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ORIGINAL ARTICLE

The effect of the information-motivation-behavioral skills (IMB) model variables on orthorexia nervosa behaviors of pregnant women

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Abstract

Purpose This study aims to test the effect of the components of the Information-Motivation-Behavioral Skills Model on Orthorexia Nervosa (ON) behavior of pregnant women and health outcomes using a hypothetical model.

Methods The study is cross-sectional research and was carried out with 350 pregnant women who had the Non-Stress Test in the obstetrics outpatient clinic of a university hospital. The participants were selected using the convenience sampling method. The data were collected with a questionnaire. Data were analyzed using the structural equation model.

Results It was found that 26.6% of pregnant women had an ON tendency. High information for obsession with obsession with healthy eating causes more ON behaviors ($\beta = -0.25$, $p < 0.001$). The higher motivation for obsession with healthy eating obsession ($\beta = 0.73$, $p < 0.01$) and a higher tendency to ON behaviors ($\beta = -0.16$, $p < 0.05$) are associated with better health outcomes.

Conclusion Our findings show that high levels of information and motivation about the obsession with healthy eating effect ON tendency and health outcomes. The findings are significant in that they lead and guide the interventions for the detection, prevention, and treatment of ON during pregnancy.

Level of Evidence Level V, cross-sectional study

Keywords Information-Motivation-Behavioral Skills Model · Pregnancy · Orthorexia Nervosa

Introduction

Orthorexia Nervosa (ON) has been briefly defined as an "obsession with healthy eating" [1]. The obsessions of orthorexic individuals can be related to a wide variety of issues, such as pesticides in foods, foods with hormones, chemical sweeteners, preservative chemicals, food dyes, carcinogenic substances in food packaging, and product labels. ON is related to the content of the food consumed rather than the amount of food [2, 3]. In addition to how meals are prepared, extra time is spent researching, cataloging, weighing, and measuring food, and planning and intervening in future meals [4]. The phobia of eating unhealthy foods limits the consumption of certain products. Over time, the diet becomes more rigid, and eating foods categorized as "unhealthy" causes feelings of guilt, fear of becoming ill, and self-punishment behaviors, such as following an even more restricted diet [5]. Therefore, ON can result in social isolation, impaired quality of life, malnutrition, and extreme weight loss [5–7]. In this context, ON can mean an "unhealthy addiction to healthy eating" [8]. However, ON is not yet an official diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (DSM)-5 [9], it is controversial whether it is different from anorexia nervosa (AN) or bulimia nervosa [10].

The prevalence of ON symptoms has previously been reported as less than 1% in the US sample [11], 4.5% in university students [12], 21.4% of pregnant women [13], and 35–57.8% in high-risk groups (for example, artists, athletes, healthcare professionals, and performance artists) [14]. The prevalence of eating disorders is highest among women before their reproductive years or during reproductive years,

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which leads to some questions about pregnancy [15]. It has been noted that eating disorders have increased in pregnant women in recent years [16].

Pregnancy is a process involving changes that can be a turning point for the onset and recurrence of obsession with healthy eating [16]. The reasons for the obsession during pregnancy can be explained by several theories. The first is that the thought of harming the baby increases with responsibility in the pregnant woman. The second is to be overprotective against threats. The third is intrusive thoughts about the baby's safety. These thoughts cause significant anxiety in the mother and obsessive–compulsive symptoms occur [17]. Despite being acted to achieve optimum health, ON can lead to nutritional deficiencies, medical complications, and poor quality of life [4]. It is believed that insufficient intake of nutrients, together with the physiological changes that occur during pregnancy, causes metabolic changes in the mother and epigenetic modifications in the fetus. Therefore, it is necessary to have adequate and balanced energy and nutrient intake during pregnancy to maintain maternal and fetal health [18]. Pre-pregnancy weight and diet during pregnancy may partially mediate the relationship between pregnancy complications and delivery outcomes [19]. In this sense, gestational weight gain (GWG) is an important indicator to monitor and evaluate a pregnant woman's nutritional status [20].

Studies on ON generally focus on measuring its prevalence in at-risk groups [21]. Studies on ON during pregnancy are fairly limited. To the best of our knowledge, there is only one study investigating ON risk in pregnant women. The descriptive study conducted with 70 women in Turkey investigated pregnant women's obsession with healthy eating and eating attitudes [13]. The reasons for the lack of sufficient evidence regarding ON during pregnancy are the desire of the pregnant women to conceal this problem, the masking of ON symptoms by some nutritional problems, such as anorexia, hyperemesis gravidarum, and pica, seen especially in the first trimester, and not evaluating nutritional disorders routinely during prenatal controls. ON is a problem that should be addressed; however, it is often overlooked during pregnancy [22]. Eating disorders and malnutrition during pregnancy increase maternal and fetal morbidity and mortality [8]. Under these conditions, the diagnosis and treatment of eating disorders during pregnancy become particularly important [23].

Theoretical framework

The conceptual framework of this study is based on the Information-Motivation-Behavioral Skills (IMB) Model [24]. According to the model, the availability of information is the first of the fundamental components that affect obsession with healthy eating behavior. The second component of the model is motivation. The pregnant woman's motivation is her attitudes and evaluations about the obsession with healthy eating. Social motivation refers to pregnant women's perceived social support from other people for healthy eating. The last component in the model is behavioral skills, which represent the perceived skills of the pregnant woman regarding the obsession with healthy eating behaviors (preparing, cooking, and storing food, calculating calories, reading food labels, etc.) and self-confidence. The IMB model contributes to the development of healthy behaviors. In this way, the objective and subjective health outcomes of the individual are positively affected as a result of behavioral change [25]. It has been reported in the literature that programs based on the IMB Model increase individuals' self-efficacy, reduce negative attitudes, and are effective in developing positive behaviors [24, 26].

Although the IMB model was used to develop healthy eating behaviors in previous studies [27–29], to the best of our knowledge, no studies have yet been conducted with pregnant women on this topic. This study aims to test the effect of the IMB model components on the ON behavior of pregnant women and the health outcomes and to examine the relationship between these components. This study is significant in terms of guiding the interventions to develop healthy eating behaviors of pregnant women.

Methodology

This cross-sectional study was conducted with pregnant women who received a Non-Stress Test (NST called cardiotocography, records fetus's movement, heartbeat, and uterus contractions) at Afyonkarahisar Health Sciences University, Health Application and Research Center, Obstetrics Outpatient Clinic between January 2 and March 15, 2020. Although there may a difference in daily routines in the hospital, it has been reported that a mean of 10 NSTs was performed daily on pregnant women (200 monthly). For this limited population ($N = 2400$), the sample size was calculated to be 332 at a 95% confidence level using the following formula [30]:

$$n = \frac{\mathrm{N}\, t^2\, \mathrm{p}\, \mathrm{q}}{(\mathrm{N}-1)d^2 + t^2\, \mathrm{p}\, \mathrm{q}} = \frac{2400(1.96)^2 0.5\ 0.5}{(2400-1)(0.05)^2 + (1.96)^2 0.5\ 0.5}$$

N population, n sample size, t the theoretical value found from the t table for 95% confidence level, d desired precision, p the (estimated) proportion of the population which has the attribute in question, $q = 1 - \mathrm{p}$.

Also, taking into account the possible data loss, the questionnaire was administered to 359 pregnant women who were selected through the convenience sampling method and who met the inclusion criteria of the study.

The inclusion criteria were being a pregnant woman who is over the age of 18, who can read and write, who is at gestational week 30 or over, who does not have a risky pregnancy, and who volunteered to participate in the study. Nine pregnant women who did not meet the inclusion criteria and who left some questions in the data collection forms unanswered were excluded from the study. As a result, the data obtained from 350 pregnant women were analyzed.

Data collection

The data were collected using the face-to-face interview method. The data collection process lasted for about 15–20 min. The data collection form includes questions aiming at collecting data about the sociodemographic and obstetric characteristics (e.g. age, duration of the marriage, number of pregnancies, number of living children, gestational week, educational level, occupation, economic status, social security, smoking) and anthropometric measures of pregnant women. The pre-pregnancy weight and height were self-reported by pregnant women. The present weight measurement was made by nurses before the NST test. Also, the data collection form included IMB components as follows:

Information

The nutritional information level of pregnant women was evaluated with eight statements prepared by the researchers (see Supplementary table). Each correct answer received 1 point, while each incorrect answer was scored as 0. In this study, the Kuder-Richardson (KR)-20 coefficient of the eight items was found to be 0.59.

Individual motivation

The Photographic Figure Rating Scale developed by Swami et al. (2008) was used to evaluate the individual motivation of pregnant women [31]. This scale consists of ten images of female bodies ranging in body mass index (BMI) from underweight (1) to obese (10). The women were asked to rate their visual body perception by looking at images. The BMI corresponding to each figure in the scale is as follows: Fig. 1, 12.51; Fig. 2, 14.72; Fig. 3, 16.65; Fig. 4, 18.45; Fig. 5, 20.33; Fig. 6, 23.09; Fig. 7, 26.94; Fig. 8, 29.26; Fig. 9, 35.92; Fig. 10, 41.23. Pregnant women's motivation for nutrition was evaluated by calculating the difference between their current visual body perception (VBP1) and the perception of the ideal body they want to have in the future (VBP2). As the score representing the difference gets further from zero (as the BMI gets higher), it is thought that pregnant women will exhibit more ON behaviors [32].

Social motivation (social support)

The social motivation of pregnant women regarding nutrition was evaluated with the proposition "There are people who support me about having a healthy diet". The answer "yes" was scored as 1, while the answer "no" was scored as 0.

Behavioral skills (self-efficacy)

The self-efficacy of pregnant women in adhering to their diet even in some situations that make it difficult to adhere to diet was evaluated with the Self-efficacy to Regulate Eating Habits Scale developed by Bandura (2006) [33] and adapted into Turkish by Sevinç and Argon (2014) [34]. The scale with 30-item evaluates the performance of the participants in their regular nutrition routine. Each situation in the scale is scored in 10-unit intervals, between 0 (not possible) and 100 (absolutely possible). High scores indicate increased self-efficacy. In the Turkish adaptation study of the scale, the Cronbach's Alpha coefficient was 0.98 [34]. It was found to be 0.90 in this study.

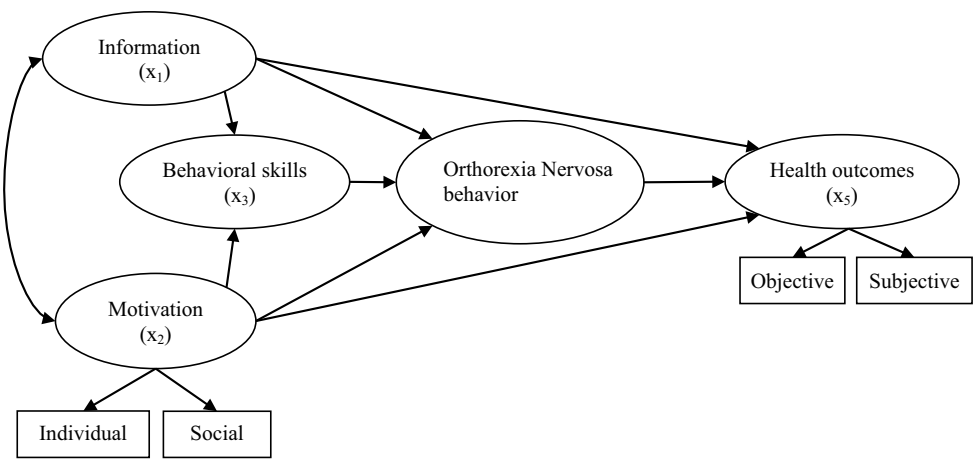

Fig. 1 Hypothetical model and research hypotheses: H_1 ($x_1 \rightarrow x_3$) Information affects behavioral skills. H_2 ($x_2 \rightarrow x_3$) Motivation affects behavioral skills. H_3 ($x_1 \rightarrow x_4$) Information affects Orthorexia Nervosa [ON] behaviors. H_4 ($x_2 \rightarrow x_4$) Motivation affects ON behaviors. H_5 ($x_3 \rightarrow x_4$) Behavioral skills affect ON behaviors. H_6 ($x_1 \rightarrow x_5$) Information affects health outcomes. H_7 ($x_2 \rightarrow x_5$) Motivation affects health outcomes. H_8 ($x_4 \rightarrow x_5$) ON behaviors affect health outcomes

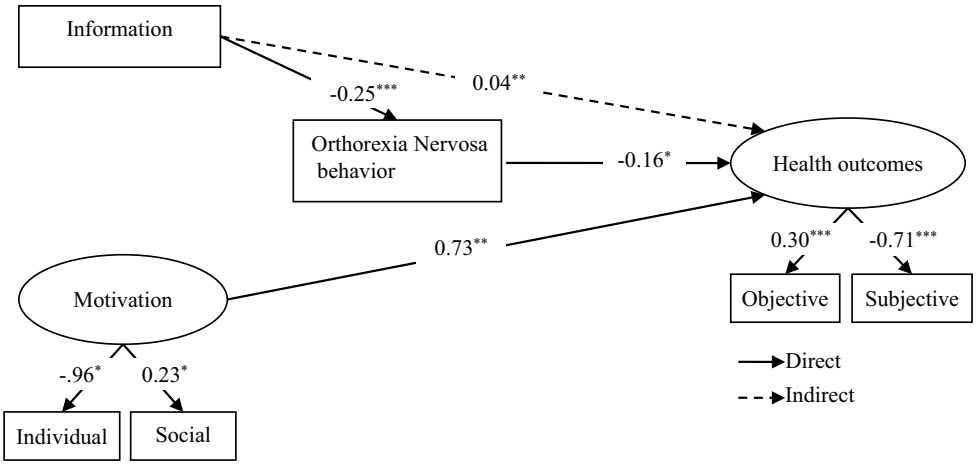

Fig. 2 Path diagram of the final model. *$p < .05$, **$p < .01$, ***$p < .001$

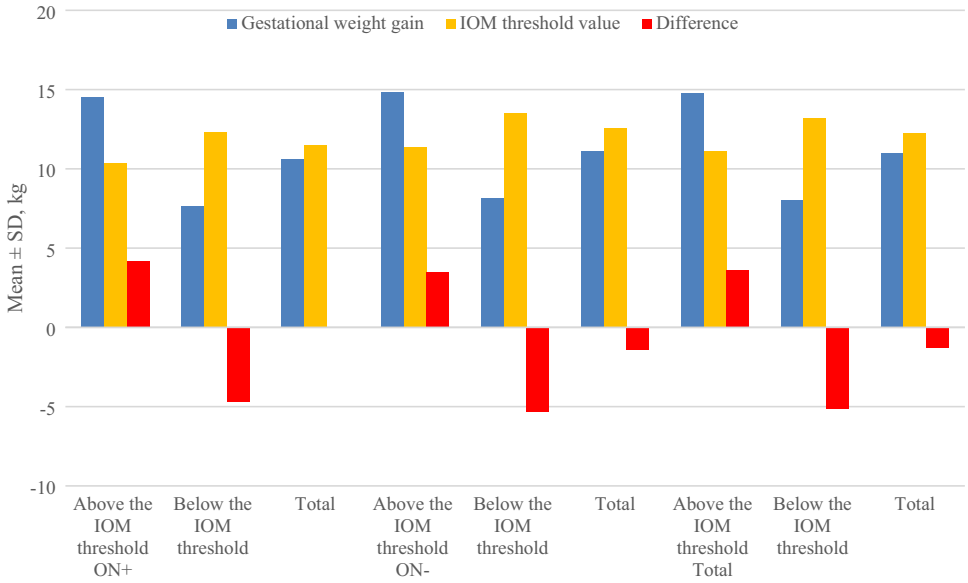

Fig. 3 Gestational weight gain, IOM threshold values, and the differences between these two according to pre-pregnancy BMI and ON tendency. *IOM* Institute of Medicine, *ON* Orthorexia Nervosa, *BMI* Body Mass Index

Orthorexia nervosa behaviors

The ON behaviors of pregnant women were evaluated using the ORTO-11, which was developed by Donini et al. (2005) [35] and adapted to Turkish by Arusoğlu et al. (2008) [32]. ORTO investigates individuals' obsession with healthy food. The scale is a four-point Likert-type scale consisting of 11 items. Each item is scored between 1 (always) and 4 (never). Low scores indicate an increased ON tendency. In the original study [35], no Cronbach's alpha was reported. The Cronbach's alpha coefficient of the scale was 0.62 in the Turkish adaptation study and 0.54 in this study.

Objective health outcome

The objective health outcomes were evaluated using GWG. This approach reflects the fact that good results have been achieved over a range of weight gains and many additional factors that may need to be considered for a pregnant woman. GWG threshold values recommended by the Institute of Medicine (IOM) according to the gestational week were calculated for each category of pre-pregnancy BMI [36]. For example, an underweight woman at 40 weeks of gestation should gain 20.4 kg in total (40×0.51), while an obese woman at 40 weeks of gestation should gain 8.8 kg (40×0.22). Institute of Medicine (IOM) use standard BMI categories defined by the World Health Organization (WHO) for GWG as below: < 18.5 kg/m^2 (underweight), 18.5 – 24.9 kg/m^2 (normal), 25 – 29.9 kg/m^2 (overweight), and > 30 kg/m^2 (obese) [36].

Subjective health outcome

The subjective health outcomes of pregnant women were evaluated with the "Perception of Body During Pregnancy" sub-dimension of the "Self-Perception of Pregnant Scale

(SPPS)" developed by Kumcağız et al. (2017) [37]. This subdimension with five negative items evaluates the perception of changes in the body during pregnancy on a 4-Likert scale. Each item is scored between 4 (always) and 1 (never). A high score indicates that body perception during pregnancy is negative. The Cronbach's alpha coefficient of the subdimension was 0.75 in the original study, 0.88 in this study.

Hypothetical model and study hypotheses

The IMB model-based hypothetical model and research hypotheses are shown in Fig. 1. Each one-way arrow (paths) in the hypothetical model represents the research hypotheses. In addition, the status of women with ON exceeding the IOM thresholds according to their pre-gravid BMI was determined by chi-square analysis.

Data analysis

Descriptive statistics of the variables were calculated. The compatibility of the data to normal distribution was tested with the Shapiro–Wilk test. Also, the absolute values of the skewness and kurtosis numbers of the variables were below two indicating the data were normally distributed. The Pearson's correlation coefficient and Variance Inflation Factor (VIF) were used to test whether there was multicollinearity between numerical variables [38]. Cronbach's alpha coefficients were calculated to test the reliability of the scales.

The goodness-of-fit of the hypothetical model was checked with the standardized regression coefficients and error variances in Confirmatory Factor Analysis (CFA). The maximum probability technique was used in SEM, and direct and indirect path coefficients were estimated using the Boostrap estimation method. To determine the fit of the hypothetical model, the ratio of chi-square to degrees of freedom (x^2/df), Goodness-of-Fit Index (GFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) were used. If x^2/df is below 5, it indicates an acceptable fit. A GFI, NFI, IFI, and CFI value of 0.90 and above indicate a good fit. An RMSEA value below 0.08 reflects an acceptable fit [38, 39].

Two-way MANOVA analysis and chi-square analysis were performed to reveal whether the weight gained during pregnancy exceeds the IOM thresholds according to pregravid BMI of the women with ON. Multiple comparisons were evaluated with Bonferroni in MANOVA analysis. Analysis results are presented as mean ± standard deviation (SD) and frequency.

The SPSS version 22 and AMOS version 21 (IBM SPSS Statistics, Chicago, IL, USA) were used for statistical analysis, and the significance level was accepted as $p < 0.05$.

Ethical considerations

Before the study, written permission was obtained from the Afyonkarahisar Clinical Research Ethics Committee (dated 07.02.2020 and numbered 2020/75) and from the institution where the study was conducted (dated 26/11/2019 and numbered E.20723). Informed consent of the participants was received. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Results

Sociodemographic and nutritional characteristics

The mean age of the pregnant women was 28.22 ± 5.60, the mean duration of marriage was 6.82 ± 5.27 years, the mean number of pregnancies was 2.74 ± 1.78, the mean number of surviving children was 1.79 ± 0.85, and the mean gestational week was 35.14 ± 2.51. Half of the pregnant women finished high school or university (50.8%); 76% were housewives; 93.6% had average/above-average income; 84% had social security. 24.9% of the pregnant women did not change their diet after getting pregnant, and 44.9% did not receive any training on nutrition during pregnancy. The mean visual body perception score of pregnant women was 7.60 ± 1.70, indicating overweight. The mean perception of the ideal body they want to have in the future was 4.32 ± 1.37, indicating a normal or healthy level. The pre-pregnancy BMI mean of the pregnant women was 25.49 ± 5.20, indicating overweight. The present BMI mean of pregnant women was 29.66 ± 5.15. The mean GWG according to pre-pregnancy BMI was 11.00 ± 5.17. The mean difference between GWG and the IOM threshold value was − 1.27 ± 5.44. 44% of the pregnant women gained weight above the IOM threshold value. There is no relationship found between ON tendency and exceed the IOM thresholds of pregnant women ($p < 0.05$; Table 1).

Correlations between variables and descriptive statistics

Absolute values of skewness and kurtosis numbers for each measured variable were found between 0.03 and 1.20 and 0.02–0.82, respectively. These results show that the data are suitable for modeling and is normally distributed [38]. The correlation coefficients of the variables with significant correlations were found between 0.11 and 0.50. When correlation coefficients are below 0.70 and VIF values of variables are below two, it means that there is no multicollinearity problem among the variables (Table 2).

Table 1 Sociodemographic and nutritional characteristics of pregnant women

	n (%)/M ± SD (min–max)
Age	28.22 ± 5.60 (18–45)
Duration of marriage (year)	6.82 ± 5.27 (1–25)
Number of pregnancies	2.74 ± 1.78 (1–13)
Number of living children	1.79 ± 0.85 (1–4)
Gestational week	35.14 ± 2.51 (30–40)
Education	
Primary school	55 (15.7)
Secondary school	117 (33.4)
High school	103 (29.4)
University	75 (21.4)
Occupation	
Housewife	266 (76.0)
Civil servant	39 (11.1)
Self-employed	15 (4.3)
Other	30 (8.6)
Perceived economic status	
High	122 (34.9)
Average	209 (59.7)
Low	19 (5.4)
Social security	
Yes	294 (84.0)
No	56 (16.0)
Smoking	
Yes	28 (8.0)
No	322 (92.0)
Has there been a change in the diet during pregnancy?	
Yes	139 (39.7)
Partly	124 (35.4)
No	87 (24.9)
From whom did you receive information on nutrition during pregnancy?	
No, I've never had an education	157 (44.9)
I got information from the dietitian	37 (10.6)
I got information from the doctor/nurse/ midwife	91 (26.0)
I got information from the internet	59 (16.9)
I got information from friends and family member	6 (1.7)
Present visual body perception	7.60 ± 1.70 (2–10)
The ideal visual body perception in the future	4.32 ± 1.37 (1–8)
Pre-pregnancy BMI	25.49 ± 5.20 (15.43–42.66)
Underweight (< 18.5 kg/m^2)	16 (4.6)
Normal (18.5–24.9 kg/m^2)	174 (49.7)
Overweight (25.0–29.9 kg/m^2)	96 (27.4)
Obese (≥ 30.0 kg/m^2)	64 (18.3)
Present BMI	29.66 ± 5.15 (19.10–48.27)
Underweight (< 18.5 kg/m^2)	–
Normal (18.5–24.9 kg/m^2)	59 (16.9)
Overweight (25.0–29.9 kg/m^2)	144 (41.1)
Obese (≥ 30.0 kg/m^2)	147 (42.0)
GWG (according to pre-pregnancy BMI)	11.00 ± 5.17 ([− 6 to 27])
Underweight (< 18.5 kg/m^2)	12.93 ± 3.88
Normal (18.5–24.9 kg/m^2)	11.80 ± 5.08

Table 1 (continued)

	n (%)/M ± SD (min–max)
Overweight (25.0–29.9 kg/m^2)	10.29 ± 5.11
Obese (≥ 30.0 kg/m^2)	9.39 ± 5.31
Difference between GWG and the IOM threshold value (kg)	−1.27 ± 5.44 ([−17.70] to [13.48])
ON tendency	93 (26.6)*
Status of exceeding the IOM threshold according to the ON tendency**	
ON tendency (+)	
Above the IOM threshold	40 (43)
Below the IOM threshold	53 (57)
ON tendency (-)	
Above the IOM threshold	114 (44.4)
Below the IOM threshold	143 (55.6)
Total	350 (100.0)

BMI Body Mass Index, *GWG* Gestational Weight Gain, *ON* Orthorexia Nervosa, *IOM* Institute of Medicine

*25% percentile

**Chi-square = 0.050, $p = 0.903$

The fit statistics of the hypothetical model

The goodness-of-fit of the hypothetical model was tested in two stages. First, the measurement model consisting of IMB model variables was tested. Covariance matrices were created using the Maximum Likelihood calculation method since the data showed normal distribution. As a result of the analysis, it was determined that the fit indices were at acceptable values ($x^2/df = 2.110$, GFI = 0.98, NFI = 0.93, IFI = 0.96, CFI = 0.96, and RMSEA = 0.056). The regression weight between latent variables and measured variables was significant ($p < 0.05$). There is no negative error variance. These results show that the latent variable and the measured variable define the model sufficiently.

In the second stage, which involves the SEM analysis, the effect of each latent variable on ON behavior and health outcomes was tested. The fit values of the hypothetical model were found to be within acceptable level ($x^2/df = 2.742$, GFI = 0.98, NFI = 0.90, IFI = 0.93, CFI = 0.93, and RMSEA = 0.071). However, it has been determined that they are not statistically significant in the hypothetical model. After modifications have been made, three of the eight paths suggested by the hypothetical model were found to be statistically significant ($p < 0.05$). The goodness-of-fit index of the final model is at an acceptable level ($x^2/df = 2.662$, GFI = 0.98, NFI = 0.90, IFI = 0.93, CFI = 0.93, and RMSEA = 0.069).

Direct, indirect, and total effects of variables on health outcomes

The paths (hypotheses) suggested in the hypothetical model were evaluated in terms of standardized regression coefficients and statistical significance. High information lead to more ON behaviors (H_3; $\beta = -0.25$, $p < 0.001$), explaining 6% of ON behaviors variability. The higher motivation (H_7; $\beta = 0.73$, $p < 0.05$) and more ON tendency (H_8; $\beta = -0.16$, $p < 0.01$) cause an increase in health outcomes, and they together account for 57% of the variability of health outcomes (Table 3; Fig. 2).

When the indirect effects of variables on health outcomes were examined (Table 3; Fig. 2), it was found that information indirectly affected the health outcomes ($\beta = 0.04$, $p < 0.01$). High information is associated with higher GWG ($\beta = 0.01$, $p < 0.01$) and a negative body perception ($\beta = -0.03$, $p = 0.05$). Motivation and the ON behaviors indirectly affected GWG ($\beta = 0.22$, $p < 0.05$; $\beta = -0.05$, $p < 0.01$, respectively) and body perception ($\beta = -0.52$, $p < 0.05$; $\beta = 0.11$, $p < 0.05$, respectively).

Two-way MANOVA results

The main effect of the ON tendency on GWG was not found to be significant ($p = 0.382$). IOM threshold values of pregnant women differ according to the ON tendency ($p = 0.005$). The mean IOM threshold value is 12.56 ± 3.33 kg in pregnant women without ON tendency, while it is 11.49 ± 3.12 kg in pregnant women with ON tendency. The main effect of exceeding the IOM threshold level during pregnancy on the GWG and IOM threshold level was found to be significant ($p < 0.001$). While the mean GWG is 14.76 ± 3.71 kg in pregnant women who exceed the IOM threshold value, it is 8.04 ± 4.13 kg in those not exceeding the threshold value. The mean IOM threshold value is 11.12 ± 3.19 kg for those who exceed the IOM threshold, while it is 13.18 ± 3.12 kg for those not exceeding the IOM

Table 2 Descriptive statistics for scale scores ($N = 350$)

	Min–Max	$M \pm SD$	Skewness	Kurtosis	VIF	Pearson Correlation					
						1	2	3	4	5	6
1. Information	0–8	4.35 ± 1.78	−0.03	−0.40	1.000						
2. Individual motivation	(−9) to 5	(−3.28) ± 1.96	0.19	0.37	1.336	−0.01					
3. Social motivation	0–1	0.75 ± 0.42	−1.20	−0.55	1.050	0.12*	−0.21**				
4. Behavioral skills	590–3000	2093.94 ± 436.41	−0.57	0.82	1.010	0.18**	0.09	−0.02			
5. ON behavior	17–37	29.40 ± 3.80	−0.69	−0.02	1.007	−0.25**	0.08	0.00	−0.11*		
6. Objective health outcome	(−6) to 27	11.00 ± 5.17	−0.15	0.38	1.059	0.02	−0.23**	0.13*	−0.08	0.02	
7. Subjective health outcome	5–20	14.92 ± 4.31	−0.69	−0.53	1.336	0.02	0.50**	−0.09	0.19**	0.18**	−0.21**

ON Orthorexia Nervosa, *VIF* Variance Inflation Factor

* $p < 0.05$

** $p < 0.01$

threshold value. The interaction of ON tendency and exceeding the IOM threshold did not have a significant effect on the GWG and IOM threshold ($p > 0.840$, $p > 0.871$, respectively). While 41% of the change in the GWG measurement is explained by exceeding the IOM threshold value, 10% of the change in the IOM threshold measurement is explained by the ON tendency and the situation of exceeding the IOM threshold (Table 4; Fig. 3).

Discussion

Due to physical changes, concerns about body image and weight gain increase during pregnancy [40]. Although some pregnant women reduce their calorie intake and do excessive exercise (pregorexia) [41], the mental preoccupation with healthy eating is increasing and poses a threat to ON [22]. Nevertheless, ON behavior is generally neglected during pregnancy. This study aimed to reveal how the IMB components affect ON behaviors and health outcomes of pregnant women. The results of the study show that the information and motivation affect the ON tendency and health outcomes in pregnant women. We also found an increase in GWG and the negative body perception as the ON tendency increased.

The IMB model assumes that an informed and motivated person is more prone to developing relevant behavioral skills and is more likely to engage in this behavior [42]. Our study revealed that as the information of pregnant women increased, their tendency to orthorexic behavior also increased. In addition, information affected the GWG and body perception both directly and indirectly. Similarly, interventions based on the IMB model have been found to improve the correct food selection of university students [43], diet and exercise self-care behaviors of adults with diabetes [44], and healthy lifestyle and mental well-being of pregnant women with high BMI [45].

Motivation is necessary to gain optimal nutritional behavior [46]. Many pregnant women have a high individual motivation to improve health behaviors. Pregnancy is also considered the best time to combat problems, such as bad eating habits and inadequate physical activity [41]. The majority of pregnant women in our study stated that they changed their nutritional attitude during pregnancy to be healthier. Similarly, a study conducted in Iran revealed that the behavioral intentions of pregnant women positively affected their healthy eating behaviors [47].

The effect of social support on healthy eating obsession during pregnancy is controversial in the literature. In some studies, social support has been recognized as a powerful precursor to developing a healthy lifestyle during pregnancy [48], and the social effects of healthy eating behaviors have been attributed to families and spouses [49]. In our study, the motivation was found to be higher in pregnant women

Table 3 Effects of exogenous variables on the endogenous variable in the final model ($N=350$)

Endogenous variable		Exogenous variable	β	CR (p)	SMC	SDE	SIE	STE
ON behavior	←	Information	−0.25	−4.92***	0.06	−0.25*		−0.25*
Health outcome	←	Information			0.57		0.04**	0.04**
	←	Motivation	0.73	2.95**		0.73*		0.73*
	←	ON behavior	−0.16	−2.28*		−0.16**		−0.16**
Objective health outcome	←	Information					0.01**	0.01**
	←	Motivation					0.22*	0.22*
	←	ON behavior					−0.05**	−0.05**
Subjective health outcome	←	Information					−0.03*	−0.03*
	←	Motivation					−0.52*	−0.52*
	←	ON behavior					0.11*	0.11*

ON Ortorexia Nevrosa, β Standardized Regression Weight, *CR* Critical Ratio, *SMC* Squared Multiple Correlations, *SDE* Standardized Direct Effects, *SIE* Standardized Indirect Effects, *STE* Standardized Total Effects

*$p<0.05$

**$p<0.01$

***$p<0.001$

Table 4 Two-way MANOVA results ($N=350$)

	Dependent Variable	F	p	Partial Eta Squared (η^2)
ON tendency	GWG[a]	0.767	0.382	0.002
	IOM threshold[b]	8.122	**0.005**	0.023
Status of exceeding the IOM threshold	GWG	195.585	**< 0.001**	0.361
	IOM threshold	28.442	**< 0.001**	0.076
ON tendency X Status of exceeding the IOM threshold	GWG	0.041	0.840	0.000
	IOM threshold	0.026	0.871	0.000

GWG Gestational Weight Gain, *IOM* Institute of Medicine, *ON* Orthorexia Nervosa

[a]$R^2=0.414$

[b]$R^2=0.109$

who perceive their external appearance as close to ideal and who have high social support for healthy eating. Also, pregnant women with high motivation have higher GWG and more negative body perception. However, overweight and obese pregnant women in Ireland think that the environment they live in does not support healthy eating behaviors [50]. According to a study conducted in Australia, the BMIs of pregnant women do not affect their perceptions of social support associated with healthy eating. Women with normal and overweight BMI appear to be motivated and avoiding excessive weight gain during pregnancy [51]. Interestingly, some women are motivated by esthetic and social expectations rather than health concerns [52].

GWG is an important indicator to monitor and evaluate a pregnant woman's nutritional status [20]. In our study, it was determined that as the tendency to ON increased in pregnant women, GWG increased. There is no relationship was found between ON tendency and exceed the IOM threshold. However, it was determined that the IOM threshold value in pregnant women with ON tendency was significantly lower than those without ON tendency. These analyses show that pregnant women with ON tendency had higher BMI. At the same time, the results reflect the fact that in those who are obsessed with healthy eating, the quality of the food is more important than the amount of food as compatible with the literature [2, 3].

At the heart of the eating, disorders are often negative body perception and trying to be slim. However, individuals with ON appear to lack characteristic traits, such as excessive fear of being obese, and attaching a high value to the shape and weight of the body are not found, as do individuals with AN and BN [53]. Our study revealed that as ON tendencies of pregnant women increased, they had more negative body perception. In other words, dissatisfaction with the body image and higher BMI appears to be associated with ON in pregnancy. Similarly, in a study conducted

in Norway, increased BMI during pregnancy was found to be associated with maternal eating disorders [54]. On the other hand, some researchers suggest that the negative body image of individuals with ON is not as pronounced as in other eating disorders [14, 21].

Those with ON symptoms in healthy food selection assessment were defined as "health fanatics" by Donini et al. [35]. One out of every four pregnant women who participated in our study could be a health fanatic with a tendency to ON. The frequency of ON we revealed seems to be slightly higher than the frequency found by the limited number of studies about ON in pregnant women (21.4%) [13]. It is known that ON emerges in all cultures familiar with the "ideal woman" figure and its prevalence has been increasing rapidly [32]. Being extremely concerned about being "thin", which the media promote as "healthy, fashionable and perfect", seems to continue to contribute to the prevalence of ON, especially in a period, such as pregnancy, when weight gain is inevitable and body image is affected [55].

Limitations of the study

This study has some limitations. First, this study is limited to its sample. Therefore, the results are limited in terms of generalizability. Second, the data are based on the statements of the participants, and it has not been clinically confirmed. Third, the extent of ORTO-11 in determining ON may be limited due to its psychometric properties. Therefore, it cannot be excluded that the ORTO-11 measures "healthy eating" rather than "orthorexic eating behavior." Hence, the results reveal healthier eating in general, which does not necessarily have to be orthorexic/pathological and which could then be health-promoting instead of health-damaging.

What is already known on this subject?

Due to physical changes, concerns about body image and weight gain increase during pregnancy. Although some pregnant women reduce their calorie intake and do excessive exercise, the mental preoccupation with healthy eating is increasing and poses a threat to ON. However, ON is an issue that is neglected during pregnancy. Studies about ON during pregnancy are extremely limited.

What does this study add?

The study shows that high levels of information and motivation of pregnant women about the obsession with healthy eating effect ON tendency and health outcomes. The findings are significant in that they lead and guide the interventions for the detection, prevention, and treatment of ON during pregnancy.

Conclusion

The results of the study revealed that high information and motivation about healthy eating obsession affect ON tendency and health outcomes. This study is one of the first studies that examine ON behaviors and the factors influencing ON behaviors during pregnancy based on the IMB model. The results of the study are valuable in that they can lead and guide the studies about ON during pregnancy. It is recommended to routinely question the history of excessive focus on body image and eating disorders in all pregnant women, especially in those with negative body image and high GWG. It is thought that interventions based on the IMB model may contribute to the reduction of morbidity and mortality that can be caused by ON behaviors during pregnancy and to the improvement of maternal and fetal outcomes.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest in the research and writing of this manuscript.

Ethical statement All procedures performed in studies involving human participants were by the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendment or comparable ethical standards.

Informed consent Informed consent was administered to all participants.

References

1. Bratman S (1997) Health Food Junkie. Yoga J 8:42–50
2. Bartrina J (2007) Orthorexia or when a healthy diet becomes an obsession. Arch Latinoam Nutr 57:313–315
3. Mathieu J (2005) What is orthorexia? J Am Diet Assoc 105:1510–1512. https://doi.org/10.1016/j.jada.2005.08.021
4. Koven NS, Abry AW (2015) The clinical basis of orthorexia nervosa: emerging perspectives. Neuropsychiatr Dis Treat 11:385–394. https://doi.org/10.2147/NDT.S61665
5. Lopes R, Melo R, Dias Pereira B (2020) Orthorexia nervosa and comorbid depression successfully treated with mirtazapine: a case report. Eat Weight Disord 25:163–167. https://doi.org/10.1007/s40519-018-0539-5
6. Moroze RM, Dunn TM, Craig Holland J et al (2015) Microthinking about micronutrients: a case of transition from obsessions about healthy eating to near-fatal "orthorexia nervosa" and

proposed diagnostic criteria. Psychosomatics 56:397–403. https://doi.org/10.1016/j.psym.2014.03.003
7. Park SW, Kim JY, Go GJ et al (2011) Orthorexia nervosa with hyponatremia, subcutaneous emphysema, pneumomediastinum, pneumothorax, and pancytopenia. Electrolyte Blood Press 9:32–37. https://doi.org/10.5049/EBP.2011.9.1.32
8. Pieczykolan A, Flis E, Bień A (2017) Eating disorders during pregnancy. Nursing and Public Health 7:223–226. https://doi.org/10.17219/pzp/66326
9. American Psychiatric Association (2013) Diagnostic and Statistical Manual of Mental Disorders (DSM-5). 5th edn. American Psychiatric Association, Arlington, VA. https://www.psychiatry.org/psychiatrists/practice/dsm. Accessed 17 Jan 2021
10. Dunn TM, Bratman S (2016) On orthorexia nervosa: A review of the literature and proposed diagnostic criteria. Eat Behav 21:11–17. https://doi.org/10.1016/j.eatbeh.2015.12.006
11. Dunn TM, Gibbs J, Whitney N, Starosta A (2017) Prevalence of orthorexia nervosa is less than 1%: data from a US sample. Eat Weight Disord 22:185–192. https://doi.org/10.1007/s40519-016-0258-8
12. Oberle CD, De Nadai AS, Madrid LA (2021) Orthorexia Nervosa Inventory (ONI): development and validation of a new measure of orthorexic symptomatology. Eat Weight Disord 26:609–622. https://doi.org/10.1007/s40519-020-00896-6
13. İpkirmaz İB, Saka M (2020) The evaluation of healthy nutrition obsession (Orthorexia Nervosa) and eating attitudes of pregnant women. Başkent Univ Fac Heal Sci J 5:17–30
14. Varga M, Dukay-Szabó S, Túry F, Van Furth EF (2013) Evidence and gaps in the literature on orthorexia nervosa. Eat Weight Disord 18:103–111. https://doi.org/10.1007/s40519-013-0026-y
15. Currin L, Schmidt U, Treasure J, Jick H (2005) Time trends in eating disorder incidence. Br J Psychiatry 186:132–135. https://doi.org/10.1192/bjp.186.2.132
16. Dukay-Szabó S, Varga M, Túry F (2016) Eating disorders and pregnancy - a review of literature. Clin Neurosci 69:299-305. https://doi.org/10.18071/isz.69.0299
17. Abramowitz JS, Nelson CA, Rygwall R, Khandker M (2007) The cognitive mediation of obsessive-compulsive symptoms: A longitudinal study. J Anxiety Disord 21:91–104. https://doi.org/10.1016/j.janxdis.2006.05.003
18. Siriken B, Siriken F, Ünsal C, Çiftci G, (2018) Nutrition and epigenetic. J Harran Univ Fac Vet Med 7:12–18
19. Shin D, Lee KW, Song WO (2016) Pre-Pregnancy weight status is associated with diet quality and nutritional biomarkers during pregnancy. Nutrients 8:1–12. https://doi.org/10.3390/nu8030162
20. Yang S, Peng A, Wei S et al (2015) Pre-pregnancy body mass index, gestational weight gain, and birth weight: A cohort study in China. PLoS ONE 10:1–12. https://doi.org/10.1371/journal.pone.0130101
21. Brytek-Matera A, Gramaglia C, Gambaro E et al (2018) The psychopathology of body image in orthorexia nervosa. J Psychopathol 24:133–140
22. Kadioğlu M, Oskay Ü (2017) The effects of eating disorders on pregnancy and postpartum period. J Women's Heal Nurs 3:40–53
23. dos Santos AM, Benute GRG, dos Santos NO et al (2017) Presence of eating disorders and its relationship to anxiety and depression in pregnant women. Midwifery 51:12–15. https://doi.org/10.1016/j.midw.2017.05.005
24. Fisher JD, Fisher WA (1992) Changing AIDS - risk behavior. Psychol Bull 111:455–474. https://doi.org/10.1037/0033-2909.111.3.455
25. Osborn CY, Rivet Amico K, Fisher WA et al (2010) An information-motivation-behavioral skills analysis of diet and exercise behavior in puerto ricans with diabetes. J Health Psychol 15:1201–1213. https://doi.org/10.1177/1359105310364173
26. Fisher JD, Fisher WA, Misovich SJ et al (1996) Changing AIDS risk behavior: effects of an intervention emphasizing AIDS risk reduction information, motivation, and behavioral skills in a college student population. Health Psychol 15:114–123. https://doi.org/10.1037//0278-6133.15.2.114
27. Daly P, Pace T, Berg J et al (2016) A mindful eating intervention: A theory-guided randomized anti-obesity feasibility study with adolescent Latino females. Complement Ther Med 28:22–28. https://doi.org/10.1016/j.ctim.2016.07.006
28. Sinley RC, Albrecht JA, Author C, State M (2018) Application of the IMB Model to the reported intake of fruits and vegetables of Native American Children. J Health Dispar Res Pract 11:16–30
29. Peyman N, Abdollahi M (2017) Using of information-motivation-behavioral skills model on nutritional behaviors in controlling anemia among girl students. J Res Health 7:736–744. https://doi.org/10.18869/acadpub.jrh.7.2.736
30. Özdamar K (2015) Biostatistics with SPSS, 10th edn. Nisan Bookstore, Eskişehir
31. Swami V, Salem N, Furnham A, Tovée MJ (2008) Initial examination of the validity and reliability of the female photographic figure rating scale for body image assessment. Pers Individ Dif 44:1752–1761. https://doi.org/10.1016/j.paid.2008.02.002
32. Arusoğlu G, Kabakçi E, Köksal G, Kutluay Merdol T (2008) Orthorexia nervosa and adaptation of ORTO-11 into Turkish. Turkish J Psychiatry 19:283–291
33. Bandura A (2006) Guide for Constructing Self-Efficacy Scales. In: Urdan T, Pajares F (eds) Self-Efficacy Beliefs of Adolescents. Information Age Pub, Greenwich, CT, pp 307–337
34. Sevinç S, Argon G (2014) Turkish reliability and validity of self-efficacy to regulate eating habits scale in the cardiac patients. J Ege Univ Nurs Fac 30:19–33
35. Donini LM, Marsili D, Graziani MP et al (2005) Orthorexia nervosa: Validation of a diagnosis questionnaire. Eat Weight Disord 10:e28-32. https://doi.org/10.1007/BF03327537
36. IOM (Institute of Medicine), (2009) Weight gain during pregnancy: reexamining the guidelines. The National Academies Press, Washington (DC)
37. Kumcağiz H, Ersanli E, Murat N (2017) The development of a self-perception of pregnants scale and its psychometric features. J Psychiatr Nurs 8:23–31. https://doi.org/10.14744/phd.2017.12599
38. Kline RRB (2011) Principles and Practice of Structural Equation Modeling, 3rd edn. The Guilford Press, New York
39. Gürbüz S (2019) Structural Equation Modeling with AMOS. Seçkin Publishing, Ankara
40. Easter A, Treasure J, Micali N (2011) Fertility and prenatal attitudes towards pregnancy in women with eating disorders: Results from the Avon Longitudinal Study of Parents and Children. BJOG An Int J Obstet Gynaecol 118:1491–1498. https://doi.org/10.1111/j.1471-0528.2011.03077.x
41. Kominiarek MA, Peaceman AM (2017) Gestational weight gain. Am J Obstet Gynecol 217:642–651. https://doi.org/10.1016/j.ajog.2017.05.040
42. Fisher WA, Fisher JD, Harman J (2003) The information-motivation-behavioral skills model: a general social psychological approach to understanding and promoting health behavior. In: Suls J, Wallston KA (eds) Social Psychological Foundations of Health and Illness. Blackwell Publishing Ltd, Malden, MA, pp 82–106
43. Maupome AL, Muro MÁV, Garduño MLM (2020) Improving food choices when eating with peers: An IMB Model-based weight-loss intervention. Curr Dev Nutr 4:1327. https://doi.org/10.1093/cdn/nzaa059_044
44. Gavgani RM, Poursharifi H, Aliasgarzadeh A (2010) Effectiveness of information-motivation and behavioral skill (IMB) model in improving self-care behaviors & Hba1c measure in adults with type2 diabetes in Iran-Tabriz. Procedia Soc Behav Sci 5:1868–1873. https://doi.org/10.1016/j.sbspro.2010.07.380

45. Tabari NSM, Faramarzi M, Shirvani MA et al (2019) Effect of counseling based on Information-Behavioral Motivation Model on health promoting lifestyle behaviors and psychological well-being in obese and overweight pregnant women: a randomized clinical trial. J Maz Univ Med Sci 29:99–110
46. Khoramabadi M, Dolatian M, Hajian S et al (2015) Effects of education based on health belief model on dietary behaviors of iranian pregnant women. Glob J Health Sci 8:230–239. https://doi.org/10.5539/gjhs.v8n2p230
47. Chitsaz A, Javadi M, Lin C-Y, Pakpour A (2017) The predictors of healthy eating behavior among pregnant women: An application of the Theory of Planned Behavior. Int J Pediatr 5:5897–5905. https://doi.org/10.22038/ijp.2017.25576.2176
48. Jelsma JGM, Van Leeuwen KM, Oostdam N et al (2016) Beliefs, barriers, and preferences of European overweight women to adopt a healthier lifestyle in pregnancy to minimize risk of developing gestational diabetes mellitus: An explorative study. J Pregnancy 2016:1–11. https://doi.org/10.1155/2016/3435791
49. Sharafi SF, Javadi M, Barikani A (2016) Reliability and validity of Short Food Frequency Questionnaire among pregnant females. Biotechnol Heal Sci 3:e34608. https://doi.org/10.17795/bhs-34608
50. O'Brien OA, Lindsay KL, McCarthy M et al (2017) Influences on the food choices and physical activity behaviours of overweight and obese pregnant women: A qualitative study. Midwifery 47:28–35. https://doi.org/10.1016/j.midw.2017.02.003
51. de Jersey SJ, Mallan K, Callaway L et al (2017) A cross-sectional comparison of predisposing, reinforcing, and enabling factors for lifestyle health behaviors and weight gain in healthy and overweight pregnant women. Matern Child Health J 21:626–635. https://doi.org/10.1007/s10995-016-2148-0
52. Scott J, Oxlad M, Dodd J et al (2020) Creating healthy change in the preconception period for women with overweight or obesity: A qualitative study using the Information – Motivation – Behavioural Skills Model. J Clin Med 9:1–20. https://doi.org/10.3390/jcm9103351
53. Brytek-Matera A (2012) Orthorexia nervosa - An eating disorder, obsessive-compulsive disorder or disturbed eating habit? Arch Psychiatry Psychother 1:55–69
54. Watson HJ, Zerwas S, Torgersen L et al (2017) Maternal eating disorders and perinatal outcomes: A three-generation study in the Norwegian mother and child cohort study. J Abnorm Psychol 126:552–564. https://doi.org/10.1037/abn0000241
55. Mandera A, Pawlikowska A, Szuster EM et al (2019) The pregorexia - anorexia during the pregnancy. J Educ Heal Sport 9:137–144. https://doi.org/10.5281/zenodo.2718477