Research Article

The Influence of Chronological Period of Data Collection on Differences in Reported Dietary Intake Among School-Aged Children Surveyed in 39 Countries

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ABSTRACT

Objective: To examine whether dietary intake reported by school-aged children relates to the chronological period of data collection.

Design: Cross-sectional surveys in 39 countries in different monthly periods of the 2009–2010 school year.

Settings: Questionnaires were completed in schools anonymously.

Participants: Children from 39 countries, aged 11, 13, and 15 years (n = 209,320).

Main Outcome Measures: Daily consumption of fruits, vegetables, sweets, and soft drinks, derived from a food frequency questionnaire.

Analysis: Multivariate logistic regression (applied for 3 countries); 2-level random intercept logistic regression (applied for 36 countries).

Results: Monthly variations in food intake among students from Canada, England, and Norway, where data collection took place almost all months of the school year, revealed significantly lower daily consumption of food items in January to February. A 2-level random intercept logistic regression model for 36 countries, where questionnaires were administered in relatively shorter periods, indicated the lowest likelihood of fruit and soft drink consumption when the data were collected in March to April ($\beta = -0.30$; $P = .006$, compared with October to December) and in January to February ($\beta = -0.65$; $P = .018$, compared with May to June), respectively.

Conclusions and Implications: The chronological period of data collection must be considered when comparing children's reported food consumption, but this effect is small relative to cross-national variations in dietary patterns.

Key Words: children, diet surveys, time of year variation, multilevel analysis (*J Nutr Educ Behav*. 2014;46:359-369.)

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INTRODUCTION

Identifying habitual food consumption patterns is critical for epidemiologic investigations. In many studies, data are collected during relatively short periods of the year; however, consumption of individual food items can vary throughout the year. Failure to account for this variability may obscure associations between dietary consumption and disease risk.[1-3]

Substantial time of year differences in intake of fruits and vegetables have been documented.[1,4-7] For instance, 303 people from northwestern Spain, aged 19–40 years, were asked to record their food intake twice (in winter and summer) during 1 year using the 7 non–consecutive-day dietary record method; consumption of most fruits and vegetables and some milk products showed significant seasonal differences, including 5.3% higher fruit intake and 9.6% higher vegetable intake in summer among Spanish females.[4] Smolkova et al[5] administered a food frequency questionnaire to 164 male Slovak subjects in February to March and September to October for 2 consecutive years; they reported that vegetable consumption was twofold higher during September to October. There have been some studies of time of year variation in children's physical activity, as well.[8] Findings from these studies suggest the importance of taking time of year effects into account in future nutrition studies. Monthly differences could affect interpretation of clinical trials with dietary outcomes and epidemiological studies comparing group data gathered at different times of the year. Furthermore, identifying the effect of monthly variations in data collection will make it easier to examine the influence of country differences in food policy, systems, and

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culture, unrelated to period of observation.

Children's fruit and vegetable consumption is frequently used as an indicator of a healthy diet.[9-11] In addition, excessive intake of soft (sugar-sweetened) drinks, sweets, and chips is an important indicator of a less-healthy diet, rich in sugar and fat.[12-15] Evidence suggests that diets low in fruit and vegetable intake but high in sugar and fat put adolescents at increased risk for long-term health problems, such as obesity, cancer, and cardiovascular disease.[9,16,17] Although several researchers have hypothesized seasonal variation in consumption of fruits, vegetables, and soft drinks, to the researchers' knowledge, time of year variation in consumption of these food items has not been studied among children and adolescent populations.[4,18] Moreover, comparison between dietary studies of young populations is difficult because of differences in the chronological period of data collection, even with identical measurements of dietary habits. In addition, time of year variations across food groups could have implications for the timing of interventions targeting children's dietary patterns.

The Health Behaviour in School-Aged Children (HBSC) study was among the first international surveys of adolescent health.[19,20] The HBSC survey questions covered a range of health indicators and health-related behaviors as well as the life circumstances of young people.[21] The HBSC Food Frequency Questionnaire included 4 food items (fruits, vegetables, sweets or chocolates, and soft drinks) in the national questionnaires of 39 countries or regions participating during the 2009–2010 school year. Comparison of HBSC data between countries revealed a wide variation in food consumption.[22] To explain these variations, varied hypotheses were tested, including socioeconomic differences.[23] However, an additional component of variation (bias) originating from different chronological periods of data collection in participating countries has not been explored, even though the study protocol provided a wide time range for fieldwork, from September to June (2009–2010 school year).[24]

The current study examined to what extent the monthly period during which dietary data are collected accounts for country differences in rates of fruit, vegetable, sweets, and soft drink consumption, and whether these differences are sufficient to influence epidemiologic and intervention studies involving school-aged children and adolescents.

METHODS

Participants and Procedure

The HBSC 2009–2010 cross-national survey was completed in 37 European countries and regions (ie, Flemish Belgium), the US, and Canada.[22] Researchers strictly followed the standardized international research protocol[23] to ensure consistency in survey instruments, data collection, and procedures. Methodological details are provided elsewhere.[19-22,24]

The study was supported by the World Health Organization (Europe); it conformed to the principles outlined in the Declaration of Helsinki and was approved by the national ethics committee for biomedical research. National and local educational institutions agreed to the study protocol.

The population selected was a representative sample of 11-, 13- and 15-year-olds with mean ages of 11.5, 13.5, and 15.5 years, respectively, and a recommended sample size of approximately 1,500 students per age group in each country.[24] In practice, many countries chose to sample more than the minimum sample size in each age group to increase precision of estimates in subpopulations.

Participants were selected using a clustered hierarchical sampling design, in which the initial sampling unit was the school class (except Iceland and Greenland, where a census survey approach was considered because of small populations of young people in those countries). Standardized questionnaires, including core questions that were identical in all participating countries, were administrated in school classrooms.[20] This was carried out by schoolteachers in some countries and by professional fieldworkers or members of school health teams in others. The analytic sample included 209,320 students from 39 countries. Table 1 describes the sample and data collection period for each country.

Measures

In all countries, students completed a validated, self-administered food frequency scale asking how many times a week they ate fruits, vegetables, sweets and chocolates (labeled "sweets"), and sweetened soft drinks (cola or other soft drinks that contain sugar). Possible responses were: "never," "< 1/wk," "about 1/wk," "2–4 d/wk," "5–6 d/wk," "once every day", or "every day, more than once". Responses were recoded into dichotomous outcome variables (1 = daily; 0 = less than daily) as was accepted according to the HBSC study protocol.[24]

Explanatory variables were gender, age (11, 13, and 15 years), family material wealth, and the period of data collection. Family material wealth was measured using the Family Affluence Scale (FAS), assessing a 3-point (low, middle, and high) ordinal family affluence scale.[25] Respondents recorded the month and year of data collection. According to the period of data collection, countries were classified into 5 groups. Group 1 consisted of 3 countries (Canada, England, and Norway) in which the collection of data had a long duration. Respondents from those countries were assessed during 4 periods of data collection: September to December ($MONTH_1$) of 2009, and January to February ($MONTH_2$), March to April ($MONTH_3$), or May to June ($MONTH_4$) of 2010. The remaining 36 countries comprised 4 groups classified into the same 4 periods of data collection as for Canada, England, and Norway, based on the median of the month of data collection. A country-specific (country-level) explanatory variable MONTH was composed for multilevel analysis, indicating a monthly period of national data collection. In all analyses, September to December ($MONTH_1$) was selected as a reference monthly period.

Data Analysis

Gender-, age-, and FAS-adjusted rates of dichotomized food intake (estimated marginal means) for each country and the variance between countries were estimated using the univariate procedure from General Linear Models. To get an overall picture of the relationship between estimated means and