

# A cross-cultural comparison of dietary intakes and physical activity between American and Czech school-aged children

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## Abstract

**Objective:** The prevalence of child overweight in the Czech Republic is substantially lower than that in the USA. The objective of the present pilot study was to explore dietary intakes, frequency of dining in fast-food establishments, and the amount and intensity of physical activity between a sample of American and Czech children.

**Design:** A cross-sectional correlational pilot study.

**Setting:** Four public schools in the USA and four public schools in the Czech Republic.

**Subjects:** Ninety-five Czech and forty-four American 4–6th graders from urban public schools participated in the study. Dietary intake and number of fast-food visits were evaluated using two multiple-pass 24 h recalls. Physical activity was measured using the modified Self-Administered Physical Activity Checklist.

**Results:** American children (mean age 10·8 (SE 0·2) years) consumed more energy and fat, less fruits and vegetables, more soft drinks, and visited fast-food establishments more often than Czech children (mean age 11·0 (SE 0·1) years). Although no differences were found in vigorous activity by nationality, Czech children spent significantly more time in moderate physical activities than American children.

**Conclusions:** Despite the influx of some negative Western dietary trends into the country, Czech children had a healthier diet and were more physically active than American children. Further research is warranted to determine whether the same differences in dietary intakes, physical activity and fast-food visits exist between nationally representative samples of American and Czech children.

**Keywords**  
Children  
Dietary intakes  
Physical activity  
Child overweight

It is estimated that up to 31·5 % of American children aged 6–19 years are at risk for overweight or are currently overweight<sup>(1)</sup>. Causes of child obesity are complex and difficult to identify because a wide range of factors influence children's body weight and adiposity. However, experts agree that obesity results from an imbalance between energy intake and energy expenditure<sup>(2,3)</sup>. Dietary and behavioural factors that often contribute to positive energy balance include excessive intakes of fat, frequent fast-food consumption, inadequate fruit and vegetable intake, lack of physical activity and greater television watching<sup>(4–8)</sup>.

A dramatic decrease in energy expenditure over the last three decades has also contributed to a positive energy balance among American children<sup>(2,9)</sup>. About 14 % of 12–21-year-olds are not physically active at all and less than half engage in regular vigorous exercise<sup>(10)</sup>. In addition, children continue to spend more time in sedentary behaviours even though a direct association between television

watching and increased risk of overweight has been demonstrated in previous research<sup>(11,12)</sup>.

While the prevalence of child overweight continues to increase among American youth, children in the Czech Republic are significantly leaner than American children. According to the National Anthropological Survey, a survey conducted in the Czech Republic every ten years, only 4·2 % of Czech girls and boys between the ages of 6 and 18 years were overweight or obese in 2001<sup>(13)</sup>. The low prevalence of overweight and obesity among Czech children also extends to Czech adolescents, whose BMI-for-age is among the lowest in the European Union<sup>(14)</sup>. While the prevalence of child overweight in the Czech Republic has been relatively low in the past two decades, it is likely that the dietary intakes and exercise behaviours of Czech children have changed significantly in the last several years. The Czech Republic, former Czechoslovakia, was under communist rule for 40 years and has been undergoing dramatic economic, social and political

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changes since the late 1980s. While the transformation of the country has been positive in relation to food availability (e.g. increased variety of fruits and vegetables and other nutrient-dense foods), the Czech population has also been influenced by negative Western dietary trends (e.g. increased exposure to fast-food restaurants and snack foods)<sup>(15–17)</sup>.

To date, no previous studies have compared lifestyle factors that directly influence children's weight status between American children and children from a transitional country who are exposed to a similar culture and dietary trends, yet have substantially lower rates of overweight. The purpose of the present pilot study was to compare dietary intakes and to investigate whether differences in physical activity exist between a sample of American and Czech school-aged children.

## Methods

The target populations of the study were American and Czech 4–6th graders living in urban areas. A cluster sampling technique was utilized to recruit children in one mid-western American city and one city in the Czech Republic between May and September of 2005. In the USA, a list of all elementary and middle schools was obtained from the State Department of Education website and four out of fifteen schools that were randomly selected agreed to participate in the study. In the Czech Republic, a list of all schools in the chosen city was created using a phonebook and three out of eight schools that were randomly selected decided to take part in the study. In addition, one elementary school in another Czech city volunteered to participate in the study. Informed written consent was obtained from the principal at each school prior to data collection. Children suffering from a chronic disease that may have influenced their dietary intakes or physical activity were excluded from the study. Four trained research assistants helped collect data. The study was approved by Oklahoma State University's Institutional Review Board in the USA and the Ethical Institute in the Czech Republic.

Two school visits were scheduled to obtain information from children. During the first visit, anthropometric measurements were obtained in the morning. Weight and height were measured according to the Centers for Disease Control and Prevention (CDC) recommendations<sup>(18)</sup> using an electronic scale (Taylor Precision Performance, Oak Brook, IL, USA) and a flexible tape. Children completed one multiple-pass 24 h recall and the modified Self-administered Physical Activity Checklist (SAPAC)<sup>(19)</sup>. Plastic food models, real food examples, bean bags and household measuring tools were used to improve the quality of the recall. The use of the multiple-pass 24 h recall was shown to be a valid method of estimating energy and macronutrient intakes of children in previous

research<sup>(20)</sup>. The SAPAC represents a 24 h recall of physical activities and sedentary behaviours that was validated in previous research<sup>(19)</sup>. To eliminate potential errors associated with children completing the checklist on their own, the SAPAC was completed by a trained research assistant. Children recalled the activities in which they participated, the length of time in each activity, and rated perceived effort. During the second visit, another multiple-pass 24 h recall and SAPAC were completed with each child.

Children's dietary intakes were analysed using the Food Processor program version 8.4 (ESHA Research, Salem, OR, USA). Recipes of traditional Czech meals were added into the database. Total energy, total fat, energy from fat, saturated fat, dietary fibre, cups of fruit, vegetables and soft drinks, and number of fast-food visits were estimated as a 2 d average. Because use of the Food Guide Pyramid for fruit and vegetable intakes was validated in previous research<sup>(21)</sup>, the MyPyramid served as a guide for calculating children's fruit and vegetable consumption<sup>(22)</sup>.

Metabolic energy equivalent tasks (MET) were assigned to all physical activities based on the updated Compendium of Physical Activities<sup>(23)</sup>. 1 MET is defined as the amount of oxygen per kilogram of body weight per minute consumed when sitting quietly (3.5 ml/kg per min)<sup>(23)</sup>. Activities during which children expended 3–5.99 MET were defined as moderate exercise. Vigorous activity was defined as any activity with MET equal to or greater than 6<sup>(23)</sup>.

Children's BMI percentiles were calculated using the 2000 CDC growth charts<sup>(24)</sup>. Children were classified as at risk for overweight (85th–94th percentile) and overweight ( $\geq 95$ th percentile). Children's weight status was also analysed using the International Obesity Taskforce (IOTF) cut-offs for BMI<sup>(25)</sup>. Descriptive statistics,  $\chi^2$  tests and independent *t* tests were used to describe the samples and compare dietary intakes and physical activity between American and Czech children. The SPSS for Windows statistical software package version 12.0 (SPSS Inc., Chicago, IL, USA) was utilized for statistical analyses. The level of significance was set at 0.05.

## Results

Ninety-five Czech and forty-four American children and parents participated in the study. The American sample included fifteen boys and twenty-nine girls, and the Czech sample consisted of forty-one boys and fifty-four girls. Characteristics of the children by nationality are summarized in Table 1. Significant differences in the consumption of energy, total fat, saturated fat, fruits and vegetables, soft drinks and the frequency of dining in fast-food restaurants were found between American and Czech children (Table 2). The results also indicated

differences in physical activity by nationality (Table 2). Both American and Czech children spent similar amounts of time in sedentary activities (Table 2).

There were no differences in the prevalence of overweight ( $P=0.107$ ) by  $\chi^2$  analysis between the American and Czech sample; however, the distribution of children

at risk for overweight and overweight appeared to differ by nationality, with BMI  $Z$  scores declining with age among Czech children. Although not significant, the proportion of overweight was higher in the American sample compared with the Czech sample of children using both the 2000 CDC growth charts and the IOTF cut-offs (Table 3). The prevalence of children who were at risk for overweight was slightly higher among the Czech children (Table 3).

**Table 1** Demographic and anthropometric characteristics of study children by nationality: American and Czech 4–6th graders from urban public schools, May–September 2005

Characteristic	Nationality				<i>P</i> value
	American ( <i>n</i> 44)		Czech ( <i>n</i> 95)		
	Mean	SE	Mean	SE	
Age (years)	10.8	0.2	11.0	0.1	0.33
BMI (kg/m <sup>2</sup> )	18.9	0.6	18.4	0.3	0.37
BMI percentile	56.9	4.5	54.1	2.9	0.59
Weight <i>Z</i> score	0.4	0.1	0.4	0.1	0.97

All *P* values were non-significant.

## Discussion

Our pilot study contributes to the existing literature on factors influencing child overweight by comparing dietary intakes and physical activity between a sample of American children and children from the Czech Republic, a country with very low child obesity rates<sup>(13,14)</sup>. Our study found notable differences in dietary quality and exercise

**Table 2** Dietary intakes, physical activity and sedentary behaviours of study children by nationality: American and Czech 4–6th graders from urban public schools, May–September 2005

Variable	Nationality				<i>P</i> value
	American ( <i>n</i> 44)		Czech ( <i>n</i> 95)		
	Mean	SE	Mean	SE	
Daily dietary intakes					
Total energy (kJ)	7708	381	5874	151	<0.001
Total energy (kcal)	1841	91	1403	36	<0.001
Dietary fat (g)	68.3	4.4	45.2	1.5	<0.001
Energy from fat (% of energy)	32.4	1.1	28.6	0.6	0.001
Energy from carbohydrates (% of energy)	53.7	1.3	57.3	0.7	0.010
Energy from protein (% of energy)	14.0	4.3	14.1	3.5	0.907
Saturated fat (g)	25.7	4.2	18.1	6.6	<0.001
Dietary fibre (g)	10.9	4.4	11.5	4.5	0.446
Fruit (cups)	0.78	0.12	1.39	0.12	0.002
Vegetables (cups)	0.75	0.09	1.18	0.08	0.003
Soft drinks (cups)*	0.73	0.70	0.34	0.64	0.002
Fast food (no. of visits)	0.51	0.13	0.04	0.02	<0.001
Daily physical activity & sedentary behaviours					
Total physical activity (MET-min)	407	48	495	26	0.086
Moderate (min)	48.3	7.7	84.8	10.8	0.032
Vigorous (min)	19.5	5.0	23.9	3.7	0.500
Moderate & vigorous (min)	67.9	8.8	96.7	5.2	0.004
Television (min)	41.9	6.6	57.5	4.5	0.052
Computer use (min)	10.2	2.4	8.3	2.0	0.567

\*1 cup = 240 ml.

**Table 3** Prevalence of at risk for overweight and overweight in study children by nationality and applying different reference standards: American and Czech 4–6th graders from urban public schools, May–September 2005

Reference standard	At risk for overweight				Overweight			
	American ( <i>n</i> 44)		Czech ( <i>n</i> 95)		American ( <i>n</i> 44)		Czech ( <i>n</i> 95)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
2000 CDC*	3	6.7	10	10.5	8	18.2	4	4.2
IOTF†	3	6.8	9	9.5	5	11.4	2	2.1

\*Centers for Disease Control and Prevention (2002)<sup>(24)</sup>.

†International Obesity Taskforce (2000)<sup>(25)</sup>.

behaviours between American and Czech children. While the proportion of energy derived from fat was within the recommended range<sup>(2)</sup> of 25–35% in both countries, children in the American sample consumed more energy, total fat and saturated fat than Czech children. Because one-third of American children in our sample made at least one trip to a fast-food restaurant, the consumption of fast foods may have contributed to their higher energy, total fat and saturated fat intakes. Our findings are not surprising since fast-food establishments have become an essential part of American culture in the last several decades<sup>(17,26)</sup>. The higher intake of saturated fat among American children is especially noteworthy because a recent follow-up study of 41 518 women by Field *et al.*<sup>(27)</sup> found that the positive relationship between weight gain and dietary fat was stronger with increased consumption of saturated fat and animal fat compared with total fat. Despite the influx of Western dietary trends into the Czech Republic, the exposure of Czech children to fast food and soft drinks was minimal in our sample. Furthermore, Czech children consumed nearly twice as many fruits and vegetables as American children, which is surprising given a significant increase in fruit and vegetable cost in the Czech Republic since the 1990s<sup>(15)</sup>.

Even though children in both samples met the recommendation of at least 60 min of physical activity daily<sup>(28)</sup>, Czech children spent substantially more time in moderate exercise than American children. Because many Czech children in our sample reported walking to and from school and playing outside in the afternoon, these activities largely contributed to the amount of moderate activity they obtained throughout the day. In contrast, almost none of the children in our American sample reported walking to or from school.

Children in the American sample engaged in similar amounts of vigorous exercise as Czech children. While this trend in the data was not anticipated, our results may be explained by the fact that the physical activity of American children was largely limited to organized sports or physical education classes rather than moderate-intensity activities throughout the day. It is noteworthy that Czech children in our study appeared to have more opportunities to be active throughout the day because they were required to spend less time at school than American children. Surprisingly, children in our Czech sample spent slightly more time watching television than children in the American sample.

Our cross-cultural exploration of differences in dietary intakes and physical activity between a sample of American and Czech children provides important insights on factors that may be contributing to the low prevalence of child overweight in the Czech Republic. The results of our study are especially noteworthy given that the demographic and dietary characteristics of children in the American sample are similar to those of a nationally representative sample of American children who were

investigated during the Third National Health and Examination Survey<sup>(7)</sup>. However, our work has several limitations that need to be addressed in future research. First, due to the pilot nature of the study, our findings cannot be generalized to a large group of American or Czech children. The prevalence of overweight and at risk for overweight in our sample of American children was lower than the prevalence of overweight and at risk for overweight found in a nationally representative sample of American children of the 2003–2004 National Health and Nutrition Examination Survey<sup>(29)</sup>. This finding may have been caused by the parents of overweight children being less likely to allow their children to participate in the study. In addition, our sample was limited to children attending urban public schools whose physical activity and other characteristics may differ from those of other children. Second, analysis of the children's dietary intakes was limited to two multiple-pass 24 h recalls. A future study utilizing 24 h recalls combined with parent-assisted food records to improve the quality of the dietary analysis is warranted. Lastly, while the modified SAPAC represents a validated tool for estimating physical activity among children, it does not allow for capturing all activities in which children engaged throughout the day.

## Conclusions

Our cross-cultural study represents the first step in exploring the differences in dietary intakes and physical activity between American and Czech children. Czech children in our study consumed diets of higher nutritional quality and were more physically active than children in the American sample. The low intakes of fruits and vegetables in the American sample are of concern, given the important role of fruits and vegetables in the prevention of obesity. In addition, our results suggest that less frequent engagement in moderate activities may be responsible for the American children in our sample being less physically active than Czech children.

Despite a number of negative Western dietary and lifestyle trends, Czech children in our sample appeared to have healthier diets and were more active than American children. Thus, it is possible that certain social, cultural or environmental factors have a positive influence on their dietary and exercise behaviours, thus providing potential protection against overweight. Given the limited sample size in our pilot study, our recommendations for future research include comparing dietary intakes, physical activity and factors that influence BMI among nationally representative samples of American and Czech children.

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