Preliminary study on pre-treatment physical activity and quality of life in infertility

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Abstract

The increasing incidence of infertility and contrary the remaining levels of success rate of assisted reproductive therapies (ART) justify expanding the biomedical approach and underline the importance of psychosocial and lifestyle factors. The aim of the study was to examine the effects of pre-treatment physical activity (PA) on the quality of life (QoL) in infertile women. A cross sectional cohort study was carried out involving 50 female patients with infertility diagnosis. Standardized QoL questionnaires and pre-treatment PA patterns were administrated during December 2018 – April 2019 in a university hospital-based fertility centre in South-Hungary. 43% of the women reported regular exercise. Regarding GPAQ moderate intensity PA in work and recreation was preferred. They spent 4.2 hours with active transportation weekly, and 4.5 hours sedentary daily. 68.89% reached the 150min/week MVPA recommendation and 18.2% spent more than 4 hours with exercise Respondents were less satisfied with Physical Domain (57.7±7.5) and most with Psychological Domain (72.2±12.1) of WHOQOL-BREF. Lower QoL by Emotional (56.46±18.12) and Mind-Body (56.84±19.67), mediate by Social (62.76±17.40) and better values by Relational Subscale (76.48±19.62) were measured with FertiQoL. Significant difference between active and inactive group was described for Psychological domain (Z=-2.240, p=0.025). Positive correlation was found between MVPA vs Total MET and Emotional Subscale (p=0.014, p=0.009) and between work-related PA and Mind-body Subscale (p=0.006). Pre-treatment PA could positively affect QoL undergoing ART. However, for more impressive results, objective assessment of physical activity, increased number of participants, and further examinations are needed.

Introduction

Burden of infertility as a critical component of reproductive health has often been neglected in the global efforts for success in improving maternal and child health. 10 to 15% of couples of fertile age struggle with 1-year infertility in Hungary (Bernard & Krizsa, 2006). Every year 920 in vitro fertilisations (IVF) and 3502 intra-cytoplasmic sperm injections (ICSI) are conducted nationwide and after assisted reproductive therapy 31.7% and 34.5 % of pregnancies per aspiration can be reported (Calhaz-Jorge et al., 2016). Similarly, 12% to 15% of fertility problems was described in 2012 (McLaren, 2012) and age-standardized pre-

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valence of secondary infertility (as the percent of women who seek a child aged 20–44 years) was reported in a World Health Organization (WHO) study as one of the highest with 18.0% (13.8%, 24.1%) in Central/Eastern Europe in 2010 (Mascarenhas, Flaxman, Boerma, Vanderpoel, & Stevens, 2012). Although infertility rates remain unchanged over two decades, but increasing trend in fertility therapy was reported. The 640144 initiated cycles in 2012 imply more than threefold increase (3.14) in relation to the previous fifteen years and double (1.97) increase compared to ten years before. Success rates (clinical pregnancy) per aspiration and per transfer are stable with 29.4% and 33.8% in IVF and 27.8% and 32.3 % for ICSI (Calhaz-Jorge et al., 2016).

The increasing incidence of assisted reproductive investigations and unchanged success rates highlighting the need for inspection of social, psychological and lifestyle covariates. To describe the impact of interventions or health conditions in a broader way allowed us the generic quality of life (QoL) concept of the WHO, defined as "people's perception of their position in life in the context of the culture and value systems in which they live in relation to their objectives, expectations, standards and concerns" (WHO, 1995). This comprehensive framework involves physical and psychological health aspects as well as social relationships, environment and spiritual aspects and widely used on subjects with different conditions, inter alia in infertility (Chachamovich, Chachamovich, Zachia, Knauth, & Passos, 2007). The failure to become pregnant may specifically affect various life dimensions such as depression, anxiety, social isolation, sexual dysfunction, social and psychological distress, poorer marital adjustment (Rashidi et al., 2008). For this reason, it is necessary to explore the fertility quality of life (FertiQoL) as well.

Benefits from regular physical activity in maintain physical, mental and social health do not call into question (WHO, 2018). Although depending on intensity or duration, certain studies controversially evaluating health effects of exercise or even PA in relation to assisted reproductive treatments (ART) (Morris et al., 2006; Palomba et al., 2014; Rao, Zeng, & Tang, 2018; Rich-Edwards et al., 2002). These studies primarily focus on outcomes of ART less on QoL aspects.

Therefore, the aim of the current research was to describe PA and QoL patterns and their relationships in ART patients.

Method

A cross-sectional, observational cohort study was conducted with consecutive sampling at the Assisted Reproduction Unit, Department of Obstetrics and Gynaecology, University of Pécs, Hungary. All female patients with both female and male factors of infertility who were indicated for fertility treatment (IVF/ICSI) were consecutively invited to participate in the study. Participants were recruited according to the date of the fertility consultation. Inclusion criterions were BMI $\geq$ 18 kg/m^2 and $\leq$ 38 kg/m^2 and women had any significant health risk relevant to the ART procedure and outcome (metabolic and vascular diseases including diabetes mellitus, metabolic syndrome, fatty liver diseases and atherosclerosis, severe endometriosis (stage III or IV) and/or adenomyosis. Participants were not diagnosed with any mental disorders, and had no significant physical or mobility impairments.

Data collection was carried out during the routine examination on the 3rd day of the unstimulated cycles. 50 women agreed and tended to participate in the study until April 2019, which means approximately 80% response rate. Self-administrated questionnaires were given to participants and were filled out at home in a conventional paper-pencil form. Questionnaires were returned at the 21st day of the unstimulated cycles.

Assessment Scales

Socio-demographic characteristics were obtained by using questions regarding age, educational level, income, marital status, duration of partnership, duration of infertility, BMI and lifestyle habits.

To describe PA and exercise habits participants self-reported on the intensity and frequency of exercise and reported all kind of physical activity. The Hungarian version of the WHO's PA questionnaire the Global Physical Activity Questionnaire (GPAQ) was applied. This multi-domain tool contains 16 items on intensity, frequency and duration on three field of PA: work, active transportation and recreation or leisure time and sedentary behaviour on the last week (time spent sitting or lying) is also described. How to evaluate the intensity of certain activities is well described for

respondents in the introduction section of the questionnaires: "'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate"(WHO, 2012).

Results could be expressed in time (minutes) or in energy expenditure (MET: Metabolic Equivalent of Task). Translation and cultural adaptation of the questionnaire on general population was carried out by our research group and the tool's Hungarian version proved reliable and valid. Validation and related findings are currently in press.

Quality of life was measured in general, and as infertility-related quality of life as well. The validated Hungarian version by Paulik et al. of World Health Organization Quality of Life-BREF (WHOQOL-BREF) generic questionnaire was used. The instrument comprises 26 items, which measure the following broad domains: physical health, psychological health, social relationships, and environment. Raw data can be expressed 4-20 linearly or transformed for a 0-100 scale. We decided to express our data in the scale format where the value of 100 means the best QoL (Paulik et al., 2007; W. H. O. WHO, 1998)

Fertility-related QoL was measured with the Hungarian version of the Fertility Quality of Life Questionnaire (FertiQoL). FertiQoL is an internationally validated instrument to measure QoL in individuals experiencing fertility problems in diverse life areas. The Core module describe general health, self-perceptions, emotions, partnership, family and social relationships, work life and future life plans (26 items). Additionally, the optional FertiQoL Treatment module assesses the environment and tolerability of fertility treatment for patients who have used fertility medical services regarding medical consultation or intervention. (10 items) (Boivin, Takefman, & Braverman, 2011). One version of FertiQoL already existed in Hungarian (Cserepes, Korosi, & Bugan, 2014). However, we decided for a repeated review on linguistic reasons. The redefined validated Hungarian version is submitted for publication by the research team. Our results confirmed the reliability and validity of the new version.

Ethical approval

This study was approved in advance by the University of Pécs, Clinical Center, Regional and Local Research Ethics Committee (Nr. 6533). Each participant voluntarily provided written informed consent before participating. The investigation conforms to the principles outlined in the Declaration of Helsinki.

Data analysis

Statistical analyses were performed using SPSS 24.0 software (SPSS Inc., Chicago, IL, USA). Normality of data distribution was tested by Kolmogorov-Smirnov test. Mann-Whitney U-test were used to compare continuous variables. The association between two continuous variables was tested by Spearman's rank correlation. Data was expressed as mean ± SD and the significance level of $p < 0.05$ was considered in each case.

Results

General characteristics

The major socio-demographic characteristics of the study population are presented in Table1. 49 female patients in reproductive age (34.0±5.3 years), with mostly normal weight (63.83%, BMI 18.5–24.9 kg/m2) participated in the study. They were sampled from a larger proportion with higher educational degree (61.2%) and with satisfactory economic status (98.0%). Each participant was either married or lived with a partner, and the duration of the partnership was 7.7±3.7 years on average with 44.2±27.0-month long child-wish. We found various cases of infertility, duration and type of treatments. However, these primarily nulliparous women (87.8%) typically received IVF/ICSI (81.3%) with mostly female indication (43.8%).

75.5% of the participants rated their physical health particularly good or very good. In general, they self-reported a health-conscious lifestyle regarding diet, tobacco use and PA. 49% of them claimed to be physically active, a quartile of them exercise 4-6 times weekly.

Table 1. General characteristics of women undergoing ART

Socio-demographic Data N=49	
Age (years)	
Mean (SD)	34.0 (±5.3)
Education	
Low	4 (8.2%)
Intermediate	15 (30.6%)
High	30 (61.2%)
Marital status (N=44)	
Married	38 (77.6%)
Partner	11 (22.4%)
Place of residence	
County seat	15 (30.6%)
City	22 (44.9%)
Village	12 (24.5%)
Income	
Low	1 (2.0%)
Medium	28 (57.1%)
High	20 (40.8%)
Health Status and Lifestyle	
BMI (kg/m2. N=47)	
Mean (SD)	23.5 (±4.6)
Underweight (<18.5)	6 (12.8%)
Normal weight (18.5–24.9)	30 (63.8%)
Overweight (25–29.9)	4 (8.5%)
Obesity (>30)	7 (14.9%)
Self-Rated Physical Health	
Poor	0
Fair	1 (2.0%)
Neither good nor bad	11 (22.4%)
Good	31 (63.3%)
Excellent	6 (12.2%)

Healthy Diet	
Pay particular attention	1 (2.0%)
Pay some attention	21 (42.9%)
Not really	23 (46.9%)
Not	4 (8.2%)
Tobacco Use (N=48)	
Regular	1 (2.1%)
Occasional	3 (6.3%)
Non-Smoker	44 (91.7%)
Exercise	
Regularly	24 (49.0%)
Not	25 (51.0%)
Regular exercise (N=24)	
1-3 days weekly	18 (75.0%)
4-6 days weekly	6 (25.0%)
Infertility	
Case of infertility (N=48)	
Female	21 (43.8%)
Male	4 (8.3%)
Dual	9 (18.8%)
Undefined (by medical professionals)	11 (22.9%)
Final diagnosis in progress	3 (6.3%)
Type of ART Treatment – at baseline (N=31)	
IVF/ICSI	39 (81.3%)
IUI	1 (2.1%)
OI	2 (4.2%)
HSG	2 (4.2%)
Examination in progress	14 (31.1%)
Child-wish (months)	
Mean (SD)	44.2 (±27.0)
Relationship (years)	
Mean (SD)	7.7 (±3.8)
Parity	
Nulliparous	43 (87.8)
Multiparous	6 (12.2)

Quality of Life

Based on the WHOQOL-BREF which examines general QoL, 79.6% of the respondents self-reported good or very good health and 85.7% of them was satisfied or very satisfied with his/her QoL. Respondents were less satisfied with Physical Health Domain (57.7±7.5) and most satisfied with Psychological Domain (72.2±12.1) of their QoL (Table 2).

Infertility-related Quality of Life

For the purpose of measuring the level of infertility-related QoL, a more specific tool, the FertiQoL was applied. We found similar values with this specific scale like with WHOQOL-BREF. In the four Core subscale of the questionnaire we found lower QoL by Emotional Scale (56.46±18.12) and Mind-Body Scale (56.84±19.67), mediate QoL by Social Scale (62.76±17.40) and moderately better values by Relational Scale (76.48±19.62). Respondents already

receiving ART treatment rated their QoL referring the interventions equally in both Treatment subscales: Environment Scale (67.46±17.99) and Tolerability Scale (63.30±25.12) (Table 2).

Table 2. Pre-treatment quality of life characteristics of women undergoing ART (N=49)

	WHOQOL-BREF				
	Very poor	Poor	Neither poor nor good	Good	Very good
SRH (%)	0.0	4.1	16.3	22.4	57.1
	Very dissatisfied	Dissatisfied	Neither dissatisfied nor satisfied	Satisfied	Very satisfied
QoL (%)	2.0	0.0	12.2	12.2	73.5
Domains	Mean	SD	Median	IQR lower	IQR upper
Physical Health Domain	57.7	7.5	56.0	56.0	63.0
Psychological Domain	72.2	12.1	75.0	66.0	81.0
Social Relationships Domain	71.5	15.1	75.0	63.0	81.0
Environment Domain	62.3	12.8	63.0	56.0	69.0
	FertiQol				
Emotional Scale	56.46	18.12	58.33	41.67	72.92
Mind-Body Scale	56.84	19.67	58.33	43.75	70.83
Relational Scale	76.48	19.62	79.17	62.50	93.75
Social Scale	62.76	17.40	62.50	50.00	72.92
Environment Scale	67.46	17.99	68.75	62.50	79.17
Tolerability Scale	63.30	25.12	68.75	43.75	81.25

Physical activity

Pre-treatment physical activity patterns of women undergoing ART was summarised in Table 3. Intensity, frequency and mode of PA were described using the GPAQ questionnaire. Respondents performed in average 169.3±515.8 min/week vigorous and 376.7±585.1 min/week moderate PA in work and only 40.7±91.4 min/week vigorous activity in recreation/leisure time domain. However, mean values (0.0) revealed, that vigorous PA during work or leisure time are not common in the studied group. They preferred moderate intensity recreational activities in 2 hours weekly (139.6±379.9 min/week). Nevertheless, they spent 254.3±489.8 min/week in average with active transportation, for example with walking or cycling, which covers 1017.3±1959.4 MET energy expenditure. Means significantly differs in these relations also, only 120 min transportation and 90 min moderate work PA are characteristic. They spend sedentary three-and-a-half-hour daily (2782.5±1824.7 min/day).

If we analyse data by intensity, we found that respondents spent 716.3±892.0 minutes (3705.2±5188.4 MET) with moderate to vigorous activities (MVPA). When taken together all type and intensity activities lasting more than 10 minutes, women performed around 16 hours (970.6±1199.3 min/week) or 4722.5±6199.6 MET PA. In case we categorise they performance, 31 individual (68,89%) reach the WHO's 150min/week MVPA recommendation and 12 (18.2%) person spend more than 4 hours with exercise type PA.

Table 3. Pre-treatment physical activity characteristics of women undergoing ART, measured by GPAQ (N=49)

Measure	Mean	SD	Median	IQR lower	IQR upper
PA by domains					
Work – vigorous PA					
min/week	169.3	515.8	0.0	0.0	0.0
MET	1354.7	4126.6	0.0	0.0	0.0
Work – moderate PA					
min/week	376.7	585.1	90.0	0.0	615.0
MET	1506.7	2340.6	360.0	0.0	2460.0
Transport					
min/week	254.3	489.8	120.0	60.0	210.0
MET	1017.3	1959.4	480.0	240.0	840.0
Recreation - vigorous PA					
min/week	40.7	91.4	0.0	0.0	30.0
MET	325.3	731.1	0.0	0.0	240.0
Recreation - moderate PA					
min/week	139.6	379.9	45.0	0.0	135.0
MET	558.5	1519.5	180.0	0.0	540.0
Sitting					
min/day	2782.5	1824.7	2940.0	1260.0	4200.0
PA by intensity					
MVPA min/week	716.3	892.0	300.0	104.0	967.5
MVPA MET	3705.2	5188.4	1680.0	480.0	4680.0
Total PA min/week	970.6	1199.3	470.0	210.0	1202.5
Total MET	4722.5	6199.6	2040.0	840.0	5200.0

Relationship between quality of life aspects and physical activity

Based on physical activity patterns, women were divided into two groups and means of QoL generic questions and domains were compared regarding PA as the grouping variable. In this case WHO's 150min/week MVPA recommendation to categorize women in active or inactive group. Results showed significant difference between the groups only for Psychological domain of WHOQOL-BREF (Z=-2.240, p=0.025) (Table 4).

Table 4. Relationship between pre-treatment quality of life and physical activity (measured by physical activity recommendation) undergoing ART (N=49)

	WHOQOL-BREF					
	Physical Health Domain	Psychological Domain	Social Relationships Domain	Environmental Domain		
Z	-0.917	-2.240	-0.385	-1.658		
p	0.359	**0.025***	0.700	0.097		
	FertiQoL					
	Emotional Scale	Mind-Body Scale	Relational Scale	Social Scale	Environment Scale	Tolerability Scale
Z	-1.648	-1.119	-0.457	-0.234	-0.868	-0.611
p	0.099	0.263	0.648	0.815	0.386	0.541

Regarding generic QoL scores, weak correlations were found between Psychological Domain of WHOQOL-BREF and moderate work activity minutes and METs (R=0.314, p=0.036) and total work minutes (R=0.323, p=0.030) and between vigorous recreation minutes and METs (R=0.317, p=0.034) (Table 5).

Similar correlations could be detected between the specific FertiQoL Core Scale Mind-Body domain and moderate work activity minutes and METs (R=0.369, p=0.013), MVPA METs (R=0.314, p=0.036), Total Minutes (R=0.301, p=0.045) and Total METs (R=0.336, p=0.024). FertiQoL Social Subscale also correlated with the total time spent with work (R=0.319, p=0.033) but showed unmet negative correlation with moderate intensity recreational activity (R=-0.309, p=0.039). The most positive relationship was found between Emotional Subscale and activity domains as work moderate activity (R=0.342, p=0.022), total work (R=0.335, p=0.025) and vigorous recreation (R=0.311, p=0.037) and also with cumulative PA values as MVPA (R=0.316, p=0.035), MVPA MET (R=0.365, p=0.014) and total PA time (R=0.338, p=0.023).More robust positive correlations could we describe between Mind-Body Subscale and work total minutes (R=0.403, p=0.006) and between Emotional Subscale and MVPA MET (R=0.365, p=0.014) and total MET (R=0.385, p=0.009).

Table 5. Relationship between pre-treatment quality of life and physical activity (measured by WHOQOL-BREF and GPAQ questionnaires) undergoing ART (N=49)

GPAQ		WHOQOL-BREF			
		Physical Health Domain	Psychological Domain	Social Relationships Domain	Environmental Domain
Work VPA (m/w)	R	-0.136	0.070	0.132	-0.039
	p	0.374	0.646	0.387	0.801
Work VPA (MET)	R	-0.136	0.070	0.132	-0.039
	p	0.374	0.646	0.387	0.801
Work MPA (m/w)	R	0.171	**0.314***	0.182	0.166
	p	0.261	**0.036**	0.233	0.276
Work MPA (MET)	R	0.171	**0.314***	0.182	0.166
	p	0.261	**0.036**	0.233	0.276
Work TPA (m/w)	R	0.123	**0.323***	0.247	0.121
	p	0.422	**0.030**	0.102	0.429
Transport TPA (m/w)	R	0.166	-0.040	0.032	0.226
	p	0.276	0.793	0.834	0.136
Transport TPA (MET)	R	0.166	-0.040	0.032	0.226
	p	0.276	0.793	0.834	0.136
Recreation VPA (m/w)	R	-0.024	**0.317***	0.154	0.266
	p	0.877	**0.034**	0.311	0.078
Recreation VPA (MET)	R	-0.024	**0.317***	0.154	0.266
	p	0.877	**0.034**	0.311	0.078
Recreation MPA (m/w)	R	-0.058	0.057	-0.160	0.011
	p	0.703	0.711	0.293	0.943
Recreation MPA (MET)	R	-0.058	0.057	-0.160	0.011
	p	0.703	0.711	0.293	0.943
Recreation TPA (m/w)	R	-0.029	0.177	-0.028	0.176
	p	0.852	0.246	0.857	0.248
Sitting (m/w)	R	-0.056	-0.089	-0.158	-0.074
	p	0.707	0.550	0.285	0.617
MVPA (m/w)	R	0.051	0.277	0.098	0.104
	p	0.738	0.065	0.523	0.497
MVPA MET	R	0.071	0.292	0.129	0.149
	p	0.642	0.052	0.398	0.329
Total PA (m/w)	R	0.092	0.239	0.108	0.143
	p	0.546	0.114	0.482	0.348
Total MET	R	0.094	0.245	0.118	0.160
	p	0.541	0.105	0.441	0.294

Table 6. Relationship between pre-treatment quality of life and physical activity (measured by FertiQoL and GPAQ questionnaires) undergoing ART (N=49)

GPAQ		Emotional Scale	Mind Body Scale	Relational Scale	Social Scale	Environment Scale	Tolerability Scale
				FertiQoL			
Work VPA (m/w)	R	0.174	0.151	-0.012	-0.032	0.162	0.159
	p	0.252	0.323	0.940	0.834	0.304	0.308
Work VPA (MET)	R	0.174	0.151	-0.012	-0.032	0.162	0.159
	p	0.252	0.323	0.940	0.834	0.304	0.308
Work MPA (m/w)	R	**0.342***	**0.369***	0.118	0.290	0.227	0.228
	p	**0.022**	**0.013**	0.442	0.053	0.148	0.141
Work MPA (MET)	R	**0.342***	**0.369***	0.118	0.290	0.227	0.228
	p	**0.022**	**0.013**	0.442	0.053	0.148	0.141
Work TPA (m/w)	R	**0.335***	**0.403****	0.150	**0.319***	0.268	**0.321***
	p	**0.025**	**0.006**	0.325	**0.033**	0.087	**0.036**
Transport TPA (m/w)	R	0.208	0.190	-0.113	0.114	0.089	0.190
	p	0.171	0.211	0.462	0.454	0.575	0.221
Transport TPA (MET)	R	0.208	0.190	-0.113	0.114	0.089	0.190
	p	0.171	0.211	0.462	0.454	0.575	0.221
Recreation VPA (m/w)	R	**0.311***	0.176	-0.025	0.010	0.082	0.008
	p	**0.037**	0.248	0.871	0.949	0.607	0.957
Recreation VPA (MET)	R	**0.311***	0.176	-0.025	0.010	0.082	0.008
	p	**0.037**	0.248	0.871	0.949	0.607	0.957
Recreation MPA (m/w)	R	-0.062	-0.125	-0.132	**-0.309***	-0.075	-0.297
	p	0.688	0.414	0.389	**0.039**	0.635	0.053
Recreation MPA (MET)	R	-0.062	-0.125	-0.132	**-0.309***	-0.075	-0.297
	p	0.688	0.414	0.389	**0.039**	0.635	0.053
Recreation TPA (m/w)	R	0.101	-0.059	-0.157	-0.183	-0.116	-0.282
	p	0.509	0.703	0.302	0.230	0.465	0.067
Sitting (m/w)	R	-0.069	-0.136	0.024	-0.180	-0.022	-0.017
	p	0.639	0.357	0.871	0.220	0.886	0.910
MVPA (m/w)	R	**0.316***	0.274	-0.020	0.162	0.089	0.109
	p	**0.035**	0.069	0.894	0.289	0.575	0.489
MVPA MET	R	**0.365***	**0.314***	-0.020	0.174	0.126	0.158
	p	**0.014**	**0.036**	0.898	0.252	0.425	0.312

Table 6 (continued). Relationship between pre-treatment quality of life and physical activity (measured by FertiQoL and GPAQ questionnaires) undergoing ART (N=49)

GPAQ		Emotional Scale	Mind Body Scale	Relational Scale	Social Scale	Environment Scale	Tolerability Scale
					FertiQoL		
Total PA (m/w)	R	**0.338**[*]	**0.301**[*]	-0.018	0.216	0.096	0.162
	p	**0.023**	**0.045**	0.909	0.155	0.544	0.298
Total MET	R	**0.385**[**]	**0.336**[*]	-0.017	0.225	0.120	0.187
	p	**0.009**	**0.024**	0.911	0.137	0.449	0.230

Discussion

It was assumed that abundance of pre-treatment PA will increase general and infertility-related QoL domains in ART patients. We could not describe significant differences regarding every domain of general QoL; only the Psychological domain of WHOQOL-BREF differed depending on the fulfilment of PA recommendation. Significant positive correlation was found only between pre-treatment MVPA versus Total MET and Emotional and Mind-Body aspect of infertility-related QoL.

43% of the women in the sample reported regular exercise, which could be discussed as a relatively active subpopulation in Hungary. However, Ács et al reported 10% improvement in PA habits based on representative Eurobarometer data from 2018: Hungarians regular sport participation and physical activity is 33%, which is behind the EU average (40%). Authors noted that 42% of Hungarian citizens spent more than 2.5 and less than 5.5 hours sedentary. With 3.5 hours daily sitting time (2782.5±1824.7 min/day), our results are in line with the above findings (Ács et al., 2018).

Regarding GPAQ, our respondents performed moderate intensity PA during work and preferred that during recreation. However, mean values showed some vigorous activity in work (169.3±515.8 min/week) and recreation (40.7±91.4 min/week). Medians demonstrated that most of these women completely avoided heavy forms of movement. Regarding female reproduction, there is a wide consensus on beneficial effects of PA on gestation. Most studies take attention to risk of frequent vigorous PA on fertility (Green, Daling, Weiss, Liff, & Koepsell, 1986; Wise et al., 2012) and on success of ART (Domar, Conboy, Denardo-Roney, &

Rooney, 2012; Morris et al., 2006). To describe PA levels, both instrumental and self-reported studies were published. Evenson et al discussed that the adjusted odds of intrauterine gestation are higher among IVF patients who had higher continuous active living (OR 1.96, 95% CI 1.09–3.50), sports/exercise (OR 1.48, CI 1.02–2.15), and total activity (OR 1.52, 95% CI 1.15–2.01) indices in the past year (Evenson et al., 2014).

Regarding the benefits of pre-treatment activity, Moran et al. reported positive effect of lifestyle intervention including exercise and diet in conjunction with ART in overweight and obese women and described elevated successful pregnancy rate (12 ∕ 18 vs 8 ∕ 20) in the intervention group compered to controls (Moran, Tsagareli, Norman, & Noakes, 2011). On the other hand, advers effects of excessive PA are also demonstrated. Gudmundsdottir et al found that women who are active on most days, tended to have 3.2 more fertility problem. In this study exercising to exhaustion also led to 2.3 times more fertility impairments than low intensity PA (Gudmundsdottir, Flanders, & Augestad, 2009). Based on the data by Morris et al. on lifetime exercise, exercising 4 hours or more per week indicate 40% less likely to have a livebirth (OR 0.6, CI 0.4-0.8), lead 3 times more likely to cycle cancellation and 2 times more likely to implantation failure or pregnancy loss (OR 2.8, CI 1.5-5.3; OR 2.0, CI 1.4-3.1; OR 2.0, CI 1.2-3.4 respectively) compared to non-exercise. (Morris et al., 2006). In the current research during the follow-up of IVF outcomes, particular attention was given to women in our sample, who reported at least 4 hours exercise weekly (18.2%). Regarding PA immediately after IVF, Evenson et al could not find any association between accelerometer-measured activity or sedentary behaviour with IVF outcomes. They described that after embryo transfer women

engaged only in light activity (ME 3.0 hour/day) and sedentary behaviours (ME 9.0 hour/day).

In the Hungarian validation study of the WHOQOL-BREF (Paulik et al), women reported significantly lower values than men, except for the Social Relationship domain. Females' values scored between 13.82±2.19 (Environmental domain) to 14.15±3.02 (Social relationship domain). In our dataset, Physical domain (13.71±1.18) showed close similarity with the mean value of general female subsample (13.83±3.14). In the research of Paulik et al., data were also analysed by health status and age. If we compare our results (15.84±1.88, 15.77±2.40, 14.16±2.03) with the healthy matching age group (35-44 years) of the study of Paulik et al, we can find close similarities by Psychological, Social and Environmental domains (15.69±2.25, 15.87±2.76, 14.63±1.99 respectively). Healthy people estimated each aspect of QoL as significantly better, compared to respondents with health impairments. It is promising that women's results undergoing ART were closer to the healthy population (Paulik et al., 2007).

Comparison of fertility-specific and general questionnaires can be found in literature in relation to FertiQol-Hospital Anxiety and Depression (HADS) (Aarts et al., 2011; Dural et al., 2016), FertiQol – WHOQOL (Boivin et al., 2011). Cserepes et. al conducted research using FertiQoL and Beck Depression Inventory on Hungarian sample (126 couples). Female members of the couples reported poorer QoL than males. Subscales of the Core module scored between 69,01±16,33 (Emotional Scale) to 80,26±13,85 (Social scale), total QoL was described as 77.27±12.05. These values were markedly higher than in our sample (Cserepes et al., 2014).

Domar et. al underline the role of improving mental health with psychological interventions in improved pregnancy rates among infertile women (Domar, Gross, Rooney, & Boivin, 2015). Other studies shift focus to lifestyle behaviours: Domar et al made surprising observations regrading interfering health behaviors as exhausting exercise, smoking, regular consumption of alcohol and caffeinated beverages and taking herbal supplements during IVF cycles (Domar et al., 2012). In our sample more health-conscious lifestyle could be observed.

Porat-Katz and co-authors examined the associations between the use of complementary medicine, QoL, and lifestyle habits, i.a. PA among 323 women undergoing IVF and found that these variables are linked. Complementary-medicine users reported higher scores for the FertiQol Relational domain and lower for the Social domain (p=0.005, p=0.010), greater utilization of psychosocial support (p<0.001), and higher rates of PA (p=0.004) and consulting with dietitians (p=0.050) (Porat-Katz, Paltiel, Kahane, & Eldar-Geva, 2016).

Infertility-specific and generic scales could also provide appropriate information on QoL of ART patients. Pre-treatment PA could positively influence QoL during ART. Therefore, combined investigation of this factors could be recommended to identify patients who could benefit from psychosocial interventions or lifestyle changes. Exploration of patient experiences during ART could help offset negative reactions to infertility and its treatment, to improve willingness to continue with the treatment, to improved patient outcomes, and, if treatment is unsuccessful, to cope with remaining childless circumstances. However, for more impressive results, detailed objective assessment of physical activity, increased number of participants, and further examinations on outcome measures are needed.

We intend to expand the current research to gain accelerometer data on pre-treatment physical activity of IVF patients. This will provide the opportunity to compare the role of self-reports with objective PA measures. Existing differences in response to infertility due to PA suggest the development of a specific intervention.

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Conflict of interest

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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