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# The Relationship Between Type 2 Diabetes Risk and Healthy Lifestyle Behaviours of University Students in North Cyprus

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## Abstract

**BACKGROUND/AIMS:** The development of health-promoting lifestyle behaviours can reduce the risk of lifestyle diseases such as obesity, and type 2 diabetes. This study aimed to determine associated factors and the relationships between health-promoting behaviour and the risk of type 2 diabetes in university students.

**MATERIALS AND METHODS:** This study was conducted with 374 university students, and type 2 diabetes risk and health promoting lifestyle behaviours were assessed by The Finnish Type 2 Diabetes Risk Score (FINDRISC) and Health Promoting Lifestyle Profile Scale (HPLP)-II, respectively. Data were collected by face-to-face interviews and survey techniques and some anthropometric measurements were also taken.

**RESULTS:** There was a weak negative relationship between the scores of HPLP-II-total, HPLP-II-physical activity (PA), HPLP-II-nutrition (NT), and type 2 diabetes risk ($r=-0.13$, $p=0.01$; $r=-0.17$, $p<0.001$; $r=-0.16$, $p<0.001$, respectively). The lowest FINDRISC score group had the highest HPLP-II-NT scores ($p<0.05$). Female students had a 2.3-fold increased type 2 diabetes risk in comparison to males and students who were smokers had a 2.1-fold increased type 2 diabetes risk ($p<0.05$). Overweight students had a 3.7-fold increased type 2 diabetes risk compared to underweight students ($p<0.05$).

**CONCLUSION:** There is a relationship between type 2 diabetes risk and overall healthy lifestyle behaviours and healthy lifestyle behaviours such as NT, and PA. Gender, age, obesity, alcohol consumption, smoking, NT, and PA are the factors affecting type 2 diabetes risk. Parts of university education courses and activities on healthy lifestyles can encourage students to develop their health promoting lifestyle behaviours and can be beneficial in reducing the risk of type 2 diabetes.

**Keywords:** Healthy lifestyle, diabetes mellitus, diabetes mellitus type 2

## INTRODUCTION

Lifestyle can be defined as daily routine activities which may affect an individual's health. A healthy lifestyle is defined as having control over all behaviours affecting an individual's health and their performance of health-promoting daily activities in order to decrease their risk of diseases.[1] A combination of at least four healthy lifestyle factors is associated with the reduction in the all-cause mortality risk by 66%.[2] Smoking, alcohol consumption, physical activity (PA), nutrition (NT), and other lifestyle behaviours are associated with the risk of obesity, type 2 diabetes, cancer, and cardiovascular diseases. The role of genes and lifestyle are contributing to the rapid increase in the incidence of type 2 diabetes.[3] Specifically, changing the dietary and PA behaviours are a target of many effective lifestyle programs which aim to reduce the risk of type 2 diabetes.[4] Therefore, determining the risk of type 2 diabetes is essential in preventing this disease. The International Diabetes Federation (IDF) has introduced three necessary steps for the prevention of diabetes including determining at risk groups, measuring any risk, and interventions aimed at preventing the development of type 2 diabetes. The IDF recommends the use of risk scales such as

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The Finnish Type 2 Diabetes Risk Score (FINDRISC) in order to identify at risk groups.[5] An individual's university years may cause changes in their social environment and health-related behaviour as they are away from their family control. Smoking, alcohol consumption, insufficient fruit and vegetable consumption and a sedentary lifestyle are frequently observed behavioural changes in university students.[6,7] The development of health-promoting lifestyle behaviours of university students includes the development of the current and future quality of life of students as well as social health-promoting lifestyle behaviours within the society, which reduce the risk of lifestyle diseases such as obesity, type 2 diabetes, cardiovascular diseases and cancer. Such changes may be effective in improving students' quality of life.[8,9] This study aimed to determine the associated factors and the relationships between health-promoting behaviour and the risk of type 2 diabetes in university students.

## MATERIALS AND METHODS

### Place and Time of the Research and Sample Selection

This study was conducted on the Eastern Mediterranean University students in 2016 during the spring semester. The sample size was determined to be 374 university students using a random sampling method with a 95% confidence interval and a 5% sampling error.

### Research Techniques and Tools

A questionnaire covering the general characteristics and the nutritional habits of the students, "Type 2 Diabetes Risk" and "Health Promoting Lifestyle Profile Scale-II (HPLP-II)" was used to collect data through face-to-face interviews and a survey technique, which also included some anthropometric measurements. This study was approved by the Ethical Board of Scientific Research and Publication of Eastern Mediterranean University (approval number: 2016/23-06, date: 14.03.2016). All participants were asked to sign an informed consent form according to the Declaration of Helsinki.

**Anthropometric measurements:** Body weight was measured with a 0.1 kg sensitive digital scale, and height was measured on a frontal plane with a rigid tape measure when the head, back, hips and heels were touching the wall. Waist circumference was measured with a rigid tape measure with the subject standing with their legs together and hands lowered freely over the point in between the iliac crest and the rib cage. The hip was measured with a non-stretching tape measure by standing with legs together, and hands lowered freely at the broadest section of the hip. The body mass index (BMI) was calculated using the formula: weight (kg)/height $(m)^2$. The results were classified as follows: <18.5 kg/$m^2$ underweight; 18.5-24.9 kg/$m^2$ normal; 25-29.9 kg/$m^2$ overweight; and ≥30.0 kg/$m^2$ obese. In the risk assessment of obesity-associated metabolic complications, waist circumferences which are greater than or equal to 94 cm in males and 80 cm in females are defined as risky, while waist circumferences greater than or equal to 102 cm in males and 88 cm in females are defined as high risk. A waist to hip ratio higher than 1.0 in men and higher than 0.85 in women has been determined as risky.[10] Waist to height ratio is used to determine cardiometabolic risk and type 2 diabetes risk. The optimal cut-off point for Turkish adults of 0.5 or over is accepted as being associated with increased risk.[11]

**HPLP-II:** This scale was developed to measure the behaviour of various individuals for improving/maintaining health in relation to a healthy lifestyle. HPLP-II consist of 52 items and the Cronbach's alpha coefficient is 0.92 for the Turkish validity and reliability of the scale. The scale consists of 6 sub-dimensions: health responsibility (HR), PA, NT, spiritual growth (SG), interpersonal relations (IR), and stress management (SM).[12,13]

**FINDRISC:** Although there are many risk scoring models to assess type 2 diabetes risk, they require special blood test results, which limits their widespread use. This scale serves as a fast, cheap, non-invasive, convenient and simple screening tool for students at high-risk of developing type 2 diabetes in the future.[5,14] The FINDRISC questionnaire form consists of eight simple questions regarding risk factors for type 2 diabetes, and higher scores indicate higher risks.[15]

### Statistical Analysis

The independent samples t-test and One-Way ANOVA test were used for the deductive statistical evaluation of the data. The One-Way ANOVA post-hoc Tukey's test was used to compare the differences between groups. Additionally, the Pearson correlation test was used to assess the correlation between HPLP-II and FINDRISC scores. Logistic regression analysis was used to assess the effect of factors on type 2 diabetes risk. P-values less than 0.05 were accepted as statistically significant. The Statistical Package for the Social Sciences 21.0 was used for statistical data analysis.

## RESULTS

According to Table 1, female students had higher mean scores than male students in the HPLP-II-T and HPLP-II-HR, HPLP-II-NT and HPLP-II-IR ($p<0.05$). Students above 21 years of age had higher scores than those students below 21 years in HPLP-II-NT ($p<0.05$). Students who drank alcohol showed lower mean HPLP-II-NT, HPLP-II-SG and HPLP-II-SM scores than those students who did not drink alcohol ($p<0.05$). Students who smoked had lower HPLP-II-T, HPLP-II-HR, HPLP-II-PA, HPLP-II-NT, HPLP-II-SG and HPLP-II-SM scores and they had higher FINDRISC scores than those students who did not smoke ($p<0.05$).

Type 2 diabetes risk score increased with increased BMI ranges ($p<0.05$). Risky and high-risk groups according to their waist circumference and waist to hip ratios had higher mean scores for type 2 diabetes risk than non-risk groups ($p<0.05$) (Table 2).

The lowest FINDRISC score group had the highest HPLP-II-NT scores (Table 3). There were weak negative relationships between the scores of the HPLP-II-T, HPLP-II-PA, and HPLP-II-NT with the risk of type 2 diabetes ($r=-0.13$, $p=0.01$; $r=-0.17$, $p<0.001$; $r=-0.16$, $p<0.001$, respectively) (Table 4). According to regression results, female students had a 2.3-fold increased type 2 diabetes risk than males and students who were smokers had a 2.1-fold increased type 2 diabetes risk than students who did not smoke ($p<0.05$). Overweight students had a 3.7-fold increased type 2 diabetes risk compare to underweight students ($p<0.05$). Also, according to waist circumferences, type 2 diabetes risk increased 3.8-fold in the risky group and 6.4-fold in the high-risk group compared to the non-risk group ($p<0.05$) (Table 5).

## DISCUSSION

The health-promoting lifestyle behaviours of the youth are shaped during their university years and they have effects on the quality of life and the risks of diseases in the future; therefore, it is essential to evaluate lifestyle behaviour. In this study, The HPLP-II-PA demonstrated the lowest

**Table 1. HPLP-II and Type 2 Diabetes Risk Scores of students for their gender, age, alcohol consumption, and smoking habits**

| | | HPLP-II-T | HPLP-II-HR | HPLP-II-PA | HPLP-II-NT | HPLP-II-SG | HPLP-II-IR | HPLP-II-SM | FINDRISC |
|---|---|---|---|---|---|---|---|---|---|
| | n | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S |
| **Gender** | | | | | | | | | |
| Male | 215 | 125.2±20.43 | 17.8±4.80 | 17.3±5.36 | 19.1±4.11 | 26.4±4.69 | 25.3±4.56 | 19.0±3.83 | 6.6±3.79 |
| Female | 159 | 130.5±18.20 | 19.7±4.49 | 16.9±4.38 | 20.0±3.86 | 27.1±4.43 | 27.0±4.22 | 19.5±3.69 | 6.5±4.50 |
| p | | **0.009*** | **<0.001*** | 0.405 | **0.006*** | 0.167 | **<0.001*** | 0.161 | 0.830 |
| **Age (year)** | | | | | | | | | |
| ≤21 | 198 | 126.0±18.39 | 16.7±4.19 | 17.1±4.85 | 20.1±3.68 | 26.3±4.50 | 25.9±4.40 | 19.0±3.72 | 6.3±3.92 |
| >21 | 176 | 129.0±20.93 | 17.4±4.55 | 17.2±5.10 | 21.2±4.58 | 27.1±4.65 | 26.1±4.60 | 19.4±3.83 | 6.8±4.29 |
| p | | 0.133 | 0.113 | 0.828 | **0.015*** | 0.124 | 0.682 | 0.303 | 0.235 |
| **Alcohol consumption** | | | | | | | | | |
| Yes | 185 | 129.2±18.31 | 17.3±4.21 | 17.3±4.60 | 21.2±4.08 | 27.3±4.03 | 25.9±4.39 | 19.6±3.57 | 6.1±4.11 |
| No | 189 | 125.6±20.79 | 16.8±4.53 | 17.0±5.29 | 20.1±4.16 | 26.1±4.99 | 26.2±4.60 | 18.8±3.93 | 6.9±4.07 |
| p | | 0.077 | 0.308 | 0.535 | **0.007*** | **0.006*** | 0.537 | **0.044*** | 0.087 |
| **Smoking** | | | | | | | | | |
| Yes | 192 | 124.1±20.14 | 16.4±4.29 | 16.5±5.08 | 19.9±4.29 | 25.9±4.84 | 25.8±4.59 | 18.7±3.84 | 7.4±4.07 |
| No | 182 | 130.6±17.70 | 17.6±4.39 | 17.7±4.79 | 21.3±3.91 | 27.4±4.21 | 26.2±4.40 | 19.7±3.64 | 5.7±3.96 |
| p | | **0.001*** | **0.009*** | **0.028*** | **0.001*** | **0.002*** | 0.375 | **0.009*** | **<0.001*** |
| **Total** | 374 | 127.4±19.66 | 18.6±4.76 | 17.1±4.97 | 19.5±4.03 | 26.7±4.59 | 26.0±4.50 | 19.2±3.78 | 6.5±4.10 |

*: P<0.05. x̄: Mean, S: Standard deviation, HPLP: Health Promoting Lifestyle Profile Scale, T: Total, HR: Health responsibility, PA: Physical activity, NT: Nutrition, SG: Spiritual growth, IR: Interpersonal relations, SM: Stress management, FINDRISC: Finnish Type 2 Diabetes Risk Score.

**Table 2. HPLP-II and Type 2 Diabetes Risk Scores of students in relation to their anthropometric measurements**

| | | HPLP-II-T | HPLP-II-HR | HPLP-II-PA | HPLP-II-NT | HPLP-II-SG | HPLP-II-IR | HPLP-II-SM | FINDRISC |
|---|---|---|---|---|---|---|---|---|---|
| | n | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S |
| **BMI (kg/m²)** | | | | | | | | | |
| <18.5 | 32 | 132.1±21.66 | 18.1±4.80 | 16,8±5.51 | 21.5±3.99 | 27.9±4.65 | 27.4±4.39 | 19.8±4.02 | 4.5±3.30[a] |
| 18.5-24.9 | 242 | 126.8±19.94 | 17.0±4.30 | 17.2±5.11 | 20.6±4.19 | 26.5±4.56 | 25.8±4.49 | 19.0±3.82 | 5.5±3.50[b] |
| 25.0-29.9 | 77 | 126.4±17.67 | 16.6±4.19 | 16.6±4.12 | 20.5±3.95 | 26.7±4.39 | 26.1±4.58 | 19.3±3.19 | 9.3±3.84[c] |
| ≥30.0 | 18 | 131.2±20.32 | 17.1±5.27 | 19.1±5.02 | 20.4±4.94 | 27.1±5.54 | 26.3±4.21 | 20.1±4.85 | 11.8±4.16[d] |
| p | | 0.413 | 0.410 | 0.262 | 0.639 | 0.418 | 0.300 | 0.490 | **<0.001** |
| **WC (cm)** | | | | | | | | | |
| M: <94; F: <80 | 277 | 127.2±20.04 | 17.2±4.33 | 17.1±5.12 | 20.8±4.16 | 26.5±4.52 | 26.0±4.56 | 19.0±3,79 | 5.2±3.27 |
| M: 94-102; F: 80-88 | 62 | 127.4±19.56 | 16.6±4.45 | 17.2±4.66 | 20.0±4.45 | 27.4±4.24 | 25.9±3.93 | 19.6±3.67 | 9.2±3.25 |
| M: >102; F: >88 | 35 | 129.2±17.06 | 16.8±4.65 | 17.1±4.29 | 20.8±3.56 | 27.2±5.50 | 26.6±4.94 | 20.2±3.72 | 12.4±3.84 |
| p | | 0.855 | 0.649 | 0.980 | 0.452 | 0.277 | 0.765 | 0.131 | **<0.001*** |
| **WHR** | | | | | | | | | |
| M: <1.0 F: <0.8 | 329 | 127.6±19.7 | 17.0±4.41 | 17.3±4.99 | 20.7±4.23 | 26.7±4.51 | 26.0±4.45 | 19.2±3.78 | 6.2±3.80 |
| M: ≥1.0 F: ≥0.8 | 45 | 125.9±19.52 | 17.2±4.13 | 16.0±4.66 | 20.4±3.60 | 26.4±5.12 | 26.1±4.83 | 19.2±3.74 | 9.0±5.30 |
| p | | 0.583 | 0.824 | 0.097 | 0.619 | 0.599 | 0.954 | 0.980 | **<0.001*** |
| **WHTR** | | | | | | | | | |
| <0.5 | 223 | 127.4±20.76 | 17.2±4.53 | 17.2±5.35 | 20.6±4.16 | 26.6±4.58 | 26.2±4.48 | 19.0±3.93 | 5.0±3.26 |
| ≥0.5 | 137 | 127.0±18.10 | 16.8±4.24 | 16.9±4.25 | 20.5±4.25 | 26.9±4.74 | 25.8±4.66 | 19.4±3.54 | 8.9±4.24 |
| p | | 0.467 | 0.233 | 0.364 | 0.394 | 0.758 | 0.338 | 0.577 | **<0.001*** |
| **Total** | 374 | 127.4±19.66 | 18.6±4.76 | 17.1±4.97 | 19.5±4.03 | 26.7±4.59 | 26.0±4.50 | 19.2±3.78 | 6.5±4.10 |

[a,b]: BMI is statistically different than 25.0-29.9 kg/m² and 30.0 kg/m² (p<0.05), [c,d]: Statistically different than all other BMI groups (p<0.05), *: All groups are statistically different from each other (p<0.05). x̄: Mean, S: Standard deviation, HPLP: Health Promoting Lifestyle Profile Scale, T: Total, HR: Health responsibility, PA: Physical activity, NT: Nutrition, SG: Spiritual growth, IR: Interpersonal relations, SM: Stress management, FINDRISC: Finnish Type 2 Diabetes Risk Score, BMI: Body mass index, WC: Waist circumference, WHR: Waist to hip ratio, WHTR: Waist to height ratio.

score. In other studies conducted with university students, the lowest score was reported for lifestyle related to PA[16-18]. Moreover, in our study, the mean scores of female students were higher than for male students for HPLP-II-T, HPLP-II-HR, HPLP-II-NT and HPLP-II-IR. Thus, the health-promoting lifestyle behaviour of university students may vary based on their gender.[16,19] Similar results have been found in a study conducted with university students in Japan.[20] Female university students present healthier behaviour than male students, such as attending social activities, the judicious use of alcohol, and visiting a doctor for routine health checks.[21] Students above 21 years of age have higher scores than

**Table 3. HPLP-II scores according to FINDRISC groups**

| FINDRISC groups | | HPLP-II-T | HPLP-II-HR | HPLP-II-PA | HPLP-II-NT | HPLP-II-SG | HPLP-II-IR | HPLP-II-SM |
|---|---|---|---|---|---|---|---|---|
| | n | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S | x̄ ± S |
| <7 | 202 | 129.2±21.37 | 17.2±4.66 | 17.7±5.31 | 21.2±4.50* | 27.0±4.43 | 26.1±4.45 | 19.2±3.95 |
| 7-11 | 124 | 125.1±17.72 | 16.5±4.09 | 16.6±4.70 | 20.0±3.71 | 26.4±4.61 | 25.8±4.55 | 19.3±3.49 |
| 12-14 | 29 | 125.0±15.57 | 17.2±3.17 | 16.0±3.59 | 19.8±3.70 | 26.2±4.91 | 26.1±4.61 | 18.9±3.66 |
| 15-20 | 19 | 127.3±17.38 | 18.1±4.46 | 16.4±4.08 | 20.3±2.90 | 26.1±5.54 | 26.7±4.60 | 18.6±3.93 |
| p | | 0.265 | 0.363 | 0.110 | **0.037** | 0.545 | 0.839 | 0.874 |

*: Statistically different from all other groups (p<0.05), n: Number, x̄: mean, S: Standard deviation, HPLP: Health Promoting Lifestyle Profile Scale, T: Total, HR: Health responsibility, PA: Physical activity, NT: Nutrition, SG: Spiritual growth, IR: Interpersonal relations, SM: Stress management, FINDRISC: Finnish Type 2 Diabetes Risk Score.

**Table 4. The relationship between HPLP-II and FINDRISC**

| | | HPLP-II-T | HPLPII-HR | HPLP-II-PA | HPLP-II-NT | HPLP-II-SG | HPLP-II-IR | HPLP-II-SM |
|---|---|---|---|---|---|---|---|---|
| FINDRISC | r | -0.130 | -0.061 | -0.171 | -0.174 | -0.082 | -0.032 | -0.051 |
| | p | **0.012*** | 0.239 | **<0.001*** | **<0.001*** | 0.113 | 0.540 | 0.322 |

*P<0.05, n=374, r: Pearson correlation coefficient, HPLP: Health Promoting Lifestyle Profile Scale, T: Total, HR: Health responsibility, PA: Physical activity, NT: Nutrition, SG: Spiritual growth, IR: Interpersonal relations, SM: Stress management, FINDRISC: Finnish Type 2 Diabetes Risk Score.

**Table 5. Regression analysis related factors with FINDRISC**

| | FINDRISC | | | | |
|---|---|---|---|---|---|
| | B | (SE) | p | OR | 95% CI |
| Age | 0.335 | 0.312 | 0.282 | 1.399 | 0.759-2.578 |
| Gender | 0.869 | 0.338 | **0.010*** | 2.384 | 1.229-4.628 |
| Smoking | 0.779 | 0.300 | **0.009*** | 2.180 | 1.210-3.927 |
| Alcohol usage | -0.165 | 0.291 | 0.571 | 0.848 | 0.479-1.500 |
| **BMI (kg/m²)** | | | | | |
| 18.5-24.9 | 0.985 | 0.497 | **0.047*** | 2.678 | 1.012-7.089 |
| 25.0-29.9 | 1.326 | 0.650 | **0.041*** | 3.766 | 1.054-13.458 |
| ≥30.0 | 1.970 | 1.410 | 0.163 | 7.169 | 0.452-13.747 |
| **WC (cm)** | | | | | |
| M: 94-102; F: 80-88 | 1.354 | 0.442 | **0.002*** | 3.874 | 1.631-9.205 |
| M: >102; F: >88 | 4.118 | 1.188 | **0.001*** | 6.414 | 5.980-63.697 |
| WHR | -0.132 | 0.467 | 0.777 | 0.876 | 0.351-2.187 |
| WHTR | 0.368 | 0.408 | 0.368 | 1.444 | 0.649-3.213 |
| HPLP-II-T | 0.617 | 0.472 | 0.191 | 1.853 | 0.735-4.670 |
| HPLP-II-HR | 0.530 | 0.322 | 0.100 | 1.699 | 0.903-3.197 |
| HPLP-II-PA | -0.709 | 0.331 | 0.052 | 0.492 | 0.357-0.941 |
| HPLP-II-NT | -0.580 | 0.323 | 0.073 | 0.560 | 0.297-1.055 |
| HPLP-II-SG | -0.423 | 0.329 | 0.198 | 0.655 | 0.343-1.248 |
| HPLP-II-IR | 0.056 | 0.317 | 0.859 | 1.058 | 0.568-1.970 |
| HPLP-II-SM | -0.171 | 0.312 | 0.582 | 0.843 | 0.457-1.552 |
| Constant | -2.376 | 0.633 | 0.000 | 0.093 | |

*P<0.05, SE: Standard error, OR: Odds ratio, CI: Confidence interval, WC: Waist circumference, WHR: Waist to hip ratio, WHTR: Waist to height ratio, HPLP: Health Promoting Lifestyle Profile Scale, T: Total, HR: Health responsibility, PA: Physical activity, NT: Nutrition, SG: Spiritual growth, IR: Interpersonal relations, SM: Stress management, FINDRISC: Finnish Type 2 Diabetes Risk Score. Age reference category: 21 years, gender reference category: male, cigarette reference category: non-smoker, alcohol reference category: non-drinker, BMI reference category: <18.5 kg/m², WC reference category: M: <94; F: <80, WHR reference category: M: <1.0; F: <0.8, WHTR reference category: <0.5, HPLP-II-T reference category: <127, HPLP-HR reference category: <17, HPLP-PA reference category: <17, HPLP-NT reference category: <20, HPLP-SG reference category: <27, HPLP-IR reference category: <16, HPLP-SM reference category: <19.

those students below 21 for HPLP-II-NT. Previous studies have shown that the highest scores for HPLP-II-HR and HPLP-II-NT were seen in university students between the age range 23-25 years and above 25 years of age.[22,23] There is a positive relationship between the increase in health control focus and health-promoting behaviour.[24,25] Therefore, an increase in health control focus together with the increase in age is associated with an increase in HR and awareness on health-promoting lifestyle behaviours.

In another study conducted with university students, it was found that in addition to age and gender, there was a relationship between the BMI and HPLP-II scores.[24] A study conducted with university students in Syria determined that low intensity and short durations of PA played a role in higher BMI values.[25] In this study, overweight students had a 3.7-fold increased type 2 diabetes risk compared to underweight students. Another study conducted with the Turkish population showed that 10-year cardiovascular risk ratios increased according to waist circumference categories, either calculated according to the World Health Organisation criteria or according to the proposed cut-off levels 90 cm and 100 cm for males and 80 cm and 90 cm for females.[26] In our study, students who had a higher risk of cardiovascular disease according to their waist height ratio had a higher risk score for type 2 diabetes risk. In addition, a weak negative relationship was determined between HPLPII-T, HPLP-II-PA, HPLP-II-NT with FINDRISC scores. Previous studies showed that university students did not perform sufficient PA and had negative nutritional habits such as skipping meals, frequent fast-food consumption and insufficient consumption of fruits and vegetables.[27-29] These could be due to time restrictions for preparing healthy foods and PA due to planning their course and study hours. In a study conducted in Kuwait, students reported that they did not have enough time to prepare healthy diets and could not plan their schedules during the day and also that they did not have enough time for PA due to unfavourable weather conditions.[30]

In this study, it was found that students who consumed alcohol had lower scores for HPLP-II-T, HPLP-II-NT and HPLP-II-SG compared with those students who did not consume alcohol. Moreover, it was indicated that smoking was associated with a 2.1-fold increase in type 2 diabetes risk for university students. In another study which aimed to determine the factors which could predict healthy behaviour in university students, high self-sufficiency, which is a reflective factor of SG, was associated with a decrease in alcohol and smoking and an increase in PA and nutritional behaviour.[6] In this study, students who smoked had lower mean scores for HPLP-II-T, HPLP-II-PA, HPLP-II-NT, HPLP-II-SG and HPLP-II-SM compared with those who did not smoke ($p<0.05$). In a similar study conducted with university students, it was determined that students who smoked had lower scores for HPLP-II-HR, HPLP-II-SG and HPLP-II-NT compared with those students who did not smoke.[31] In a study conducted on the smoking habits of university students, it was determined that the prevalence of respiratory tract infection was higher and physical fitness was lower in those students who smoked than in those who did not smoke. In addition, an increase in PA can be effective in increasing problem-solving ability; thus, it can provide support for SM and SG.[32] Therefore, the interpersonal development and SG of students is an essential factor affecting smoking and other lifestyle behaviours. Thus, the biopsychosocial development of university students affects health-promoting lifestyle behaviours and the risk of disease. Thus, promoting the SG of students would be conducive to adopting health-promoting lifestyle behaviours.[33]

In a study to assess a range of health behaviours and lifestyle characteristics of undergraduate students from seven universities in the United Kingdom, only a few students were found to follow positive health practices above the recommended levels.[34] Another study conducted with university students in Türkiye demonstrated that students did not have enough information about maintaining a healthy lifestyle and were not using effective methods to cope with stress.[35]

Health education programs to target modifiable risk factors such as unhealthy nutritional habits, physical inactivity and smoking habits may increase the knowledge levels and awareness of university students regarding health-promoting lifestyle behaviours and thus may be effective in allowing for the adoption of health-promoting lifestyle behaviours.[36] In addition, organising training and courses on healthy lifestyles, and activities related with healthy lifestyles enhances the health-promoting lifestyle behaviours in university students.[37,38]

### Study Limitations

There are several limitations of this study. Firstly, body composition could not be analysed. Thus, the assessment of major anthropometric measurements so as to better understand body composition may lead to a better understanding of the relationships between type 2 diabetes and the factors of NT and PA as main components of quality of life. Secondly, this study was conducted at only one university campus. Multi-centre large sample studies can be beneficial in revealing a stronger relationship between type 2 diabetes and healthy lifestyle behaviours. Thirdly, detailed daily food consumption and PA records could be beneficial for further analysis in order to assess the relationships between type 2 diabetes risk and these two major lifestyle behaviours.

## CONCLUSION

There is a relationship between type 2 diabetes risk and overall healthy lifestyle behaviours and healthy lifestyle behaviours such as NT and PA. Gender, age, waist-height ratio, alcohol consumption, smoking, NT and PA habits are the factors affecting healthy lifestyle behaviours and type 2 diabetes risk, and thus, the quality of life. Courses and activities on healthy lifestyles as a part of university education, well-designed and low-cost university food halls which include healthy food choices, as well as sport centres can encourage students to develop health promoting lifestyle behaviours and can be beneficial in reducing the risk of type 2 diabetes. For further studies which include large multi-centre samples, a larger sample size, dietary and PA records, and body composition analysis could be beneficial in obtaining more accurate results on this issue.

## MAIN POINTS

- Healthy lifestyle behaviours are related with type 2 diabetes risk among young adults.
- Obesity is related with increased type 2 diabetes risk among young adults.
- Nutritional habits (HPLP-NT) are related with increased type 2 diabetes risk among young adults.
- Physical activity levels (HPLP-PA) are related with increased type 2 diabetes risk among young adults.
- Smoking is related with increased type 2 diabetes risk among young adults.

## ETHICS

**Ethics Committee Approval:** This study was approved by the Ethical Board of Scientific Research and Publication of Eastern Mediterranean University (approval number: 2016/23-06, date: 14.03.2016).

**Informed Consent:** All participants were asked to sign an informed consent form according to the Declaration of Helsinki.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: C.G., M.M.B., Design: C.G., M.M.B., Supervision: C.G., Materials: C.G., M.M.B., Data Collection and/or Processing: M.M.B., Analysis and/or Interpretation: C.G., Literature Search: C.G., M.M.B., Writing: C.G., Critical Review: C.G., M.M.B.

## DISCLOSURES

**Conflict of Interest:** No conflict of interest was declared by the authors.

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