Article

Not peer-reviewed version

Why Should Diabetes Women Be Active?- the Role of Personality, Self-Esteem, Body- Esteem and Imagery

Dagmara Budnik-Przybylska *, Malwina Fituch , Aleksandra Kowalewska

Posted Date: 19 March 2024

doi: 10.20944/preprints202403.1079.v1

Keywords: diabetes; personality; physical activity; self-esteem; body esteem; imagery

Article

Why Should Diabetes Women Be Active?—The Role of Personality, Self-Esteem, Body-Esteem and Imagery

Dagmara Budnik-Przybylska [1,*], Malwina Fituch [2] and Aleksandra Kowalewska [3]

[1] University of Gdansk; dagmara.budnik-przybylska@ug.edu.pl
[2] Mindfitness; malwina.fituch@gmail.com
[3] University of Gdansk;kowalewska.1997@gmail.com
* Correspondence: dagmara.budnik-przybylska@ug.edu.pl

Abstract: Diabetes is one of the fastest spreading diseases of civilisation in the 21st century. The aim of the study was twofold: 1) to find differences in personality traits, self-esteem, body- esteem, and imagery between healthy women and women with diabetes 2) to check whether there are differences in analyzed factors in women with diabetes who participate in sports compared to women who do not. We used 3 questionnaires: Imagination: in sport - short form, Self-Esteem Scale (SES), and BFIS Personality, which were tested online. We found that women with diabetes were characterised by significantly higher neuroticism and lower extraversion and higher conscientiousness (marginally significant). We also found that women with diabetes who practice sport rated their bodies more highly in terms of sexual attractiveness and made better use of imagined affirmations than healthy women who were not active. Our study provides new insights into diabetics in terms of coping with the disease.

Keywords: diabetes; personality; physical activity; self-esteem; body esteem; imagery

1. Introduction

Diabetes is among the fastest-spreading diseases of civilization in the 21st century. More and more adults and children are suffering from it, currently, the number is close to 430 million people worldwide, and in Poland alone, it is about 3 million [1]. A huge impact on the life of a person with diabetes is physical activity, which, when increased and regular, decreases the risk of type 2 diabetes, and reduces the risk of coronary heart disease and vascular complications in people with type 1 diabetes. Physical activity is recommended especially for type 2 diabetes. This is not only to achieve complete blood glucose control but also, in combination with an appropriate diet, to help manage the disease [2, 3]. People with type 2 diabetes often have problems with obesity, which is another reason why regular physical activity is recommended[2]. Obesity, particularly truncal obesity, is closely correlated to the prevalence of diabetes and cardiovascular disease [4]. Regular exercise may prevent or delay type 2 diabetes development [5]. Excess body fat results in reduced glucose tolerance and reduced insulin sensitivity, which in turn leads to insulin resistance and diabetes. Specific exercise (Pilates) with a moderate intensity may improve the functionality of older women with diabetes type 2. Exercise sessions in Pilates reduced blood glucose levels sharply between 28 and 30% [6].

It has been proven in many studies that physical activity has a huge impact on self-esteem and self-worth [7, 8]. It has also been shown that people who participate in sport have higher self-esteem than those who do not. Improved motor skills and the acquisition of new skills support this. People who take part in any sport gain the ability to have an objective perception of themselves and a realistic assessment of their abilities since the physical activity they do is meaningful to them and they have a positive emotional attitude towards it [7, 8]. The higher the self-esteem, the aspirations increase and the individual chooses more and more difficult tasks. In diabetics, psychological well-being and attitudes to life can deteriorate [9]. Reduced self-esteem is noted in children and adolescents

 doi:10.20944/preprints202403.1079.v1

compared to their peers [10]. As a metabolic and chronic disease, poorly managed diabetes is associated with many complications and carries the risk of developing disorders in the physical as well as the psychological sphere. And the worse the somatic state of the patient, the lower the quality of life [11]. Quality of life, on the other hand, is largely determined by self-esteem. The higher the self-esteem, the higher the sense of quality of life[12].

The level of self-esteem is strongly correlated with the subjective evaluation of one's own body. In people with diabetes, it is not easy to maintain a normal body weight, which is associated with changes in self-esteem and evaluation of one's body. Thin people assess themselves most favourably and also have the highest self-esteem. Patients with a normal body weight also have positive self-esteem, but are characterized by higher levels of self-criticism. Obese or overweight individuals are characterized by higher self-esteem in areas other than physical appearance [12].

Based on self-esteem, self-confidence, and capabilities are formed in physically active people. Self-belief correlates with a positive evaluation of one's capabilities and vice versa - lack of self-confidence correlates with low self-esteem. Also, high self-esteem positively correlates with playing performance [13[.

Diabetes is an incurable and chronic disease. People with diabetes need to watch their diet, constantly monitor their blood glucose levels, remember to take insulin or tablets, and engage in regular physical activity. It can be concluded that diabetes is associated with some stressful situations and psychological burdens that can affect an individual's personality, especially those at a young age.

Several studies have looked at the personality of people with diabetes and found that they differ in some characteristics from healthy people [10,13-18]. However, the results of the studies vary. Some point to high emotional instability and accompanying explosiveness and irritability in children and adolescents compared to their peers. In interpersonal interactions, withdrawal and a tendency to become dependent and subordinate to others can be observed in people with diabetes. In others, it has been found that people with diabetes display a strong need for social contact. They are more conscientious, responsible, and persistent, with greater emotional maturity[13]. Ruszczyńska [14] also proved in her research that patients are characterized by greater neuroticism manifested by strong anxiety. In a study conducted by Wheeler et al. [15] on 28 patients with type I diabetes, it was revealed that neuroticism was negatively related to insulin acceptance but positively linked with conscientiousness. Studies of Esmaeilinasab et al.,[16] revealed that Extraversion and conscientiousness can help control blood sugar whereas anxiety and neuroticism correlate negatively with glycemic control. Similarly, Szymańska[10] found that people with diabetes are less resistant to stress. Similar findings were in the study of Mukherjee et al.,[17] where neuroticism was significantly higher in all diabetics compared to healthy controls. One of the more important hypotheses to explain this correlation is the 'psychological burden hypothesis', which states that stress associated with the knowledge that a person has diabetes, any other chronic disease or certain complications, can lead to the development of depression or other negative psychological states[17].

Basinska and Schmidt [18] mentioned that people with autoimmune diseases, including diabetes, are characterised by common personality traits. They are calm, introverted, trustworthy, conscientious, adaptable to their environment, sensitive to criticism, stubborn, rigid, and keeping to themselves. When examining neuroticism and physical activity, neuroticism was not associated with physical activity. Overall, neuroticism appears to be negatively related to physical activity, but has little effect [19].

In the cross-sectional study, Woon et al.[20] studied The Big-Five Personality Traits and Quality of Life in Elderly Malaysian Patients with Diabetes Mellitus. The results of the study, they undoubtedly confirmed the hypothesis that personality traits may play an important role in moderating the impact of diabetes on patients' lives, even among elderly diabetic patients who were likely to have lived with the disease for a long time.

Traits such as conscientiousness and agreeableness may act as protective factors for the 'Quality of life' variable in older patients with diabetes, while the trait of neuroticism may potentially be a risk factor for reduced 'Quality of life' in these patients [20].

 doi:10.20944/preprints202403.1079.v1

In another population-based study, Attanayake et al. [21], it was found that people with diabetes undertook less physical activity than people without diabetes and this was consistent over time. The strongest predictor for people with diabetes, whether or not they engaged in sport, was gender and BMI. People with diabetes were less active and had a higher BMI than people without diabetes. Other issues that may contribute to low activity among people with diabetes include physical or cognitive disability, depressive symptoms, and poor sleep [21].

Studies show that people feel better after doing physical activity. Happiness hormones such as dopamine, serotonin, and endorphin are produced. Which has a soothing effect on the nervous system. Studies in Finland, Japan, and South Africa have shown that people who exercise regularly are less cynical and neurotic. In addition, they have a stronger sense of integration with the people around them. In the Netherlands, similar findings were observed after studying 20,000 twins. Those who trained regularly at least twice weekly were more pro-social and less neurotic [22]. A short duration of any type of exercise seems to reduce the risk of all-cause mortality and serious adverse events in patients with either hypertension, type 2 diabetes or cardiovascular diseases [23].

Another study proved that HIIT training (High-intensity interval training) decreased osteopontin level and improved body composition and metabolic status. Osteopontin is a novel adipose tissue-derived cytokine correlating with obesity and its related metabolic diseases such as insulin resistance and type II diabetes. This is why this exercise can be suggested as a therapeutic procedure for women with diabetes[24].

As mentioned before, sport is linked to lower level of neuroticism and the developing of pro-social behaviour. Regular physical activity is linked to lower level of blood sugar. Furthermore, the performance could be enhanced by imagery.

People who practice sport more often use imagery as a mental training technique and present higher imagery ability than novices or nonathletes [25, 26]. Imagery is a multifaceted and broadly applicable concept that can be used as a general ability in an individual's daily life, but it is often used for performance optimization, therapy and personal development or problem-solving [26-28]. Imagery is multisensory mental representations of actions (or objects and situations), without experience and corresponding sensory input [29, 30]. It can be recalled from memory or can be a new combination of stimuli [31].

Motor imagery is important for an athlete because, by refining and transforming them, he tries to perform the movement as he has imagined it. It is an externalized pattern through which the athlete can learn with the help of movement imagery, the individual can control the movements being performed and analyze errors and imperfections to improve them.

Vividness of positive future imagery was significantly linked with optimism, regardless of socio-demographic variables and regular use of mental imagery. The ability to generate vivid mental imagery of positive future events may serve as an adaptable indicator of optimism. Enhancing positive future imagery could provide a cognitive target for innovative treatments aimed at fostering optimism, with implications for mental health but also physical well-being [32]. Findings of the research of Odou and Vella-Brodrick [33] suggest that positive psychology interventions but also practicing imagery can foster well-being and the subsequent benefits of well-being.

The subjects of the study were psychological variables, namely self-esteem levels, self-perception of their own body, personality traits, and the ability to use imagery. The subject of the study also includes people with diabetes and healthy people, as well as those who participate in sports and those who do not.

The aim of the study was twofold: 1) to find differences in personality traits, self-esteem, body-esteem and imagery between healthy women and women with diabetes 2) to check whether there are differences in analyzed factors in women with diabetes who participate in sports compared to women who do not.

The study posed the following research questions:

1) Are there differences between healthy and diabetic women in the level of personality traits, self-esteem, body esteem, and ability to use imagery?

 doi:10.20944/preprints202403.1079.v1

2) Are there differences between diabetic women participating in sport and not participating in sport in levels of personality traits, self-esteem, body esteem, and ability to use imagery?

The following hypotheses were put forward:

1. Women with diabetes are more neurotic and conscientious than healthy women.
2. Healthy women participating in sport assess their bodies better in terms of physical fitness than healthy women not participating in sport, moreover, they are characterised by higher imagery.

2. Materials and Methods

Participants

In our study a total of 138 women took part. They ranged in age from 19 to 47 years. The majority of respondents were between 20 and 30 years old (M=25,72; SD=5,55). Respondents with diabetes made up half of the group and there were 68 and 70 healthy women were 80. A larger proportion of respondents were sport practitioners, with 40, while non-sport practitioners numbered 28.

Written consent was obtained from the athletes to participate in the study, ensuring the protection of their personal data. The investigation followed the ethical principles regarding human experiments as defined in the Declaration of Helsinki and received approval from the local Institutional Review Board (University of Gdańsk, 11/2015).

Procedure

The study took place via online questionnaires. Before testing, respondents were asked to assist in the ongoing research, which will serve as empirical material for the research paper. Respondents were assured that there were no right or wrong answers, as well as that all information contained in the questionnaires was anonymous. Respondents answered questions from 4 questionnaires. The personality traits, level of self-esteem, self-assessment of one's own body, and the ability to use imagery were examined.

Measurements:

We used four research tools for the study:

Self-Esteem Scale (SES). To examine the level of self-esteem, we used the Self-Esteem Scale (SES) questionnaire created by Marshall Rosenberg [34] in Polish adaptation [35]. The survey consists of 10 questions, which are answered on a 4-point scale, where 1 is "strongly agree" and 4 is "strongly disagree." You can get from 10 to a maximum of 40 points. The more the higher the self-assessment.

Body Esteem Scale (BES) by Franzoi and Shields [36], in the Polish adaptation [37]. This questionnaire measures respondents' attitudes towards their own body. It consists of 35 items that are divided into three, gender-dependent subscales. The subscales for women are: Sexual Attractiveness, Weight Concern and Physical Condition, but for men are the following: Physical Attractiveness, Upper Body Strength and Physical Condition. The reliability of subscales of the original version was high both for females (Cronbach's alpha from .80 to .89) and males (Cronbach's alpha from .85 to .88). In our study only women were taken part.

BFIS Personality. The Polish version [38] of the Big Five Inventory-Short (BFI-S) [39] was used in our study. It is a fifteen-item tool with a 7-point Likert's scale, where 1 means definitely not, and 7 means definitely yes. This questionnaire is used to measure personality within the five-factor personality theory: Extraversion, Openness to Experience, Agreeableness, Neuroticism and Conscientiousness. As it is a short form, this scale is more often used in exploratory research [40, 41].

Imagination in Action. The questionnaire is a short form of Imagination in sport (ISQ)[42] modified to this study. It consists of 21 questions, with a 5-point Likert's scale, where 1 means " not at all" while 5 means "completely yes." In the instruction of this study, the respondents were asked to imagine doing any physical activity i.e. riding a bike before they start answering the questions included in the test. The test consists of two parts: the first has 18 questions and refers to the

 doi:10.20944/preprints202403.1079.v1

imagination that the subjects were asked to imagine in the instructions, while the second concerns the use of imagination in everyday life - there are 3 questions. The overall score of the test consists of 6 subscales: physiological feelings, modality, visual, ease/control, affirmations and perspective. The higher the score on each scale, the more easily and effectively a person uses imagery.

3. Results

Firstly we wanted to check the first hypothesis, whether women with diabetes are more neurotic and conscientious than healthy women.

Statistically significant differences were found between diabetic and healthy women (Table 1). The diabetic women scored higher on the neuroticism scale and consciousness - the last marginally significant. In contrast, healthy women scored higher on the extraversion scale.

Table 1. Comparison of diabetic and healthy women.

Variable	Diabetic Women *N*=68		Healthy woman *N*=70				
	M	*SD*	*M*	*SD*	*U Mann-Whitney*	*Z*	*p*
Openness	5.30	1.17	5.20	1.02	2223.50	-1.27	.20
Conscientiousness	5.28	.87	5.01	.89	1960.50	-1.98	.05
Extraversion	**3.74**	**1.36**	**4.27**	**1.21**	**1839.00**	**2.31**	**.02**
Agreeableness	5.00	1.19	4.97	1.03	2291.00	-0.40	.69
Neuroticism	**4.87**	**1.38**	**4.42**	**.99**	**1881.50**	**-2.12**	**.03**
Self-esteem	26.13	4.37	25.87	5.16	2327.00	-0.27	.79
Sexual attractiveness	3.62	.63	3.71	.65	2183.50	.70	.48
Weight control	3.18	.87	3.17	.88	2351.00	-0.13	.90
Physical condition	3.23	.80	3.32	.71	2142.00	.74	.46
Physiological feelings	3.02	1.31	3.12	1.10	2252.50	.48	.63
Modality	3.27	1.35	3.03	1.16	2090.00	-1.24	.22
Ease/Control	3.92	.93	3.76	.90	2125.00	-0.60	.55
Perspective	3.27	1.14	3.21	1.06	2258.50	-0.20	.85
Affirmations	3.70	1.23	3.68	1.13	2308.00	-0.48	.63
Visual	4.16	.88	4.02	.82	2098.00	-0.94	.35
General	4.22	.85	4.21	.79	2302.50	-0.72	.47

Next, we verified the second research question: Are there differences between diabetic women participating in sport and those not participating in sport in levels of personality traits, self-esteem, body evaluation, and ability to use imagery? We found only two significant differences i.e. affirmations and sexual attractiveness, where active diabetic women obtained higher results. However, we also found that active diabetic women present a marginally significant lower level of extraversion.

 doi:10.20944/preprints202403.1079.v1

Table 2. Comparison of diabetic women participating in sports and not participating in sports.

Variable	*Diabetic women participating in sports* *N*=40		*Diabetic women non participating in sports* *N*=28				
	M	*SD*	*M*	*SD*	*U Mann-Whitney*	*Z*	*p*
			Personality				
Openness	5.48	1.17	5.05	1.14	436.00	-1.54	.12
Conscientiousness	5.30	.97	5.25	.72	535.50	-0.30	.76
Extraversion	3.44	1.28	4.15	1.40	412.00	1.84	.07
Agreeableness	5.14	1.16	4.80	1.22	473.50	-1.07	.28
Neuroticism	4.71	1.27	5.10	1.51	467.50	1.15	.25
			Self- esteem				
Self-esteem	25.85	4.44	26.54	4.32	524.00	.44	.66
			Body esteem				
Sexual attractiveness	**3.18**	**1.27**	**2.79**	**1.34**	**394.50**	**-2.06**	**.04**
Weight control	3.42	1.36	3.07	1.35	478.00	-1.02	.31
Physical condition	3.88	1.04	3.96	.76	454.00	-1.31	.19
			Imagery				
Physiological feelings	3.39	1.10	3.10	1.19	458.50	-1.26	.21
Modality	4.08	1.01	3.15	1.32	471.50	-1.10	.27
Easiness	4.15	.98	4.18	.75	555.00	-0.06	.96
Perspective	4.37	.72	4.00	.98	478.00	-1.02	.31
Affirmations	**3.75**	**.63**	**3.43**	**.60**	**332.50**	**-2.83**	**.00**
Visual	3.30	.93	3.02	.77	437.50	-1.52	.13
General	3.36	.82	3.04	.74	535.50	-0.30	.76

4. Discussion

The aim of the study was twofold: 1) to find differences in personality traits, self-esteem, body-esteem, and imagery between healthy women and women with diabetes 2) to check whether there are differences in analyzed factors in women with diabetes who participate in sports compared to women who do not.

Answering the first question: Are there differences between healthy and diabetic women in the level of personality traits, self-esteem, body esteem, and ability to use imagery? we have found that diabetic women are characterised by higher neuroticism, consciousness and lower extraversion. The obtained results are in line with previous research [10,13-18], which showed that people with diabetes are more conscientious and neurotic than healthy people. This means that they are more organised and determined to achieve goals and have a strong tendency to have volatile moods and cope less well with difficult situations [43]. This may transfer to coping with the disease, disease control, and test scores. People with diabetes, through high levels of conscientiousness, may have a constant need to achieve better test results and thus a desire to keep blood sugar levels in check [16].

However, through high levels of neuroticism, they may find it difficult in difficult situations. Another study [44] on personality in people with diabetes showed that people with diabetes have

 doi:10.20944/preprints202403.1079.v1

lower extraversion than healthy people, and higher emotionality. Also in a study by Szymanska [10], results showed that diabetic people cope less well with stressful and difficult situations.

Answering the second research question we found that diabetic women who practice sport assess their bodies better in terms of sexual attractiveness and use imagery better in terms of affirmations than healthy people who do not practice sport. People who exercise regularly seem to be more confident by using imagery for that purpose and they realistically assess their bodies [47].

People with diabetes who are physically active were more positive about the parts of the body that are responsible for sexual attractiveness and were better able to create and use affirmations than people with diabetes but who do not exercise. Diabetes did not affect body perception, it is only affected by physical activity.

Looking at the prevention and effectiveness of physical activity interventions for women with pre-existing gestational diabetes, it was found that consideration of childcare, social support and cultural sensitivity were most important. These interventions had positive effects and increased physical activity intensity in women. Education on how to reduce the future risk of type 2 diabetes and the use of pedometers in interventions were not associated with intervention effectiveness [45].

As we can see, there is no doubt that a disease such as diabetes carries a huge burden of responsibility for one's life. It has an impact on, or can result from obesity. And above all, based on personality traits, there are noticeable correlations with neuroticism. However, we are not sure what is the cause and what is the effect. Admittedly, a person with diabetes may display more neurotic traits, and it may also be that neurotic people are more prone to experience feelings of anxiety, anger, jealousy, sadness, or guilt. As a result, they react more acutely to daily stress and cope less well with it. Food is an easy access to emotional regulation, which can lead to abuse, obesity and increased morbidity.

These are only speculations. Surely, we need much broader, more accurate data combined with data on the moment of diagnosis. This would give a broader perspective on observing the difference in management in pre-disease and post-disease individuals.

Research supports the idea that some character traits occur on a purely molecular level [22]. Both serotonin and dopamine influence how we feel. Different levels of them in different people, make them have different personalities. Dopamine itself is linked to curiosity and the desire to discover new things. Serotonin is linked to the very desire to compromise, which is sort of the opposite in a neurotic attitude. And the fact is that it is serotonin and dopamine that are produced during physical activity [22].

Our study confirmed that women with diabetes who are physically active are more positive about the parts of the body that are responsible for sexual attractiveness and are better able to create and use affirmations than people with diabetes but who do not exercise. Diabetes does not affect body perception, it is only affected by physical activity.

In a study by Ziemianek et al. [46], in which they examined the self-esteem and body image of women and men who exercise at the gym, results from the BES questionnaire show that physically active people rate their bodies above average. The above results are also consistent with a study by Budnik-Przybylska et al. [47], in which dancers showed higher imagery abilities as well as better ratings of their bodies in terms of physical fitness.

The correlation between feeling better and physical activity is serotonin. Several studies [48] have shown an association between serotonin-related measures and mood in the normal range. Lower serotonin receptor function in platelets was associated with lower mood in one study [49] while better mood was associated with higher blood serotonin levels in another study [50].

In our study, we found that diabetic women participating in sport rated the body parts responsible for sexual attractiveness more favourably and were better able to create affirmations than diabetic women not participating in sport. This may be related to greater self-confidence in physically active people, and the creation of affirmations itself may have a beneficial effect on the subjective assessment of sexual attractiveness, but it may also be linked to a better mood, provided by serotonin obtained, thanks to physical activity [48].

 doi:10.20944/preprints202403.1079.v1

The weakness of the study was the relatively small number of participants, however, we obtained similar results to previous studies on personality and revealed other unique findings. Very interesting and useful in the future in similar studies would be to investigate the difference over time between the absence of the disease, the moment of diagnosis, and the management of diabetes after diagnosis. This would give interesting insights into how the disease of diabetes could affect personality traits if this could happen at all.

In contrast, strength is the study group, which is people with diabetes who are difficult to reach. The study could have used a self-assessment questionnaire examining individual aspects instead of an overall self-assessment. In the future, people could also be asked about their disease status, whether they have good test results or bad ones, or whether their blood glucose levels are regulated or not.

5. Conclusions

To conclude our study develops new insight into diabetics in terms of coping with this disease. We found that taking part in sports activities and using imagery seems to be a natural and for free cure, which is easy to use and does not require any expensive equipment. It helps not only with medical treatment but also develop stronger body esteem. Those methods could be used also as a kind of prevention.

Author Contributions: D.B-P conceptualization, methodology, formal analysis, writing-original draft preparation, writing—review and editing, supervision, M.F. writing-original draft preparation, writing—review and editing, A.K. investigation, data curation, formal analysis, writing-original draft preparation. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (University of Gdańsk, 11/2015).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Towpik, I.; Walicka, M.; Marcinkowska, K.; Lisicka, I.; Raczyńska, M.; Wierzba, W.; Strojek, K.; Ryś, P.; Wajda-Cuszlag, M.; Franek, E. Epidemiology of diabetes in Poland in 2014–2017. *Clinical Diabetology* **2020**, 9 (5), 279-285.
2. Chen, L.; Pei, J.-H.; Kuang, J.; Chen, H.-M.; Chen, Z.; Li, Z.-W.; Yang, H.-Z. Effect of lifestyle intervention in patients with type 2 diabetes: a meta-analysis. *Metabolism* **2015**, 64 (2), 338-347.
3. Skorupska, S.; Chomiuk, T.; Mamcarz, A. Czy sport to zdrowie dla chorego na cukrzycę [Is sport healthy for a diabetic]. *Przegląd Kardiodiabetologiczny* **2008**, 3 (3), 232-236.
4. Leong, K. S.; Wilding, J. P. Obesity and diabetes. *Best Practice & Research Clinical Endocrinology & Metabolism* **1999**, 13 (2), 221-237.
5. Schellenberg, E. S.; Dryden, D. M.; Vandermeer, B.; Ha, C.; Korownyk, C. Lifestyle interventions for patients with and at risk for type 2 diabetes: a systematic review and meta-analysis. *Annals of Internal Medicine* **2013**, 159 (8), 543-551.
6. Melo, K. C. B.; de Souza Araújo, F.; Júnior, C. C. M. C.; de Andrade, K. T. P.; Moreira, S. R. Pilates method training: functional and blood glucose responses of older women with type 2 diabetes. *The Journal of Strength & Conditioning Research* **2020**, 34 (4), 1001-1007.
7. Gilani, S. R. M.; Dashipour, A. The effects of physical activity on self-esteem: A comparative study. *International Journal of High Risk Behaviors and Addiction* **2017**, 6 (1).
8. Zamani Sani, S. H.; Fathirezaie, Z.; Brand, S.; Pühse, U.; Holsboer-Trachsler, E.; Gerber, M.; Talepasand, S. Physical activity and self-esteem: testing direct and indirect relationships associated with psychological and physical mechanisms. *Neuropsychiatric disease and treatment* **2016**, 2617-2625.
9. Laughin, A. Cukrzyca. Nowe spojrzenie na leczenie [Diabetes. A new look at treatment]. Astrum, **2018**.
10. Sylwia, S. Osobowość młodzieży chorej na cukrzycę [Personality of adolescents with diabetes]. *Acta Universitatis Lodziensis, Folia Psychologica* 4, **2000**: 2000; pp 57-65.

 doi:10.20944/preprints202403.1079.v1

11. Glińska, J.; Skupińska, A.; Lewandowska, M.; Brosowska, B.; Kunikowska, B. Czynniki demograficzne a ogólna jakość życia chorych z cukrzycą typu 1 i 2. [Demographic factors and overall quality of life in patients with type 1 and type 2 diabetes] *Problemy pielęgniarstwa* **2012**, 20 (3).
12. Bertrandt, K. Samoocena a jakość życia i występowanie objawów depresyjnych u osób z nadwagą i otyłością w porównaniu z osobami o prawidłowej masie ciała. [Self-esteem vs. quality of life and prevalence of depressive symptoms in overweight and obese compared to normal weight individuals]. *Probl Hig Epidemiol* **2011**, 92 (4), 783-787.
13. Sankowski, T. Wybrane psychologiczne aspekty aktywności sportowej.[Selected psychological aspects of sports activities] Wydawnictwo AWF, Poznań **2001**.
14. Ruszczyńska, B.; Semetkowska-Jurkiewicz, E.; Burka, M.; Krupa-Wojciechowska, B. Evaluation of mental status of patients with diabetes mellitus type 1 in relation to the duration of the illness. *Psychiatria Polska* **1991**, 25 (5), 23-31.
15. Wheeler, K.; Wagaman, A.; McCord, D. Personality traits as predictors of adherence in adolescents with type I diabetes. *Journal of child and adolescent psychiatric nursing* **2012**, 25 (2), 66-74.
16. Esmaeilinasab, M.; Ebrahimi, M.; Mokarrar, M. H.; Rahmati, L.; Mahjouri, M. Y.; Arzaghi, S. M. Type II diabetes and personality; a study to explore other psychosomatic aspects of diabetes. *Journal of Diabetes & Metabolic Disorders* **2016**, 15, 1-5.
17. Mukherjee, A.; Yadav, B. S.; Sarvottam, K. Comparative analysis of big five personality traits in obese and normal weight type 2 diabetes mellitus patients. *Journal of Family Medicine and Primary Care* **2022**, 11 (2), 691.
18. Basińska, M. A.; Ratajska, A. Psychosomatyka: problemy i kierunki badań; Wydawnictwo Tekst, **2010**.
19. Rhodes, R. E.; Smith, N. Personality correlates of physical activity: a review and meta-analysis. *British Journal of Sports Medicine* **2006**, 40 (12), 958.
20. Woon, L.; Singh, G. K. A.; Sidi, H. Does Personality and Anxiety Symptomatology Matter in the Diabetes Mellitus Treatment Adherence? A Cross-Sectional Study Among Women with Diabetes Mellitus. *IIUM Medical Journal Malaysia* **2021**, 20 (4).
21. AB Attanayake, H. D.; Barnett, A.; Burton, N. W.; Brown, W. J.; Cramb, S. M. Diabetes and physical activity: A prospective cohort study. *Plos One* **2022**, 17 (10), e0276761.
22. Hansen, A. The Happiness Cure: Why You're Not Built for Constant Happiness, and How to Find a Way Through; Random House, **2023**.
23. Rijal, A.; Nielsen, E. E.; Adhikari, T. B.; Dhakal, S.; Maagaard, M.; Piri, R.; Neupane, D.; Gæde, P. H.; Olsen, M. H.; Jakobsen, J. C. Effects of adding exercise to usual care in patients with either hypertension, type 2 diabetes or cardiovascular disease: a systematic review with meta-analysis and trial sequential analysis. *British Journal of Sports Medicine* **2023**, 57 (14), 930-939.
24. Dashti, N.; Rezaeian, N.; Karimi, M.; Kooroshfard, N. The Effect of high intensity interval training on serum levels of Osteopontin and insulin resistance index in sedentary overweight and obese women. *Journal of Sport and Exercise Physiology* **2021**, 14 (2), 115-126.
25. Budnik-Przybylska, D.; Karasiewicz, K.; Morris, T.; Watt, A. Reliability, factor structure, and construct validity of the Polish version of the sport imagery ability measure. *Current Issues in Personality Psychology* **2014**, 2 (4), 196-207.
26. Cumming, J.; Williams, S. E. Introducing the revised applied model of deliberate imagery use for sport, dance, exercise, and rehabilitation. *Movement & Sport Sciences-Science & Motricité* **2013**, (82), 69-81.
27. Oettingen, G.; Reininger, K. M. The power of prospection: Mental contrasting and behavior change. *Social and Personality Psychology Compass* **2016**, 10 (11), 591-604.
28. Solbrig, L.; Whalley, B.; Kavanagh, D. J.; May, J.; Parkin, T.; Jones, R.; Andrade, J. Functional imagery training versus motivational interviewing for weight loss: a randomised controlled trial of brief individual interventions for overweight and obesity. *International Journal of Obesity* **2019**, 43 (4), 883-894.
29. White, A.; Hardy, L. Use of different imagery perspectives on the learning and performance of different motor skills. *British Journal of Psychology* **1995**, 86 (2), 169-180.
30. Kosslyn, S. M.; Thompson, W. L.; Ganis, G. The case for mental imagery; Oxford University Press, **2006**.
31. Pearson, J. The human imagination: the cognitive neuroscience of visual mental imagery. *Nature Reviews Neuroscience* **2019**, 20 (10), 624-634.
32. Blackwell, S. E.; Rius-Ottenheim, N.; Schulte-van Maaren, Y. W.; Carlier, I. V.; Middelkoop, V. D.; Zitman, F. G.; Spinhoven, P.; Holmes, E. A.; Giltay, E. J. Optimism and mental imagery: A possible cognitive marker to promote well-being? *Psychiatry research* **2013**, 206 (1), 56-61.
33. Odou, N.; Vella-Brodrick, D. A. The efficacy of positive psychology interventions to increase well-being and the role of mental imagery ability. *Social Indicators Research* **2013**, 110, 111-129.
34. Rosenberg, M. Rosenberg self-esteem scale (RSE). Acceptance and commitment therapy. *Measures package* **1965**, 61 (52), 18.
35. Dzwonkowska, I.; Lachowicz-Tabaczek, K.; Łaguna, M. Samoocena i jej pomiar: SES: polska adaptacja skali SES M. Rosenberga: podręcznik; Pracownia Testów Psychologicznych, **2008.**

 doi:10.20944/preprints202403.1079.v1

36. Franzoi, S. L.; Shields, S. A. The Body Esteem Scale: Multidimensional structure and sex differences in a college population. *Journal of Personality Assessment* **1984**, 48 (2), 173-178.
37. Lipowska, M.; Lipowski, M. Polish normalization of the body esteem scale. *Health Psychology Report* **2013**, 1 (1), 72-81.
38. Strus, W.; Cieciuch, J.; Rowinski, T. Polska adaptacja Big Five Inventory—Short. Unpublished work **2017**.
39. Gerlitz, J.-Y.; Schupp, J. Zur Erhebung der Big-Five-basierten persoenlichkeitsmerkmale im SOEP. DIW *Research Notes* **2005**, 4 (10.1016).
40. Hahn, E.; Gottschling, J.; Spinath, F. M. Short measurements of personality–Validity and reliability of the GSOEP Big Five Inventory (BFI-S). *Journal of Research in Personality* **2012**, 46 (3), 355-359.
41. Lang, F. R.; John, D.; Lüdtke, O.; Schupp, J.; Wagner, G. G. Short assessment of the Big Five: Robust across survey methods except telephone interviewing. *Behavior Research Methods* **2011**, 43, 548-567.
42. Budnik-Przybylska, D. The Imagination in Sport Questionnaire–reliability and validity characteristics. Current Issues in Personality Psychology 2014, 2 (2), 68-80.
43. Costa Jr, P. T.; McCrae, R. R.; Löckenhoff, C. E. Personality across the life span. *Annual review of psychology* **2019**, 70, 423-448.
44. Dylczyk, J. Cechy osobowości, strategie radzenia sobie a funkcjonowanie emocjonalno-społeczne młodzieży z cukrzycą typu 1 [Personal traits, coping strategies and emotional and social functioning of adolescents with type 1 diabetes]. Jagiellonian University Repository, **2013**.
45. Buelo, A.; Kirk, A.; Lindsay, R.; Jepson, R. Exploring the effectiveness of physical activity interventions in women with previous gestational diabetes: a systematic review of quantitative and qualitative studies. *Preventive Medicine Reports* **2019**, 14, 100877.
46. Ziemianek, P.; Jendrysik, K.; Horodecki, M.; Knapik, A. Self-esteem and the value of body in people who exercise regularly at the gym-the results of pilot studies. *Quality in Sport* **2015**, 1 (3), 61-69.
47. Budnik-Przybylska, D.; Kaźmierczak, M.; Przybylski, J.; Bertollo, M. Can personality factors and body esteem predict imagery ability in dancers? *Sports* **2019**, 7 (6), 131.
48. Young, S. N. How to increase serotonin in the human brain without drugs. *Journal of psychiatry & neuroscience: JPN* **2007**, 32 (6), 394.
49. Peirson, A.; Heuchert, J. Correlations for serotonin levels and measures of mood in a nonclinical sample. *Psychological Reports* **2000**, 87 (3), 707-716.
50. Williams, E.; Stewart-Knox, B.; Helander, A.; McConville, C.; Bradbury, I.; Rowland, I. Associations between whole-blood serotonin and subjective mood in healthy male volunteers. *Biological Psychology* **2006**, 71 (2), 171-174.