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Association between sociodemographic, obstetric, and lifestyle factors among Hungarian pregnant women—A cross-sectional study

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Abstract

Aim: To learn the association between sociodemographic and obstetric factors and lifestyle characteristics of pregnant women, and to identify factors that can influence pregnant women's health consciousness.

Methods: A cross-sectional, questionnaire-based study was performed among women who gave birth in Szeged in 2014–2015. Data collection was based on a self-administered questionnaire and health documentations. Overall maternal health promoting behavior (MHPB) index was defined by summarizing the scores obtained from diet, physical activity, smoking status, and alcohol consumption.

Results: The final analysis included 1548 mothers; 41.3% ($n = 602$) of the sample had healthy diet, 9.0% ($n = 134$) were physically active and attended special pregnancy exercise classes, 84.4% ($n = 1279$) did not drink alcohol, and 93.5% ($n = 1447$) were nonsmokers. Regarding the MHPB index, 0.8% ($n = 11$) of the women reached the maximum score (20), while the average was 14.8 (SD = 2.58). Advanced maternal age ($p < 0.001$), having a spouse or partner ($p < 0.001$), higher educational level ($p < 0.001$), planned pregnancy ($p < 0.001$), and early visit at pregnancy care ($p = 0.046$) were significantly associated with higher MHPB index.

Conclusion: The lifestyle of pregnant women can have a great impact on the developing fetus, either in a positive or negative way. In order to evaluate maternal lifestyle, overall health behavior should be considered. Lifestyle of the included women was not satisfactory, an improvement in health consciousness is needed at every social level; however, the differences between the various social classes may suggest the importance of further promotion and improvement of pregnancy planning and pregnancy care among younger and lower educated women.

Key words: health behavior, health literacy, healthy lifestyle, maternal behavior, pregnancy.

Introduction

Promotion of healthy life start is one of the priorities of the World Health Organization's (WHO) Health 2020 policy, and it plays an important role in other WHO programs (e.g., Life Course Approach to Health) as well. They emphasize that promotion of health should start before conception, as maternal lifestyle before and during pregnancy is as important as sociodemographic factors and previous health status

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of the mother. Moreover, there is a strong suggestion that healthy lifestyle and social status of the mother cannot be strictly separated,[1,2] and other factors such as involvement of family members play an important role as well.[3]

Demography is globally changing, and it affects many of the nonmodifiable factors of pregnancy outcome. Maternal age is relevant because besides the fact that the birth rates are globally decreasing, the average maternal age at first child's birth is increasing; actually, in developed countries it is over 30 years of age, and it is gradually growing. In case of age-specific fertility rates, a shift can also be observed: while among the 15–19 and 20–24 age groups, it drops; in groups over 30, it shows an increasing tendency.[4] In Hungary, the situation is the same: in 2018, the average maternal age at first child's birth was 28.8 years, and during the last decades, age-specific fertility rate of women under 30 dropped by 30%, whereas in women over 30, it tripled.[5] Advanced maternal age comes with higher health risks for the fetus and the pregnant woman as well. Lean et al.[6] have investigated the correlation between fetal adverse events and advanced maternal age. Maternal age was significantly associated with stillbirth, fetal growth restriction, infant death, and severe infant health conditions. Sheen et al.[7] have found that advanced maternal age is significantly correlated with more severe maternal complications during delivery. Moreover, maternal education level is also an important nonmodifiable sociodemographic determinant of pregnancy outcome. Lower education may be associated with poorer health literacy and health behavior, which can affect the lifestyle, and therefore the maternal and fetal/newborn health. However, there are studies which have described that more educated women reported inferior lifestyle status compared to women from the general population.[8]

Diet, physical activity, alcohol consumption, and smoking status are the four most important lifestyle factors, which can positively or negatively affect fetal health. The overall effect of maternal diet[9,10] and the effect of specific diets[11,12] during pregnancy have been widely investigated. Gestational diabetes mellitus, hypertension, depressive symptoms during pregnancy, preterm birth, small for gestational age show significant correlation with maternal diet during pregnancy.[9] Besides pregnancy outcomes and fetal health, maternal diet can also affect the child's later health; cognitive functions, development of allergic diseases, and diabetes mellitus can also be correlated with maternal eating patterns.[13,14] Dietary supplementation may be considered in order to achieve higher micronutrient intake levels during pregnancy. Daily folic acid is recommended to prevent neural tube defects.[15] Additionally, daily folic acid and iron supplementation is suggested to prevent low birth weight, maternal anemia, and iron deficiency,[16] and daily calcium intake to lower the risk of preeclampsia.[17] However, recommendations about physical activity during pregnancy are equivocal,[18] though physical activity can prevent excessive gestational weight gain, gestational diabetes mellitus, preeclampsia, and several adverse neonatal outcomes.[19] Smoking during pregnancy can seriously affect the development and future health of the child; it can be the causative agent of growth restriction and congenital disorders,[20] hyperactivity, cognitive dysfunctions,[21] and childhood obesity as well.[22] Alcohol consumption during pregnancy can affect fetal growth,[23] and it is associated with several socioeconomic factors, such as income and educational level; however, the evidence is not clearly stated.[24]

These lifestyle factors have been widely investigated in several studies separately; however, the overall lifestyle and health behavior are often more informative and should be considered together.

The aim of this study was to determine the association between sociodemographic and obstetric factors, and lifestyle characteristics of pregnant women who delivered in Szeged, Hungary; moreover, to identify the factors that can influence pregnant women's health consciousness.

Methods

Study design and participants

A cross-sectional, questionnaire-based study was performed among women delivering at the Department of Obstetrics and Gynecology, University of Szeged in 2014–2015. Participation was offered to each adult (>18 years) woman who delivered her baby at the clinic during the study period. Altogether 1669 women were included into the study, who filled out the questionnaire 1 or 2 days after delivery. Multiple pregnancies were excluded from the present analysis. Finally, due to multiple pregnancies ($n = 49$) and missing data, 1548 mothers were involved into the final analysis.

Study variables

Data collection was based on a self-administered questionnaire and the health documentation of mothers and newborns. The self-administered questionnaire

contained general, sociodemographic, lifestyle, conception, and previous and current pregnancy-related questions. Health documentation comprised the mothers' health characteristics during pregnancy and right after delivery; data about delivery type and complications; and health characteristics of the newborn.

Maternal sociodemographic status included maternal age, education level (three categories: low [primary education or lower, vocational school], medium [secondary education], and high [university] level), type of residence and partnership status (single or in partnership). Additional questions were pregnancy planning, number of previous pregnancies, previous miscarriage, preterm delivery, and congenital disorder. The number of pregnancy week at first pregnancy care attendance was also asked, and three categories were formed: early visit (week 0–12), midterm visit (week 13–28) and late visit (week 29 or later). The self-reported use of folic acid, before and during pregnancy, was also measured.

Lifestyle-related questions included diet, physical activity, smoking, and alcohol consumption. The questionnaire and its evaluation protocol were formulated according national and international recommendations. Healthy diet was considered the most significant lifestyle factor because according to previous studies, it is the most important component of adherence to health.[25] Given that physical activity may be contradicted in case of endangered pregnancies it is weighing less. As smoking and alcohol consumption both have undoubtable consequences on maternal and fetal health, these factors were scored strictly with higher points. Dietary habits of mothers were measured by the frequency of vegetable, fruit, fish, fast food, salty snack, sweets, and soft drink consumption. Physical activity was evaluated by a question asking whether the mother was regularly physically active or not during the current pregnancy, without any specification of the exercise type. Smoking status was divided into two subgroups: smokers and nonsmokers (never smokers and ex-smokers). Alcohol consumption was divided into "no alcohol consumption" and "alcohol consumption during pregnancy" groups. First, maternal diet, physical activity, smoking, and alcohol consumption during pregnancy were expressed in diet, physical activity, alcohol consumption, and smoking scores. The dietary score included vegetable, fruit, fish, fast food, salty snack, sweets, and soft drink consumption. The physical activity score included physical activity during pregnancy and attendance at special pregnancy exercise classes. Smoking and alcohol consumption were categorized as "yes" or "no." The given points of each field and the particular scores could be seen in Table 1. The components of "healthy lifestyle" were defined according to the following: minimum 10 points in diet field were considered "healthy diet"; minimum 2 points in physical activity field, "regular physical activity"; and 3–3 points in smoking and alcohol consumption fields were considered as "non-smoking" and "no alcohol consumption."

In order to assess the overall adherence to healthy lifestyle of the included pregnant women, the maternal health promoting behavior (MHPB) index was formulated. The MHPB index was calculated by summarizing the scores obtained from diet, physical activity, smoking status, and alcohol consumption. The scale ranged between 0 to 20, where 0 means the poorest and 20 the highest level of health promoting behavior. Higher scores mean healthier lifestyle.

Birth weight was examined as fetal outcome in connection with the MHPB scores. Less than 2500 g was considered low birth weight (LBW); 2500–3999 g normal birth weight (NBW); and ≥4000 g high birth weight (HBW).

Statistical analysis

Characteristics of the study population were evaluated by descriptive statistics. The association between the separate components of healthy lifestyle (diet and physical activity) and sociodemographic characteristics and obstetric factors were analyzed with the chi-square test. The Kolmogorov–Smirnov test was used to test the normality of the MHPB score as a continuous variable. Because of non-normality, the association between the MHPB scores and sociodemographic and obstetric characteristics was analyzed by the non-parametric Kruskal–Wallis test. The level of statistical significance was set at $p < 0.05$.

Statistical analysis was performed by using IBM SPSS 26.0 program.

Ethics statement

The study protocol was approved by the Regional and Institutional Review Board of Human Investigation in the University of Szeged, Hungary (number: 3328). Participation was voluntary, and a written informed consent was obtained from each participant of the study.

Results

The sociodemographic and obstetric characteristics of the study population are shown in Table 2. The

TABLE 1 Given points of each lifestyle field of maternal health promoting behavior index

Lifestyle factor	Given points
Dietary habits	
Vegetable consumption	
Daily	2
Weekly	1
Less frequently	0
Fruit consumption	
Daily	2
Weekly	1
Less frequently	0
Fish consumption	
Weekly	1
Less frequently	0
Fast foods	
Monthly or never	1
More frequently	0
Salty snacks	
Monthly or never	2
Weekly	1
Daily	0
Sweets	
Monthly or never	2
Weekly	1
Daily	0
Soft drinks	
Monthly or never	2
Weekly	1
Daily	0
Maximum total diet score	12
Physical activity	
General physical activity	
Yes	1
No	0
Pregnancy exercise	
Yes	1
No	0
Maximum total physical activity score	2
Smoking during pregnancy	
No	3
Yes	0
Maximum total smoking score	3
Alcohol consumption during pregnancy	
No	3
Yes	0
Maximum total alcohol score	3
Maximum overall lifestyle score	20

frequency of the different components of lifestyle is presented in Table 3. Assessing the points of dietary habits, 602 (41.3%) of the included women followed a healthy diet, 134 (9.0%) were physically active and attended special pregnancy exercise classes, 1279 (84.4%) did not drink alcohol, and 1447 (93.5%) did not smoke during the present pregnancy.

The association between the different components of healthy lifestyle and the mothers' characteristics are shown in Table 4. Healthy diet was significantly associated with older age ($p < 0.001$), higher educational level (<0.001), nonsingle partnership status ($p = 0.013$), planned pregnancy ($p = 0.023$), diagnosis of gestational diabetes mellitus (<0.001), negative diagnosis of anemia ($p = 0.049$), and taking folic acid before and during pregnancy ($p = 0.021$ and $p < 0.001$, respectively). Regular physical activity was significantly associated with higher maternal age ($p = 0.001$), higher educational level (<0.001), living in county town (<0.001), planned pregnancy ($p = 0.009$), first pregnancy (<0.001), and folic acid before and during pregnancy ($p < 0.001$ and $p = 0.003$, respectively). Nonsmoking behavior was significantly associated with higher maternal age ($p < 0.001$), higher educational level ($p < 0.001$), nonsingle partnership status ($p < 0.001$), living in nonrural area ($p = 0.040$), planned pregnancy ($p < 0.001$), first pregnancy ($p < 0.001$), diagnosis of high blood pressure ($p = 0.027$), and folic acid intake before and during pregnancy ($p < 0.001$ and $p < 0.001$, respectively). No alcohol consumption was significantly associated with younger maternal age ($p = 0.006$), lower educational level ($p < 0.001$), living in a town or village ($p < 0.001$), earlier presentation at pregnancy care ($p = 0.021$), diagnosis of gestational diabetes mellitus ($p = 0.035$), and no folic-acid intake during pregnancy ($p = 0.020$). Our results show that planned pregnancy had a positive impact on all four investigated fields; however, early visit at pregnancy care had no effect on maternal health behavior. More conscious dietary habits were observed in case of gestational diabetes; however, those who had high blood pressure or anemia tended to follow a more unhealthy diet. Mothers who obtained a high dietary score were more likely to consume folic acid; moreover, pregnancy vitamin and folic acid consumption were associated with physical activity and nonsmoking behavior as well.

Figure 1 shows the distribution of overall MHPB index: 11 (0.8%) women reached the maximum score, while the average result was 14.8 (SD = 2.58), and the median was 15.00.[4–20] A threshold can be established at 15 points: at and above 15 points there is no need for intervention, the maintenance of good lifestyle habits should be strengthened; below 15 points the adherence to healthy lifestyle is poor, information and further education of the mother is needed. Additionally, 0 points in any lifestyle field (i.e., dietary habits, physical activity, smoking, alcohol consumption)

TABLE 2 Main characteristics of study population

Characteristics	*n*	%
Sociodemographic characteristics		
Age group (years)		
−24	147	9.5
25–34	949	61.3
35–	452	29.2
Educational level		
Low	273	17.7
Medium	506	32.8
High	763	49.5
Partnership status		
Single	147	10.3
In partnership	1286	89.7
Residence		
County town	920	60.0
Town	270	17.6
Village	343	22.4
Obstetric characteristics		
Planned pregnancy		
Yes	1306	84.6
No	237	15.4
First pregnancy		
Yes	751	48.7
No	791	51.3
Presence at pregnancy care		
Early (0–12)	1379	91.3
Midterm (13–28)	126	8.4
Late (29–)	5	0.3
Previous miscarriage		
Yes	278	18.1
No	1262	81.9
Previous preterm delivery		
Yes	62	8.1
No	708	91.9
Previous congenital disorder		
Yes	29	3.8
No	740	96.2
High blood pressure		
Yes	118	7.6
No	1430	92.4
Gestational diabetes mellitus		
Yes	156	10.1
No	1392	89.9
Anemia		
Yes	228	14.7
No	1320	85.3
Folic acid before pregnancy		
Yes	519	34.1
No	1004	65.9
Folic acid during pregnancy		
Yes	1047	70.4
No	440	29.6

should be considered as a critical situation, and smoking or alcohol consumption should not be ignored even if the overall score is above 15 points.

TABLE 3 Frequency of obtained lifestyle scores among study population

Lifestyle factor	*n*	%
Vegetable consumption		
Daily	955	63.8
Weekly	472	31.5
Less frequently	71	4.7
Fruit consumption		
Daily	1178	78.5
Weekly	293	19.5
Less frequently	29	1.9
Fish consumption		
Weekly	584	39.2
Less frequently	905	60.8
Fast foods		
Monthly or never	1270	84.8
More frequently	228	15.2
Salty snacks		
Monthly or never	1067	71.7
Weekly	360	24.2
Daily	61	4.1
Sweets		
Monthly or never	296	19.7
Weekly	815	54.3
Daily	390	26.0
Soft drinks		
Monthly or never	993	66.7
Weekly	387	26.0
Daily	109	7.3
Physical activity		
Yes	755	50.5
No	741	49.5
Pregnancy exercise		
Yes	174	11.4
No	1349	88.6
Smoking during pregnancy		
No	1447	93.5
Yes	101	6.5
Alcohol consumption during pregnancy		
No	1279	84.4
Yes	236	15.6

Table 5 presents the association between the overall MHPB scores and maternal characteristics. Advanced maternal age ($p < 0.001$), nonsingle partnership status ($p < 0.001$), higher educational level ($p < 0.001$), planned pregnancy ($p < 0.001$), and early visit at pregnancy care ($p = 0.046$) were significantly associated with higher MHPB index. Type of residence, first pregnancy, previous miscarriage, preterm delivery, or congenital diseases were not associated with the health promoting behavior of pregnant women.

Maternal high blood pressure during pregnancy was not associated with the overall lifestyle score; however, a strong correlation was found between

TABLE 4 Association between the separate field of health behavior and population characteristics (chi-square test)

Characteristics	Healthy diet		Regular physical activity		Nonsmoking		No alcohol consumption	
	n (%)	*p*	*n* (%)	*p*	*n* (%)	*p*	*n* (%)	*p*
Sociodemographic characteristics								
Age group		**<0.001**		**0.001**		**<0.001**		**0.006**
−24	27 (20.6)		2 (1.4)		121 (82.3)		132 (93.6)	
25–34	364 (40.6)		99 (10.9)		893 (94.1)		775 (83.2)	
35–	211 (49.0)		33 (7.7)		433 (95.8)		372 (84.2)	
Educational level		**<0.001**		**<0.001**		**<0.001**		**<0.001**
Low	50 (21.7)		3 (1.2)		209 (76.6)		239 (92.6)	
Medium	178 (37.2)		25 (5.2)		473 (93.5)		430 (86.7)	
High	374 (50.1)		106 (14.2)		759 (99.5)		605 (80.1)	
Partnership status		**0.013**		0.067		**<0.001**		0.414
Single	47 (31.8)		8 (5.1)		137 (82.5)		142 (86.6)	
In partnership	555 (42.4)		126 (9.5)		1309 (94.9)		1135 (84.1)	
Residence		0.125		**<0.001**		**0.040**		**<0.001**
County town	374 (42.7)		107 (12.0)		866 (94.1)		732 (81.3)	
Town	107 (41.8)		15 (5.8)		257 (95.2)		237 (89.1)	
Village	114 (36.2)		11 (3.5)		311 (90.7)		300 (89.6)	
Obstetric characteristics								
Planned pregnancy		**0.023**		**0.009**		**<0.001**		0.964
Yes	527 (42.5)		124 (9.9)		1245 (95.3)		1082 (84.5)	
No	74 (34.3)		10 (4.4)		197 (83.1)		194 (84.3)	
First pregnancy		0.297		**<0.001**		**0.034**		0.519
Yes	283 (39.9)		100 (13.8)		713 (94.9)		626 (85.1)	
No	317 (42.6)		34 (4.5)		730 (92.3)		649 (83.9)	
Presence at pregnancy care		0.230		0.644		0.163		**0.021**
Early (0–12)	544 (41.7)		120 (9.1)		1294 (93.8)		1133 (84.0)	
Midterm (13–28)	47 (40.2)		13 (10.7)		113 (89.7)		113 (91.9)	
Late (28–)	0 (0.0)		0 (0.0)		5 (100)		3 (60.0)	
Previous miscarriage		0.051		0.813		0.123		0.871
Yes	123 (46.6)		23 (8.6)		254 (91.4)		232 (84.7)	
No	476 (40.1)		110 (9.1)		1185 (93.9)		1040 (84.3)	
Previous preterm delivery		0.498		0.672		0.715		0.731
Yes	25 (47.2)		2 (3.4)		56 (90.3)		52 (85.2)	
No	284 (42.4)		31 (4.6)		649 (91.7)		579 (83.5)	
Previous congenital disorder		0.824		0.244		0.688		0.066
Yes	11 (40.7)		0 (0)		26 (89.7)		27 (96.4)	
No	299 (42.9)		34 (4.8)		679 (91.8)		605 (83.4)	
High blood pressure		0.107		0.334		**0.027**		0.060
Yes	37 (33.9)		7 (6.5)		116 (98.3)		105 (90.5)	
No	565 (41.9)		127 (9.2)		1331 (93.1)		1174 (83.9)	
Gestational diabetes mellitus		**<0.001**		0.898		0.687		**0.035**
Yes	100 (67.1)		14 (9.3)		147 (94.2)		139 (90.3)	
No	502 (38.3)		120 (9.0)		1300 (93.4)		1140 (83.8)	
Anemia		**0.049**		0.063		0.404		0.106
Yes	76 (35.2)		27 (12.4)		216 (94.7)		181 (80.8)	
No	526 (42.3)		107 (8.5)		1231 (93.3)		1098 (85.1)	
Folic acid before pregnancy		**0.021**		**<0.001**		**<0.001**		0.553
Yes	226 (45.5)		64 (12.9)		505 (97.3)		427 (83.9)	
No	370 (39.2)		67 (6.9)		919 (91.5)		836 (84.5)	
Folic acid during pregnancy		**<0.001**		**0.003**		**<0.001**		**0.020**
Yes	451 (44.5)		108 (10.7)		1005 (96.0)		854 (82.6)	
No	139 (34.4)		24 (5.6)		390 (88.6)		377 (87.5)	

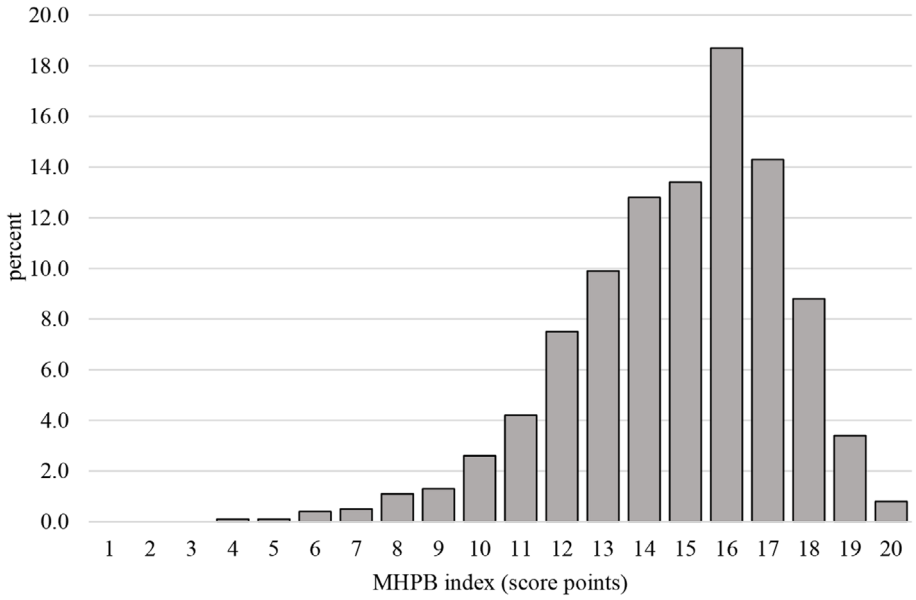

FIGURE 1 Maternal health promoting behavior (MHPB) index distribution ($N = 1391$). Obtained MHPB scores are shown on the horizontal axis, and the ratio (%) of pregnant women who obtained the certain scores are indicated on the vertical axis.

MHPB index and gestational diabetes mellitus ($p < 0.001$). Higher MHPB points were associated with gestational diabetes mellitus, which may be explained with the more conscious health behavior of diagnosed mothers. Anemia during pregnancy was also correlated with MHPB points: higher scores were associated with a negative diagnosis of anemia ($p = 0.036$); however, no other correlation was found between maternal disease burden and MHPB scores.

Folic acid intake before and during pregnancy was strongly correlated with the MHPB index: mothers who took some kind of folic acid before or during pregnancy reached significantly higher overall MHPB points ($p < 0.001$ and $p < 0.001$, respectively).

A significant correlation was found between birth weight of the newborn and the obtained maternal MHPB scores ($p = 0.003$). Significantly higher scores were obtained in women delivering a newborn with NBW compared to mothers who delivered LBW babies ($p = 0.006$). However, no significant correlation was found in case of HBW. The average MHPB score was 13.855 for LBW, 14.881 for NBW, and 14.580 for HBW.

Figure 2 demonstrates the associations among the investigated variables and MHPB index, implying that educational level and age group were proved to be the factors associated with the majority of the investigated variables considering sociodemographic characteristics. Furthermore, folic acid intake during pregnancy related to the group of obstetric characteristics.

Discussion

The aim of the study was to identify the socioeconomic and obstetric factors that can influence pregnant women's lifestyle (diet, physical activity, smoking, and alcohol consumption). Our results showed that maternal age, educational level, place of residence as sociodemographic factors, and planning of pregnancy and the use of folic acid as obstetric factors were significantly associated with healthier lifestyle components. Additionally, the answers were quantified by the MHPB index as the complex analysis of different lifestyle components. The overall MHPB index was strongly correlated with advanced maternal age, higher educational level, and planned pregnancy.

Our results are in line with previous studies that have suggested that maternal dietary behavior would be strongly connected with the socioeconomic status. Nonmodifiable factors not only directly, but also indirectly can affect maternal and fetal health via effects on maternal health consciousness and literacy. Jardí et al.[26] have investigated the adherence to Mediterranean diet of pregnant women, whereas Wesolowska et al.[27] have examined the correlation between educational and socioeconomic status of women, and quality of diet during pregnancy. Their results are similar to ours, according to which a healthier diet was observed in case of higher educational level, higher social status, and advanced maternal age. However,

TABLE 5 Overall MHPB scores and maternal characteristics (Kruskal–Wallis nonparametric test)

Characteristics	MHPB score			*p*-Value
	Mean (SD)	Minimum	Maximum	
Sociodemographic characteristics				
Age group (years)				**<0.001**
–24	13.38 (2.98)	5	20	
25–34	14.83 (2.57)	4	20	
35–	15.21 (2.31)	7	20	
Educational level				**<0.001**
Low	13.18 (3.13)	4	19	
Medium	14.58 (2.51)	6	20	
High	15.42 (2.20)	8	20	
Partnership status				**<0.001**
Single	13.86 (3.12)	5	20	
In partnership	14.91 (2.49)	4	20	
Residence				0.441
County town	14.87 (2.61)	5	20	
Town	14.78 (2.55)	4	20	
Village	14.66 (2.49)	7	20	
Obstetric characteristics				
Planned pregnancy				**<0.001**
Yes	14.96 (2.497)	4	20	
No	13.92 (2.90)	5	20	
First pregnancy				0.096
Yes	14.90 (2.65)	5	20	
No	14.71 (2.52)	4	20	
Presence at pregnancy care				**0.046**
Early (0–12)	14.84 (2.54)	4	20	
Midterm (13–28)	14.73 (2.96)	7	20	
Late (29–)	11.75 (1.50)	10	13	
Previous miscarriage				0.249
Yes	14.92 (2.64)	5	20	
No	14.77 (2.58)	4	20	
Previous preterm delivery				0.666
Yes	14.70 (2.56)	4	20	
No	14.596 (2.38)	8	19	
Previous congenital disorder				0.427
Yes	15.04 (2.68)	7	19	
No	14.70 (2.54)	4	20	
High blood pressure				0.877
Yes	14.94 (2.06)	10	19	
No	14.79 (2.62)	4	20	
Gestational diabetes mellitus				**<0.001**
Yes	16.13 (2.25)	6	20	
No	14.66 (2.58)	4	20	
Anemia				**0.036**
Yes	14.51 (2.64)	6	20	
No	14.86 (2.57)	4	20	
Folic acid before pregnancy				**<0.001**
Yes	15.23 (2.38)	7	20	
No	14.62 (2.63)	4	20	
Folic acid during pregnancy				**<0.001**
Yes	15.06 (2.45)	6	20	
No	14.24 (2.77)	4	20	

Abbreviation: MHPB, maternal health promoting behavior.

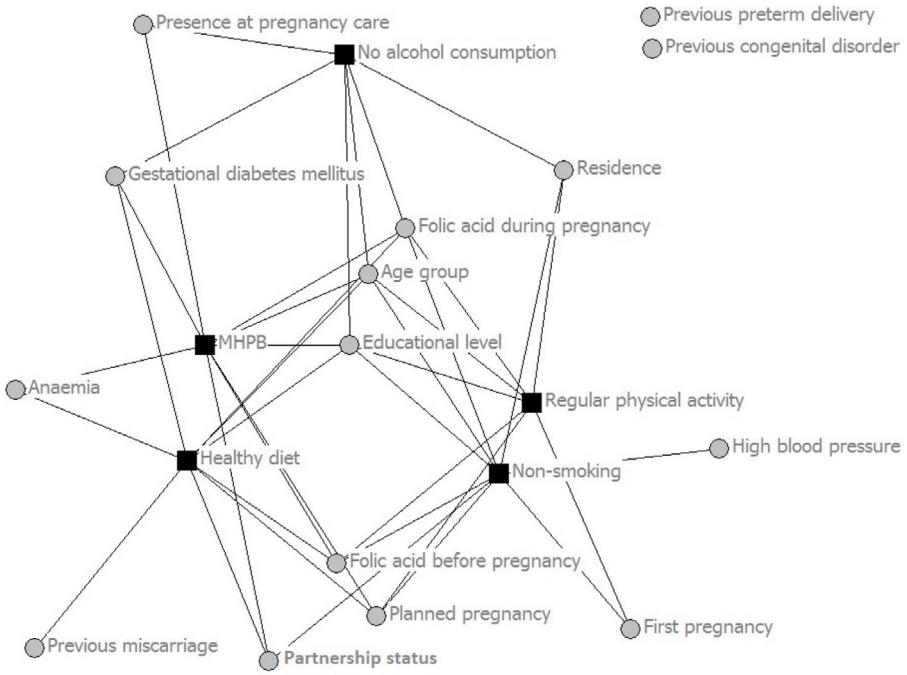

FIGURE 2 Associations among the investigated variables and maternal health promoting behavior (MHPB) index. The figure maps the pattern of relations among the variables investigated in the paper in order to offer a summarizing overview. Squares show the lifestyle factors used for forming the MHPB index, and circles show the analyzed characteristics. The position of the variables illustrates the number of connections: the elements displayed in the central part of the structure have more relations with other indices. Accordingly, it can be said in this sense, that some sociodemographic characteristics (education level, age-group) and folic acid during pregnancy prove to be variables correlated with multiple other indices. In contrast, the factors of previous preterm delivery and previous congenital disorder are not related to any of the indices.

maternal advanced age means a higher health risk; some investigations suggest that advanced age is associated with higher health literacy level, and more health-conscious lifestyle and behavior. Advanced age women tend to consume less unhealthy snacks and drinks during pregnancy compared with younger mothers.[28] Nonetheless, compulsory genetic pregnancy screenings over 35 years can also lower the health risks.[29] Our results show that advanced maternal age is associated with the examined lifestyle fields, except for alcohol consumption during pregnancy. Mothers 25–34 years of age with higher educational level, in nonsingle partnership, living in county towns showed more frequent physical activity. The overall lifestyle score was also in connection with advanced maternal age and higher educational level. According to Barrett and Wellings,[30] pregnancy planning plays a crucial role in the health behavior of the mother. The primary scope of the MHPB index was not to measure the risk, but the adherence to healthy lifestyle, which is well reflected in the index, as it shows the classical correlations with age, education and marital status. The index was formulated by considering the most important lifestyle factors during pregnancy. The questions were composed by professionals, using recent evidences of lifestyle medicine, therefore the face validity of MHPB index is suggested. Additionally, significant correlation was found assessing the connection between the separate lifestyle factors (i.e., healthy diet, physical activity, nonsmoking, no alcohol consumption) and the overall index. Considering obstetric factors, planned pregnancy may contribute to a more conscious lifestyle during the preconception and childbearing period, therefore improving maternal and fetal health status. Planned pregnancy was associated with healthy diet, regular physical activity, nonsmoking behavior, and higher MHPB overall scores.

The lifestyle of mothers during pregnancy can strongly determine both their health and their infant's

health. Not only healthy diet, but physical activity is also an important component of the definition of healthy lifestyle. However, during pregnancy, it should be considered with limitations because of the contradicting evidence, and considering pregnancy as a specific health condition. Besides healthy diet and physical activity, abstaining from smoking and alcohol consumption is also an important criterion of appropriate health behavior, not only for a pregnant woman. From the point of prevention, the fulfillment of the four health behavior components is the best solution.

This study had some limitations. The participation in the study was offered to all eligible women, but the final decision about the enrolment was given by the participants. The lifestyle characteristics during pregnancy were collected after the delivery. The retrospective and self-administered questionnaire-based form of the study could influence the answers; this bias can originate from the selective memory, or it is possible that respondents reported more positive behaviors during pregnancy because of social expectations/prejudice. Although the study was run in a single institution, this institute has a regional responsibility, which increases the generalizability of our results. Data were obtained in 2014 and 2015, therefore it would not completely represent the present situation; however, the examined variables were mostly variables, which does not show significant changes at population level over the course of few years. Additionally, there were no central or local healthy lifestyle promoting programs implemented for pregnant women, which could radically change the adherence to healthy lifestyle.

Despite these limitations, the study provides a complex analysis on the behavior of pregnant women in Hungary.

In conclusion, our study revealed that the lifestyle of the included women was not satisfactory, and an improvement in health consciousness is needed in every social level. Nonetheless, the differences between the various social classes may suggest the importance and further promotion and improvement of pregnancy planning and pregnancy care among younger and lower educated women. Dietary and physical activity recommendations should be improved in case of younger and lower educated mothers. Precise suggestions are needed for the quality, quantity, and frequency of recommended food, preferably considering the preferences of the mother. Exact suggestions are needed for physical activity as well, considering the capability and possible health consequences of the pregnant woman. Professional consulting regarding healthy lifestyle should be incorporated into the regular pregnancy care sessions by giving precise information about the recommended lifestyle changes. Locally organized pregnancy exercise classes, within the pregnancy care sessions, would help mothers prepare their body for childbirth. Listing the possible positive and negative effects of the lifestyle factors is also needed in order to improve adherence to healthy lifestyle.

The introduced MHPB index and the formulated short questionnaire could be used as a simple measuring tool to assess the overall adherence to healthy lifestyle of pregnant women, as it only needs to answer a few, lifestyle-based questions. However, further studies are needed in order to establish the everyday use of MHPB index.

Author contributions

Evelin Polanek: conceptualization, analysis and interpretation of data, writing original draft; Adrienn Karai: interpretation of data, writing original draft; Regina Molnár: conceptualization, methodology; Gábor Németh: supervision, writing review and editing; Hajnalka Orvos: conceptualization, investigation; Péter Balogh: statistical analysis; Edit Paulik: conceptualization, investigation, writing review and editing. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors have no conflict of interest to declare.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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