# Parental heights and maternal education as predictors of length/height of children at birth, age 3 and 19 years, independently on diet: the ELSPAC study

***Maternal pregnancy diet and height of child at 3 years***

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**Word count (abstract)**: 250 **Word count (full text)**: 4510

**Number of references:** 20 **Number of tables:** 4+2 **Number of figures:** 0

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**Acknowledgement**

The authors are grateful to Pavel Piler and Vit Kandrnal for valuable comments and assistance in cohort description.

**Financial Support**

The ELSPAC study is currently supported by the RECETOX Research Infrastructure of Masaryk University (LM 2015051), the National Feasibility Programme of the Ministry of Education of the

Czech Republic (LO1214), and by the CELSPAC: Central European Longitudinal Study of Pregnancy and Childhood (MUNI/M/1075/2013) support programme.

**Conflict of interest**

The authors have no conflict of interest.

**Authorship**

JBV was responsible for the design and interpretation of all study data and drafted the manuscript. FZ was responsible for conducting the data analysis and interpretation of results. TP, JN, AP, OM, LA and PČ were responsible for the evaluation of the dietary data in the context of the early 90s in the Central-Europe and contributed to manuscript preparation. JŠ was responsible for the appropriate data management and participated in the statistical analyses. HP supervised the analyses and critically revised the manuscript. All authors contributed to the intellectual content and approved the final version of the manuscript.

**Abbreviations:**

| | |
|---|---|
| ALSPAC | Avon Longitudinal Study of Parents and Children |
| ELSPAC | European Longitudinal Study of Pregnancy and Childhood |
| KMO measurement | Kaiser-Meyer-Olkin measurement |
| SISP | Czech National Food Consumption Survey |
| WHO | World Health Organization |

**Keywords:**

**ELSPAC; dietary patterns; Central Europe; height; modelling; maternal diet**

**Abstract**

**Background**: Little is currently known about the relationship between the parental diet during pregnancy and the growth of the child from early childhood until early adulthood.

**Objective:** This study was designed to examine whether the dietary patterns of the parents during a pregnancy and of the respective child at 3 years are associated with the length/height-for-age z-score of child at birth, 3 years of age and at 19 years of age.

**Design:** Dietary patterns of pregnant women and their partners and offspring at 3 years that were enrolled in the 1990–1991 period in the Czech part of the European Longitudinal Study of Pregnancy and Childhood (ELSPAC). Multivariable linear regression models were used to estimate the relationship between the dietary patterns of parents (835 child-mother-father trios) during pregnancy and the length/height-for-age z-score of their offspring at birth, 3 years and 19 years.

**Results:** The maternal health-conscious food pattern was found to predict lower child height at 3 years, but not at birth nor at 19 years of age. An increase in the health-conscious pattern score of the maternal diet was associated with significantly lower height-for-age z-score at 3 years, however, the observed effect lost its significance after adjustment for diet of the child at 3 years.

**Conclusions:** After full adjustment, the only significant predictors of the height-for-age z-score of the child at 3 years were the heights of both parents and maternal education. More research into the association of maternal diet in pregnancy and height of child is necessary.

## Introduction

Based on data available from large registries with long follow-up, short stature is a significant risk factor for ischemic heart disease, myocardial infarction and other cardiovascular morbidities [1] Shorter people tend to have higher cardiovascular morbidity compared to taller people, who are more likely to develop cancer[2]. In addition, numerous studies have confirmed that people with shorter stature tend to live longer, as height was in a large metaanalysis positively associated with death from ruptured aortic aneurysm, pulmonary embolism, melanoma and range of cancers including pancreas, endocrine and nervous systems, ovary, breast, prostate, colorectal, blood and lung [3,4]. The mechanisms underlying the relationship between morbidity and mortality and adult height are currently unclear.

In addition to being associated with adverse effects later in life [3], short birth length may also predict shorter adult height [5]. Birth weight and birth length may be influenced by range of factors including diet. For example, studies of undernourished African populations have shown that birth weight as well as length may be modified by a simple dietary interventions, which is suggestive of the effect of diet during pregnancy on the anthropometry of the offspring [6]. The beneficial effects of complex micronutrient supplementation on birth length as well as weight were also documented in an undernourished Nepalese population [7]. The maternal diet may thus be presumed to substantially influence the dynamics and amplitude of the growth of the child. However, most of the above mentioned studies were interventional by design, frequently providing supplementation to subjects involved in studies conducted under extraordinary circumstances, e.g. in the case of severely undernourished populations [8]. Only very few observational longitudinal studies were designed to assess the relationship between dietary factors during a pregnancy and child's anthropometrical measures later in childhood or adolescence in the populations that were not substantially undernourished.

Throughout the recent decades, the employment of dietary patterns to assess the effects of nutrition on disease incidence has become increasingly widespread [9]. Dietary patterns constitute a useful method for describing dietary behaviour and may be associated with health outcomes [10]. The main advantage of this method is that it provides insight into the diet as a whole, i.e. viewing it as more than a simple sum of its components. To the best of our knowledge, no such study has investigated the relationship between the dietary patterns of the parents during a pregnancy and the anthropometry of the child later into childhood/adolescence in the Central Europe.

Investigation of the role of maternal diet during pregnancy on offspring body size and composition attracts significant attention. Previous studies have demonstrated that human fetal growth can be influenced by small variations in maternal protein intake during pregnancy.[11] However, only scarce further studies are available associating maternal pregnancy diet and/or related biomarkers, such as glycaemia, with the anthropometry of the children at higher age.[12] Therefore, we hypothesized that there could be an observable effect of the maternal pregnancy diet not only on fetal parameters, but also on the linear growth of the children throughout the entire duration of childhood and adolescence.

The present study thus aims to investigate the possible association between parental dietary patterns during pregnancy and the height of the child at 3 years and subsequently at 19 years in a large population-based cohort in the Central European region.

**Materials and Methods**

**Study subjects**

The European Longitudinal Study of Pregnancy and Childhood (ELSPAC) is a population-based study investigating environmental and other factors affecting the health and development of children from the prenatal period until adulthood. The study was initiated by the WHO Regional Office for Europe in 1985 and designed to accommodate a total of 40,000 children across Europe [13]. Originally, the project has been coordinated by Bristol University (Avon Longitudinal Study of Pregnancy and Childhood; ALSPAC [14]), and included eight independent centres based in the United Kingdom, the Czech Republic, Slovakia, Ukraine, Greece, and Russia. In the Czech part of the study, all eligible mothers originating from the Brno and Znojmo regions of the Czech Republic who were expected to deliver between 1 April 1991 and 30 June 1992 were selected as target study population. Current analysis is based on 835 children with anthropometric data at birth, 3 years and 19 years, and parental dietary data collected at 32 weeks of gestation. Self-reported questionnaires for parents included records of demographics, lifestyle, dietary habits, partnership, life attitudes, life events, social factors and environmental exposure.

**Ethics statement**

Ethical approval for the study was obtained from the European Longitudinal Study of Pregnancy and Childhood (ELSPAC) Law and Ethics committee and local research ethics committees. Written informed consent was obtained from all study participants.

**Dietary assessment**

Parents participating in the study completed a self-reported food frequency questionnaire (FFQ) according to the ELSPAC protocol [13] at 32 weeks of gestation. Based on available domestic and foreign sources as well as an expert assessment of portion sizes by nutrition specialists (dieticians), a list of individual food items associated with specific portion sizes was developed and the questionnaire finally included 145 items with answers related to the frequency of consumption. 145 items were subsequently transformed into 36 separate food groups. The utilization of domestic sources allowed us to define portion sizes not only for global foods but also for local or regional foods. This approach has been used before, e.g. by the HAPIEE study [15]. Our study assessed previous portion size definitions with respect to definition dates in view of the fact that portion sizes have changed throughout the post-communist period, the weights and volumes of many foods have changed over time and current sizes thus could not be used. Generally, portion sizes were derived from two domestic sources from the 1990s: the Verbal and Graphic Formulation of Dietary Guidelines for the Czech Republic project and the Czech National Food Consumption Survey (SISP), implemented in the 2003–2006 period [16]. A weighted average of portion sizes for the entire food group was then calculated based on the consumption ratio of individual foods. No weighted average calculation was necessary in the case of groups defined by a single food.

Similarly, the diet of the children at 3 years was investigated using a FFQ filled out by the mothers around 3$^{rd}$ birthday of their child. The dietary data on the diet of 3-year old children were available from all the 835 trios in the study. Dietary data from the 19-years-old individuals could not be, however, analysed, due to excessive amount of missing values (more than 70%).

**Anthropometric measurements**

The entire cohort of children was invited to attend an anthropometric examination which included measurements of height throughout the 19-year-long period of growth and development. For the purpose of this study, height measurements were retrieved for birth, 3 and 19 years of age. Height was measured by appropriately trained physicians, employing the standard methodology using a stadiometer. While we call these measures height at 3 years and height at 19 years, these were measured when children came to the examination centre and age was not always precisely 3 years or 19 years (3.03 years ± 0.20 years, and 18.83 y ± 0.20 years, respectively). Therefore we use height adjusted for age (which is particularly relevant at age 3 years).

**Covariates**

Several variables may be considered to constitute potential confounding factors for dietary pattern scores and anthropometric measurements at birth, at the age of 3 years and 19 years. In order to construct a statistical model for body length/height-for-age z-score at birth, 3 years and 19 years, the following independent variables were included into the analyses: maternal height, paternal height, maternal preconceptional weight, maternal age at birth, education of mother (according to highest educational qualification achieved: low – elementary school and/or vocational qualification, medium – completed secondary school at the of 18 years or equivalent, high – academic qualification reached at 21 years of age or later), maternal smoking prior to pregnancy (never smoker, smoker in the past, smoker in the last 9M), living with partner status (yes–no).

Since parental height is an important predictor for the height of the offspring, all models were adjusted to accommodate both maternal and paternal height. Moreover, as advanced maternal age at the time of birth may be associated with worse obstetric outcomes as well as developmental delays further in life, adjustments according to maternal age at the time of birth were also made. As the cohort originated from a highly homogenous South Moravian population, i.e. 99.1 % of all subjects reported themselves being Caucasian, no adjustments were made with regard to ethnicity.

**Statistical modelling**

Dietary patterns were estimated by exploratory factor analysis for 36 food groups. Uniformity was tested by examining the distribution of variables in a loading plot verified by the Kaiser-Meyer-Olkin (KMO) measurement of adequacy with the value of 0.5 considered as acceptable for further analysis. The Bartlett test of sphericity was used to test if the correlation matrix differed significantly from identity matrix [17]. Orthogonal varimax rotation was used to minimize the number of indicators which might have high loading on one factor [18].

First, the birth length, height at 3 years and 19 years were transformed to length/height-for-age z-score according to WHO Growth Chart Standards and WHO Reference 2007 (using function *zanthro* from dm0004_1 package in Stata statistical software).

The relationship between maternal dietary patterns and the z-scores was investigated using multivariable linear regression for each time point. Multivariable models were built in several steps.

Firstly, the association between mother's dietary patterns and body length/height-for-age z-score later on was estimated in crude unadjusted analysis (model 1, Table 3) . Secondly, biological factors (maternal height, paternal height, maternal preconception weight and age of mother) were added into the model (model 2, Table 3). Thirdly, social and demographic characteristics (education of mother and family structure expressed as mother living with partner) and maternal smoking were additionally included in the model (model 3, Table 4).

Missing data were imputed using Multiple imputation by chained equations method[19] and the regression models were built using imputed data. All analyses were performed using R, version 3.1.2 and STATA version 14.

## Results

As no significant associations of the paternal diet with the anthropometry of the offspring was observed, the paternal dietary patterns/data are not discussed further in detail and attention is paid to the maternal diet / diet of the child at 3 years. The median and interquartile range of mothers' food groups consumption is presented in **Table 1**.

**Dietary patterns**

Food group analysis was performed as described above. Three dietary factors were identified in mothers (Supp. Table 1). The adequacy of data for analysis was evaluated based on the KMO value [20], a comparison of partial correlation coefficients and total correlation coefficients with a maximum value of 1. The KMO value ranges from 0 to 1 with values of 0.9–1.0 indicating a remarkably high degree of correlation, values of 0.8-0.9 indicating very good correlation, values of 0.7–0.8 indicating medium correlation, values of 0.6–0.7 indicating a reasonable level of correlation and values below 0.5 indicating an unacceptable level of correlation. The KMO value for mothers was established as 0.80, thereby indicating very good correlation between different food items to proceed with factor analysis. (result of Bartlett's test of sphericity ($\chi^2$ = 15693, df = 670, p < 0.001) provided strong statistical evidence that the correlation matrix was significantly different from identity matrix).

**Supp. Table 1** reveals that three components were extracted in the case of women in the study. Among pregnant women, the first five components identified using FA accounted for 34 % of the observed variation in the food-consumption pattern among pregnant women. The first five factors were thus extracted for foods. Subsequently, the same number of components were used for factor analysis and were subsequently reduced to three factors, based on their consistency with the interpretation of dietary data. This total of three factors were identified in pregnant women explaining 15.2 % of total variance. The first factor – which accounted for 7.0 % of total variance among mothers – was labelled the health-conscious factor. This factor may be characterized by high factor loading in the case of whole-wheat bakery products, fish, legumes, fresh vegetables, root vegetables and honey. The second factor – which accounted for 4.3 % of total variance – was labelled the carbohydrate–dairy factor and included foods such as refined flour bakery products, pudding, cheese, fresh fruit, milk and diary products. The third factor – which accounted for 4.1 % of total variance – was labelled the junk food factor and included items such as biscuits, wafers, pies and cakes, French fries, roasted potatoes, pâté and ground meat. Taken together, the contribution of these dietary factors to the anthropometry of the child was low.

The factor scores across the cohort deserve further description as they are reflecting important socio-economic changes in the region at that time. Negative factor scores may be observed in the case of traditional foods in the second half of the 20$^{th}$ century, with declining consumption visible after 1989. Typical examples include potatoes (1989: 82.8 kg/person; 2012: 68.6 kg/person), meat (1989: 97.4 kg/person; 2012: 77.4 kg/person) and eggs (1989: 336 per person; 2012: 245 per person). The lowest factor scores were found among traditional Czech foods such as sausages and pig-feast specialities. Furthermore, negative factor scores also occur in the case of foods associated with health risk debates either in the 1990s (processed cheese, soft drinks) or later (wheat bread, coffee). On the other hand, positive factor scores were associated with foods which were not traditional prior to 1989 and which were subsequently seen as part of a modern lifestyle (whole-wheat bakery products, breakfast cereals, pizza, muesli bars), foods which became increasingly accessible after 1989 and foods which were part of the official dietary recommendations and have increased in consumption since then, e.g. fresh vegetables (1989: 68.7 kg/person; 2012: 77.8 kg/person) or legumes (1989: 1.3 kg/person; 2012: 2.6 kg/person).

Similarly, **Supp. Table 2** presents the three components that were extracted in the children at 3 years of age. The first factor was labelled the health-conscious factor and was characterized by high factor loading of whole-wheat bakery products, cereals, fish, legumes, vegetables and honey, and by negative factor loading of white bread and rolls, red meat, smoked meat products, butter and lard and cooking with them. The second factor was labelled the carbohydrate–meat factor and included mainly meat, such as poultry, red meat and fish, animal products – eggs and cheese, side dishes – rice, potatoes, pasta and dumplings, and vegetables and legumes. The third factor was labelled the junk food factor and included foods such as French fries, roasted potatoes, chips, canned fruit, chocolate, biscuits and sweeteners.

**Table 2** summarises non-dietary covariates used in the analysis.

**Dietary patterns and birth and 3 years length/height**

The results of multivariable regression modelling for child length/height-for-age z-score at birth and 3 years are provided in **Table 3** and **Table 4**. These tables show the estimated coefficients of linear regression models for the effects of maternal dietary patterns on child length/height-for-age z-score with various adjustments for potential confounding factors. The results for 19 years are not shown as no significant associations were observed.

Briefly, the unadjusted model 1 (Table 3) did not revealed significant associations of maternal dietary patterns and child length/height-for-age z-score, except for a slight association of junk food-dietary pattern with child length-for-age z-score at birth (beta -0.104, 95% CI: -0.196, 0.012; p = 0.027) as well as at 3 years (beta -0.166, 95% CI: -0.261, -0.070; p = 0.001). After partial adjustment (for maternal age and maternal and paternal height) (Model 2, Table 3), these associations of child length/height-for-age z-score at birth and 3 years retained its significance only at 3 years of age (beta -0.111, 95% CI: -0.201, -0.022; p = 0.015). In model 3 (Table 4), when additionally adjusted for maternal preconceptional weight, maternal education, maternal smoking and living with partner, the observed association with maternal junk food diet with length/height of child at birth / 3 years of age lost its significance. Parental height and maternal education were the only significant predictors of height-for-age z-score at 3 years.

Models for height at 19 years were constructed, however, as dietary data on the subjects at 19 years were not available, this data cannot be included into final modelling. No significant associations were observed in relation to anthropometry of the parents and/or investigated confounding factors (data not shown).

## Discussion

The presented data is so far the first to describe the dietary patterns of the young adults and their offspring in the Central Europe in the 1990s. Due to massive political changes in the time of data collection, this is a unique opportunity to study the impact of socio-economical changes on dietary behaviour and anthropometry of the offspring. Not surprisingly, the typical dietary patterns of our subjects in the early 1990s reflect rather patterns typical for the pre-revolutionary society, but start to include novel items that were not available in the Czechoslovakia before 1989. Hence, a lot of attention is paid in the further discussion to the actual items of the dietary questionnaire.

Generally, three dietary patterns were identified in the pregnant women. The health-conscious pattern was consistent with general food pyramid recommendations from the 1990s, where food consumption was subdivided into a total of six groups: 1. cereals, flour, bread products, rice, pasta; 2. vegetables; 3. fruit; 4. low-fat milk and dairy products; 5. poultry, fish, legumes, eggs and lean meat and 6. fats, oils, sweets and salt. Lower milk values observed in our health-conscious pattern may be attributed to changes taking place after 1989, when the consumption of consumer milk decreased (1989: 91.6 litres/person; 2012: 57.3 litres/person) while the consumption of low-fat UHT milk, rarely available in the Czech Republic before 1989, began to increase. The results thus correspond to consumer market behaviour in the Czech Republic in the relevant time period. Furthermore, it must be mentioned that typical junk food available in the Czech Republic in the early 1990s was substantially different from both junk food available abroad at the time was and from our current perception of what junk food is. The reasons for this situation include low junk food market penetration in the early 1990s (the first McDonald's opened in Prague on 20 March 1992 and only came to Brno in 1993), a steady state of consumption of selected cheap food (offal) and the popularity of traditional Czech foods (pig-feast specialities). Hence, the maternal junk food patterns observed in our study refer more to a traditional "unhealthy" pattern than a "junk food" pattern based on current definitions. Carbohydrates constitute the third common factor in women and include foods with a higher content of monosaccharides and polysaccharides. Despite the fact that the designation of "carbohydrates" suggests a connection to the chemical composition of food, a typical representative of oligosaccharides (legumes) exhibits a negative factor score. A closer analysis of individual foods with higher factor scores discloses a link which is not chemical but time-dependant: these are typical breakfast foods. This may be explained by examining dietary recommendations from the 1990s, which often suggested starting out one's day with foods with high carbohydrate content. Breakfast cereals are missing from this factor; not only were they not an established food item prior to 1989 in the Czechoslovakia, but their absence may also be associated with lower availability, higher cost and a specific type of consumer (i.e. one with healthier nutrition habits). Negative factor scores in the case of coffee may be explained by the food-related focus of this factor, the absence of coffee consumption in dietary recommendations, the absence of a discussion about the risks and benefits of drinking coffee in the 1990s and the gradual increase in coffee consumption in the Czechoslovakia only after 1990.

Using a very similar methodology to ours, five dietary patterns in pregnancy have been previously identified in mirror ALSPAC cohort using principal components analysis on the same set of questionnaires[10]; they include 1) health-conscious: salad, fruit, fruit juice, rice, pasta, oat/branbased breakfast cereals, fish, pulses, cheese, non-white bread; 2) traditional: vegetables, red meat, poultry; 3) processed: meat pies, sausages, burgers, fried foods, pizza, chips, white bread, eggs, baked beans; 4) confectionery: chocolate, sweets, biscuits, cakes, puddings, and 5) vegetarian: meat substitutes, pulses, nuts, herbal tea and high negative loadings for red meat and poultry [21]. When comparing these patterns, identified using similar methodologies in a Western European and a Central European population, obvious differences between the two populations appear; these disparities may be logically attributed to the transitional socio-economic situation in the Czech Republic in the early 1990s.

Briefly, the dietary patterns of the children at 3 years were similar to those of their mothers, with an exemption of carbohydrate pattern that was in the children associated with higher consumption of multiple types of meat. It can be presumed that the diet of the 3-year old child will be mainly influenced by maternal dietary patterns, however, we did not observe a significant correlation of maternal a childrens' dietary patterns (data not shown). It has to be noted, too, that the identified factors in maternal diet explained only 15.2 % of the total variance of height-for-age score which is also suggestive of the idea of maternal pregnancy diet not being closely related to linear growth in the early childhood. As for the maternal dietary patterns, the weak association of junk food with higher height-for-age z-score provides a further evidence of no robust effects of maternal diet on body height at 3 y. It can be speculated that more junk food in the diet is associated with increased body weight that, in turn, is associated with accelerated development that could results in increased z-scores for height at that age.

The fact that the maternal diet in late pregnancy may influence the anthropometry of the foetuses and neonates has been well-documented for a long time[22] [23]. However, there is no consensus on the role that maternal pregnancy diet plays in further linear growth of the offspring later into the childhood and/or adolescence and adulthood. The final model in our study suggests to rule out the maternal prenatal nutrition as well as nutrition of the child at 3 years as important predictions, the only significant predictors in our analysis being the maternal and paternal height and maternal education. Parental height has been for long recognized as a strong predictor of child height, and generally, such observation is unsurprising.

The lack of observation of significant effect of pregnancy diet of the mother on the height (height-for-age z-score) of the offspring is well in line with previous long-term observations of linear growth in the offspring of the mothers subjected to severe / nearly fatal starvation during pregnancy.[24] Generally, the reports on association of maternal dietary composition during pregnancy and subsequent dynamics of child growth and/or adult anthropometry are contradictory. On one hand, it has been reported that maternal diet in pregnancy impacts the 6 y-height in a Dutch cohort[25]. Surprisingly, in a recent study in the framework of Viva project, higher maternal protein intake in pregnancy was associated with reduced birth length of the offspring and slower linear growth long into mid-childhood.[26] On the other hand, Stein et al. investigated whether reductions in food intake by pregnant women during the Dutch famine of 1944-1945 were associated with anthropometry of the offspring in middle age, and using a population sample of 27 males and 529 females they concluded that maternal starvation during pregnancy did not significantly impact linear proportions and measures of length in the offspring.[24] In the Leningrad Siege study, either, no significant differences in the adult height were observed in the survivors born before the siege commenced, born during the siege, or born elsewhere at that time.[27] In the light of no observable effect of a huge event, such as severe and prolonged maternal starvation during pregnancy, it is not surprising that more subtle influences, such as distinct maternal dietary patterns do not display significant effects in our study.

As for the limitations of our study - it must be mentioned that the dietary patterns described in our study were documented at a late gestation stage (32 weeks of gestation) and that no dietary records were available from the 19 years old subjects. We are well aware that assessment prior to conception may have been more suitable. Likewise, we were unable to carry out adjustments for a measured level of physical activity; however, this should not be a source of strong bias in mothers as we expect most mothers in late gestation to experience only a mild level of physical activity. Because of the large number of subjects, it was necessary to use food frequency questionnaires which were not formally calibrated against diet diaries or biomarkers, i.e. a common approach in the early 1990s. The loss of effect of the role of maternal dietary intake on offspring body size at 3 y and/or 19 y may be explained, too, by incomplete adjustment for measurement error associated with the use of FFQ. FFQ is a methodological instrument designed to measure rather long-term dietary behaviour and is subjected to several methodological limitations, mainly a finite list of foods / food groups.[28] Finally, the retrospective nature of the questionnaire may introduce some memory bias when compared with a prospective food records-based methodology.

It has to be mentioned, however, that this study is the first to define the typical dietary patterns of pregnant women and their partners in the transitional period of the early 1990s in the Czech Republic. Moreover, it also provides insight into the significant relationship between these dietary patterns and the height (height-for-age z-score) of a child at 3 y. Additional key points of this study include the relatively large sample size of pregnant women and multiple adjustment for confounding factors, although the possibility of residual confounding cannot be ruled out entirely. The sample size included in the present study represents a substantial proportion of the original sample and thus it is unlikely to compromise the external validity. Moreover, children were measured by a trained physician using a standard methodology, i.e. this study did not have to rely on self-reported values or values reported by parents. Also, the observed dietary patterns are consistent with patterns expected in the Czech Republic in the early 1990s, which may be demonstrated e.g. by the absence of typical "imported" patterns, such as Mediterranean and/or vegetarian diets which were not typical in the Czech Republic at the time.

**Conclusion**

An analysis of dietary patterns offers the enormous benefit of summarizing a diet using a limited number of factors while still considering the diet as a whole. Moreover, these patterns may be of potential interest with respect to educating the public, promoting health-conscious eating habits and healthier food choices. This is the first study identifying the dietary patterns in the typical family in the Czech Republic (former Czechoslovakia) in the early 90s and contextualizing these patterns with height (height-for-age z-score) of child at 3 years and at 19 years. No significant relationship between maternal dietary patterns and child height (height-for-age z-score) at 3 years or 19 years was observed.

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