	SD	Mean Rank	U	P
Total WSS	Yes	432	92.13	92.00	44.00	120.00	11.60	557.3	-8.4	0.0001
	No	493	85.10	86.00	24.00	120.00	12.66	406.3		
	Total	925	88.39	89.00	24.00	120.00	12.66			
Total PA	Yes	432	1674.95	1164.00	132.00	7998.00	1557.01	499.2	-2.33	0.019
	No	493	1451.59	924.00	132.00	7785.00	1406.46	457.5		
	Total	925	1556.12	990.00	132.00	7998.00	1482.24			
FINDRISC-Female	Yes	325	5.04	5.00	0.00	26.00	3.30	444.3	-3.2	0.001
	No	371	5.50	5.00	0.00	16.00	2.82	501,1		
	Total	696	5.28	5.00	0.00	26.00	3.06			
FINDRISC-Male	Yes	106	5.38	5.00	0.00	26.00	3.53	446.4	-2.98	0.003
	No	123	5.84	5.00	0.00	16.00	3.02	499.2		
	Total	229	5.62	5.00	0.00	26.00	3.27			

WSS: Well Star Scale, PA: Physical Activity, FINDRISC: The Finnish Type 2 Diabetes Risk Score.

Table 4: Comparison of well-being, physical activity,and FINDRISC mean scores based on regular physical exercise habit.

		How often do you perform physical exercise?						Kruskall-Wallis H test			
		N	Mean	Median	Minimum	Maximum	SD	Mean Rank	H	P	Paired Comparison
Total WSS	Once a week	131	90.37	92.00	59.00	120.00	12.04	522.0	29.67	0.0001	2-1 2-3 1-3
	More than once a week	180	92.02	92.00	34.00	120.00	12.65	557.3			
	None	614	86.83	87.00	24.00	120.00	12.50	442.1			
	Total	925	88.35	89.00	24.00	120.00	12.64				
Total PA	Once a week	131	1608.77	1293.00	165.00	6293.00	1310.24	515.0	71.2	0.0001	2-1 2-3
	More than once a week	180	2401.76	1797.50	132.00	7998.00	1859.84	615.4			
	None	614	1289.91	714.00	132.00	7785.00	1274.09	426.5			
	Total	925	1552.63	990.00	132.00	7998.00	1475.79				
FİNDRİSK-Female	Once a week	98	4.77	4.00	0.00	16.00	2.70	426.4	23.08	0.0001	3-1 3-2
	More than once a week	136	4.60	4.00	0.00	15.00	3.34	406.4			
	None	462	5.59	5.00	0.00	26.00	3.01	503.5			
	Total	696	5.28	5.00	0.00	26.00	3.06				
FİNDRİSK-Male	Once a week	33	5.08	5.00	0.00	16.00	2.92	424.6	18.3	0.0001	3-1 3-2
	More than once a week	45	5.00	5.00	0.00	18.00	3.55	418.0			
	None	151	5.92	5.00	0.00	26.00	3.23	500.5			
	Total	229	5.62	5.00	0.00	26.00	3.28				

WSS: Well Star Scale, PA: Physical Activity, FINDRISC: The Finnish Type 2 Diabetes Risk Score.

analysed, a significant difference concerning wellbeing, the level of physical activity, and FINDRISC scores was observed between groups ($p<0.05$). As the students' regular physical exercise habit improves, the WSS scores increase ($p=0.0001$) (Table 4).

In addition, FINDRISC scores were observed to be significantly higher among females and males who did not perform a regular physical exercise ($p=0.0001$) (Table 4). This finding indicates that DM risk increases among individuals who do not perform regular exercise.

Discussion

Diabetes risk is a important variable to be evaluated among obese and overweight individuals [18]. In our study, the prevalence of overweight and obesity is 22.3% and 5.3% respectively. In a study conducted with university students, Mehmood et al. (2016) found that 21.7% of the students were overweight and 8.4% were obese [19]. In a similar study done in United States, 48% of its students were normal weight, 25.7% were overweight, and 22.9% were obese [20]. In this study, it is quite remarkable that the number of overweight students (22.3%) was 5 times more than obese ones (5.3%) and 52.8% of the students did not establish a regular and balanced dietary habit. These findings refer to an increase in the incidence of overweight and obesity among university students in the future. Therefore, raising awareness of a healthy diet can prevent many health problems that can potentially develop in the future.

In our study, 57.3% of the students were categorized in the low-risk group, 37.2% in a slightly elevated risk group, 3.1% in a moderate risk group, and 2.4% in high and very high-risk group in terms of FINDRISC scores. In a study conducted among university students in India, 31% of the students were categorized in the low-risk group, 68% in the moderate-risk group, and 1% in the high-risk group [21]. Another study, 67.1% of the students were classified in the low-risk group, 28.5% in a slightly elevated risk group, 2.2% in a moderate-risk group, and 2.2% in a high-risk group in terms of FINDRISC scores [22].

As for FINDRISC mean scores, Gezer (2017) reported [22] the FINDRISC mean scores as 4.26 ± 0.23; Tetik et al. (2019) as 7.78 ± 4.02 [23]. In this study, however, FINDRISC mean scores of the students were determined as 5.45 ± 3.06, indicating that the majority of the participants were found to belong to the low-risk group for diabetes risk.

It has been reported that diabetes risk cannot be directly associated with such parameters as fasting blood sugar, insulin, or visceral adiposity; moreover, certain factors as age, healthy diet or living conditions also play a major role [24]. Sedentary lifestyle and physical inactivity factors increase the risk of obesity and diabetes [25]. A positive energy intake balance, in which energy intake exceeds expenditure, excess weight and obesity pose a further risk of experiencing diabetes [26].

A study conducted by Doğan et al. stated that university students 'consumption of more than one fast food per week was 36.5%. A total of 37.5% university students were found to have a risk of diabetes. It was determined that the rate of those who had moderate or high diabetes risk among the population of the study was 13.1% [27].

Unhealthy dietary habits, sedentary lifestyle and decreased physical activity are closely associated with increased T2DM risk both directly and indirectly through promoting obesity and various metabolic syndrome components [28,29].

A negative correlation between Type 2 diabetes risk and healthy lifestyle behaviours was reported (r=-0.071, p=0.026). Moreover, there was a negative correlation between FINDRISC mean scores and the level of physical activity (r = -0.130, p <0.001) [23]. The obtained results in this study have demonstrated a significant difference in well-being, physical activity level, and FINDRISC scores among the students with regular and balanced dietary habits (p<0.05). It was found as well that FINDRISC scores were higher among males (p=0.003) and female (p=0.001) participants without a regular and balanced diet. Thus, this study concludes that an irregular and unbalanced diet increases diabetes risk.

As the results here in suggest, FINDRISC scores of the students who do not perform regular physical activity are higher (p=0.0001). There was a significant negative correlation found between students' total physical activity scores and FINDRISC scores (female r=-0.101, p= 0.002; male r=-0.131, p=0.000). This means that risk of diabetes declines as individuals' physical activity level increases. This result is also consistent with the literature. Similarly, Ghaderpahani et al. (2011) stated that there was a significant correlation between moderate-intensity physical activity with at least 150 min once a week and diabetes risk [OR = 0.56; % 95 Cl: 0.35-0.91 and OR = 0.50; % 95 Cl: 0.26-0.94 respectively] [30].

Well-being is often defined as the optimal function that allows the individual to lead an effective life and achieve true happiness with satisfaction in life [31]. It has been suggested that well-being is inversely correlated with perceived stress among students. A total of 150 minutes of moderate-intensity physical activity per week has been reported to reduce stress and have health-enhancing effects [32]. Physical exercise has been observed to increase the level of well-being, prevent diseases, and enhance overall health [33]. Rinder et al. showed that there was a positive correlation between well-being scale scores and physical activity levels among students (r=0.33, p<0.001) while it was negatively correlated with the diagnosis for depression, receiving mental health care, and having diagnosed diseases over the last year (r=-0.49, r=-0.62, r=-0.54, respectively, p<0.001) [31].

This study suggests that as the physical exercise habit of students increases, the Well Star Scale scores increase (p=0.0001). Although the Well Star Scale mean scores were 86.83 ± 12.50 among the students who did no physical exercise, those of the students who did an exercise once a week were 90.37 ± 12.04 and those of the ones who did exercise more than once a week were 92.02 ± 12.65, there was a significant difference found between groups (p=0.0001). Besides, a significant and positive correlation was detected between overall Well Star Scale and PA scores (r=0.166, p=0.000), indicating that total well-being scores rise as physical activity levels increase among the students.

İrregular eating habits, low levels of physical activity among the majority of students participating in the study can lead to poor living standards and an increased risk of obesity and diabetes, laying the groundwork for the pre-diabetes process.

The majority of university students do not engage in adequate physical activity, experience intense stress due to the increasing demands of their personal and academic lives, and do not show due care for their nutrition. The behaviours that make up students' lifestyles are not associated with optimal health. All these conditions can negatively affect the physical and mental health of a teenager, hence their well-being, increasing the risk of diabetes.

Study Limitations

The sample of this study included only Afyonkarahisar Health Sciences University, Faculty of Health Sciences. This was a limitation of the study. Diabetes risk can be investigated in multiple universities in bigger samples.

Conclusion and Recommendations

As the level of physical activity and well-being among individuals increases, thus declining diabetes risk. DM risk increases among students who do not establish regular dietary and exercise habits. It is recommended that certain lifestyle behaviours as a balanced and regular diet, regular and adequate physical exercise, and well-being should be provided to the students and the opportunities of physical activity shall be improved. Besides, dietary habits should be re-arranged, stress level should be minimized and obesity and diabetes risk among the young population shall be prevented. Additionally, supportive programs should be disseminated to protect and enhance physical and mental health of university students.

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