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Research Article

The nutrition and life-style of mothers from industrial and nonindustrial regions related to their economic situation

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Abstract

Aim: The study analyzed the nutrition and lifestyle of mothers related to air pollution in industrial and non-industrial regions, taking into account the economic situation of households.

Methods: The respondents were a deliberate sample of mothers from two regions of the Czech Republic – districts of Ceske Budejovice (CB, N=376) and Karvina (KA, N=449). Selected districts were chosen for their difference in the air pollution, with CB being one of the least polluted and KA one of the most polluted regions/districts in the Czech Republic. Data were collected in maternity hospitals in the years 2019 and 2020.

Results: The majority of respondents (98.5%) described their economic situation at least as average. They also consumed daily at least one hot meal. In Karvina mothers more often eat fish, poultry, legumes and also sweet meals and fried food than in Ceske Budejovice, where are more often consumed dairy products. Information about health risk are important for change of their habits.

Conclusion: Most mothers in our study subjectively evaluated their economic situation as moderately good in both regions. Better economic situation was correlated with healthy nutrition, including higher consumption of fruits and vegetables, wholegrain bread, beef and fish and lower consumption of sweet drinks and produced meats. Notably the consumption of fruits and vegetables in the industrial region has risen in comparison with previous data, which is an improvement promising a better starting position for the new generation.

Introduction

A mother's diet during pregnancy as well as before pregnancy is very important for the right course of pregnancy, especially for the fetus's development. Poor nutrition is the risk factor for delayed fetus development, low birth weight, and other risks, which may be later related to diseases in child age, but also in adulthood [1].

Worse eating habits are seen in adolescent pregnant women, than in those who became pregnant in adulthood. The reason may be also their economic situation [1].

The correct nutrition in the course of pregnancy is the prevention of gestation diabetes mellitus, early delivery, as

well as difficulties related to overweight and obesity. Therefore Marshall, et al. [1] recommend a diet rich in vegetables, fruits, whole grain bread, nuts, legumes, fish and oils with high content of unsaturated fatty acids, dietary fibres.

Arabin and Stupin [2] mentioned that 50% deaths of mothers in UK in the period 2003 – 2005 was related to overweight or obesity. Obesity before pregnancy increased birth defects in children. They postulate, that before pregnancy women should be healthy, which means normal BMI, balanced diet and regular physical activity.

Pregnancy outcome may be also related to air pollution. For our study we selected two districts: highly polluted district



of Karvina in the industrial region in Northern Moravia, and control district Ceske Budejovice (CB). Previous study observed in Karvina vs. CB higher concentrations of polycyclic aromatic hydrocarbons (PAHs) in human breast milk [3]. Pavlikova, et al. [4] in those districts analyzed the quality of diet in pregnant mothers. Fruits intake and vegetables intake were significantly lower in Karvina than in CB.

Therefore we hypothesized that diet and life style of mothers in those two districts may be also affected by their economic situation.

Methods

The respondents were a deliberate sample of mothers from two regions of the Czech Republic – districts of Ceske Budejovice (CB; n=376) (South Bohemian region) and Karvina (KA; n=449) (Moravian-Silesian Region). Selected districts were chosen for their difference in the air pollution, with CB being one of the least polluted and Karvina one of the most polluted regions in the Czech Republic [5]. The respondents were approached directly in the maternity wards in the Ceske Budejovice Hospital, Department of Obstetrics and Gynecology and Department of Neonatology, and in the Karvina Hospital, Department of Obstetrics and Gynecology and Department of Neonatology. They were informed about the goal of the research and were given the right to not to take part in it. They were included to the study when they signed the informed consent. The data remained strictly confidential and anonymous. The survey was administered by trained interviewers in the years 2019 and 2020.

The study was approved by the Ethical Committee of Ostrava University as well as the Hospital in Ceske Budejovice and Hospital in Karvina-Raj.

Among the studied lifestyle factors were the eating habits, which were characterized by the questions on the frequency of consumption of various types of food, hot meal, and the preferred types of meal preparation. The frequency of two unhealthy behaviors was also investigated – smoking and alcohol consumption.

The univariate statistics included frequencies, mean and standard deviation or median and interquartile range. The two districts were compared by several statistical methods, depending on the data type: chi-square test (or Fisher's exact test, where appropriate), nonparametric Mann-Whitney test, and nonparametric correlation (Spearman's rho). Factor analysis was used to: 1) extract a univariate solution out of three variables describing the economic situation (ES, a subjective overall evaluation of ES as below average, average, and above average; frequency of money shortage, and problems with paying the bills on a 6-point scale from never to always), 2) extract a simplified picture of consumption of 16 different food groups (see below). All analyses were carried out in IBM SPSS 26.0. A p-value of less than 0.05 was considered significant.

Results

In our study were mothers aged 15-48 years, mean of

31.7±4.7 years. Mothers in Karvina were younger, with a median of 30.0 (IQR 27-35) vs. 31.5 (IQR 29-35) in Ceske Budejovice (CB). In Karvina 57.7% of mothers were aged up to 30 years, and in CB 41.8%.

All results from questionnaires are presented as **Supplementary Material Table 1**.

Maternal education: elementary and low secondary 14.9%, upper secondary 32.8%, university 52.2%. Higher education was reached in CB ($p < 0.001$).

Most mothers- evaluated the economic situation of their families as average (83.8%) or outstanding (14.8%), more often the outstanding evaluation was observed in CB than in Karvina (18.4% and 11.8%, respectively).

Evaluating the diet, most mothers (61.2%) believed, that their diet is healthy, 29.2% judged that their diet did not correspond to healthy diet principles. Respondents from CB evaluated their diet as more healthy ($p < 0.05$).

Almost all mothers (99.9%) eat daily at least one hot meal. The frequency of hot meals is not affected by the family's economic situation.

It seems to be important that mothers in Ceske Budejovice are more interested about the information, presented on food packing. They follow especially the date of consumption, information about manufacturer, and impoter. In Karvina they follow especially composition of food and nutrition information.

When they are informed about health risk, 90.3% mothers are willing to change their habits (diet, exercise, smoking), more often in CB than in Karvina (92.6% and 88.4%, respectively, $p < 0.05$).

Evaluating the structure of consumed foods, mothers in Karvina eat more often fish ($p < 0.05$), poultry ($p < 0.001$), very significantly legumes ($p < 0.001$), but also sweet meals ($p < 0.05$), fried foods ($p < 0.05$); milk products are consumed more often in CB ($p < 0.05$).

Using factor analysis, 4 groups of eating habits were created, representing 16 groups of following foods: healthy catering, including fruits, vegetables, legumes, fish, and beef; unhealthy catering, including sweets, sweet meals and drinks, smoked foods, fried and fast snacks; carnivorousness, as consumption of beef, pork and chicken meat, smoked foods and eggs; vegetarianism, containing fruits, vegetables, wholegrain baked goods, milk products, and sweets. Comparing all 4 groups of eating habits between Ceske Budejovice and Karvina proved differences in 3 factors: healthy catering and unhealthy catering were significantly higher in Karvina ($p < 0.01$ and $p < 0.05$, respectively), vegetarianism was higher in CB ($p < 0.05$). No difference was observed in carnivorousness.

Mothers were able to determine what is their preferred meal preparation. The most frequent and the most popular were cooking (84.1%), baking (69.2%), steaming (41.1%), and grilling (38.9%). There were statistically significant



differences between regions in all preferences: in Karvina was more popular and more often cooking, steaming ($p < 0.001$), frying ($p < 0.01$), grilling ($p < 0.05$), and baking ($p < 0.05$). In Ceske Budejovice mothers had more often no preference for meal preparation ($p < 0.001$) and consumption in a raw stage ($p < 0.05$).

Better economic situation (ES) correlated strongly with healthy nutrition (Spearman's rho 0,123, $p < 0,001$). This positive trend was visible in both regions, but stronger in CB (rho 0,149). Furthermore, it was confirmed by the correlation of the two opposing factors stemming from the factor analysis of food groups (see above), namely healthy and unhealthy catering. A positive correlation between vegetarian food was also linked to better ES, but only in CB (rho 0,170, $p < 0,001$). The fourth factor, carnivorousness, showed no correlation to the ES.

The 16 individual food groups showed correlation profiles corresponding to the above- mentioned food factors, i.e., better ES was connected with higher consumption of fruit and vegetables, fish, wholegrain bread, and lower consumption of sweet drinks and produced meats. The trends were similar in both regions, although usually stronger in CB than KA.

The economic situation influenced the preferred food preparation in the case of frying, which was correlated with worse ES (Spearman's rho -0,090, $p < 0,01$). This trend was more pronounced in KA (rho 0,118). On the other hand, better ES was linked to more frequent raw food consumption, but only in CB (rho 0,129, $p < 0,05$).

Among our mothers we found 1.8% smokers, previous smokers were 26.7% in CB and 39,8% in KA. Pregnancy was a significant reason to stop smoking.

Among mothers we found 4.8% abstainers, other 28.4% did not consume alcohol during the last 12 months, 33.9% admitted alcohol consumption usually less than once per month. Alcohol consumption was lower in KA ($p < 0,001$). Between our regions, there was no difference in the consumption of beer or spirits, in CB was a higher intake of wine ($p < 0,05$).

Discussion

The economic situation is related to the subjective evaluation of health conditions (which is usually related to eating habits). A better economic situation is related to the better subjective evaluation of health conditions ($p < 0,01$). These findings are the same in Karvina as well as in Ceske Budejovice. The better economic situation also supports meals, which are related to healthy diet.

Pavlikova, et al. [4] observed in the years 2013 and 2014 in the same two districts lower intake of fruits and vegetables in mothers in Karvina.. Our results, indicating no difference between those two regions in the consumption of fruits and vegetables suggest that during the last years the quality of diet in the district of Karvina improved. This may be the result worth popularizing to obstetricians as well as in media in both districts.

It may be questionable, whether the mothers understand the principles of a healthy diet – our survey only relies on the subjective evaluation. Danielewicz, et al. [6] indicate, that vegetarian and vegan diets may be related to the shortage of some micronutrients and therefore may adversely affect pregnancy outcomes, risks may be increased preeclampsia or insufficient development of the child's brain. A possible alternative may be a Lacto-vegetarian diet, supplemented by folic acid, iron and vitamin D and B12.

DiPietro, et al. [7] showed that physically active mothers have lower increase of weight during pregnancy than non-active mothers. Overweight was in mothers decreased by active exercise before delivery.

Most mothers from Karvina and Ceske Budejovice claimed, they have sufficient financial sources for food, clothes, and paying the bills. However, most mothers (61.2%) believe their diet is healthy. But the lack of financial sources may be related to less frequent diet according to the principles of healthy diet. The better economic situation is related to more frequent consumption of fruits, fish, beef, eggs, and wholegrain bread.

Used factor analysis proved the significantly higher relationship between healthy and unhealthy catering in Karvina. On the other hand, more mothers in Ceske Budejovice prefer vegetarian diet. Both regions show the same affinity to carnivorousness.

Conclusion

Most mothers in our study subjectively evaluated their economic situation as moderately good in both regions. Better economic situation was correlated with healthy nutrition, including higher consumption of fruits and vegetables, wholegrain bread, beef and fish and lower consumption of sweet drinks and produced meats. In comparison with the previously published results the consumption of fruits and vegetables in the industrial region has risen to much healthier levels. This rather unexpected outcome brings promises for the future healthier population.

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Ethical approval: The study was conducted according to guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of the University of Ostrava in November 30, 2018, Ethics Committee of the Hospital Karvina-Raj in October 25, 2018, and Ethics Committee of the Hospital Ceske Budejovice, a.s., in January 4, 2019.

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



Consent to publish: All authors approved this text.

Conflict of interest: The authors declare no conflict of interest.

Data availability statement: All data in our paper are available from the corresponding author on reasonable request.

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