

U.S. and France Fruit and Vegetable Consumption Patterns in Adolescents:

An International Comparison

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Background

- The health benefits derived from consuming a diet high in fruits and vegetables have long been established.
- Fruits and vegetables contain many phytochemicals, vitamins, and nutrients that are important for good overall health.
- The World Cancer Research Fund (WCRF) estimates that between 30-40% of global cancers could be prevented by a change in dietary regime.
 - Body Mass Index (BMI) is an important determinant in modulating cancer risk.
- High consumption may be associated with lower BMI and a decreased prevalence of obesity, select forms of cancer, and other chronic illnesses.
 - Critical—considering obesity rates among adolescents are growing in France and currently a norm in the United States.
- Unlike the U.S., France only recently established federal health agencies, which sets dietary guidelines with comparable fruit and vegetable recommendations, in an effort to increase awareness and thwart the documented increase in obesity and associated co-morbidities.
 - Consequently, the nutritional status of the French is still relatively unknown and data are scant.
- Moreover, there are no known direct international comparisons of this nature on fruit and vegetable intake and related factors between France and the U.S.

Materials and Methods

Nationally Representative Questionnaires

- U.S.:**
 - 2001-2002 National Health and Nutrition Examination Survey (NHANES), administered by the National Center for Health Statistics, evaluates the health and dietary status of U.S. adults, adolescents, and children.
 - Includes both in-person interviews (24-hour recall) and physical examinations
 - Composed of 11,039 persons, aged six months-85+ years (for our purpose, we concentrated on adolescents 12-19 years with complete data: n = 2,257)
 - Coding: 575 distinct foods identified (322 food codes classified as fruits into 23 categories; 842 food codes classified as vegetables into 34 categories)
- France:**
 - 2002 Nutrition Barometer Survey (NBS), administered by L'Institut National de Prévention et d'Éducation pour la Santé, examines changes and progression in behaviors, knowledge, and attitudes with regard to food in the French population.
 - Includes a single 24-hour recall, a dietetic history, a food frequency questionnaire, as well as a 2-week food recall
 - Composed of 3,153 persons, aged 12-75 years (for our purpose, we concentrated on adolescents 12-19 years with complete data: n = 347)
 - Coding: 635 distinct foods identified (47 food codes classified as fruits; 71 food codes classified as vegetables)

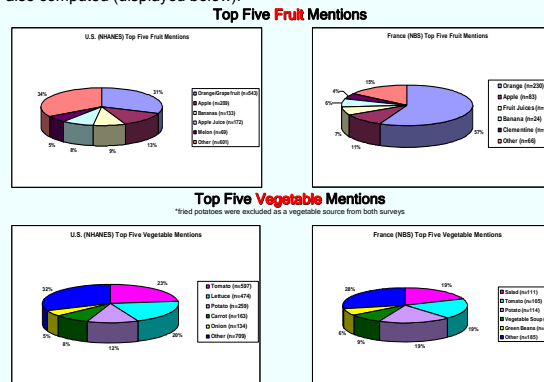
*For our purpose, we used only a single 24-hour recall for both surveys.

Statistical Analyses

- Analyses were performed using SUDAAN software package (version 9.1).
- Surveys were treated as stratified cluster samples and analyzed separately due to differences in weighting schemes and because the two instruments were carried out independently.
- Mean daily consumption frequency was examined in each survey for fruits, vegetables, and their sum (overall, and stratified by gender).
- Predicted marginal means were used to assess differences in consumption frequency between the two countries controlling for one demographic variable at a time.

Descriptive Analysis

- Main study variable: consumption frequency
- Estimated daily frequencies of fruit and vegetable consumption were computed for each child by summing 24-hour recall mentions of food codes previously identified as fruits or vegetables.
- Top five most commonly consumed fruits and vegetables in NHANES and NBS were also computed (displayed below):



Population Characteristics

- Table 1** presents a breakdown of demographic and other variables in the target populations of interest in the two countries; results are as follows:
 - Gender and Age:** The two countries are comparable on these two demographic dimensions; the proportion of girls is approximately 50% for both countries and the mean ages are also similar: 15.30 (U.S.) and 15.65 (France) (age was not categorized for analysis).
 - Body Mass Index (BMI):** The distributions of BMI in the two countries are strikingly different: only 66.62% of the U.S. population is of normal weight compared to 92.06% of the French population.
 - Day of Intake:** While not a demographic variable per se, note that nearly 67.92% of NHANES participants' 24-hour recall or "Day of Intake" fell on a weekend (Friday, Saturday, or Sunday); a more even split between weekend and weekday was observed in NBS. Because diets may vary between weekend and weekday, we controlled for this variable in our analyses.

Table 1. Sample characteristics by country

Characteristic	U.S. (NHANES) n = 2257			France (NBS) n = 347			P*
	n	%	S.E.	n	%	S.E.	
Gender							
Girls	1135	49.31	1.39	179	49.46	2.90	0.9989
Boys	1122	50.69	1.39	168	50.54	2.90	0.9989
Body Mass Index (BMI)							
Normal	1434	66.62	1.24	320	92.06	1.58	<0.001
Risk of Overweight	374	15.50	0.91	21	6.57	1.49	<0.001
Overweight	449	17.88	1.12	6	1.38	0.57	<0.001
Day of Intake							
Weekend	1572	67.92	1.32	159	46.75	2.90	<0.001
Weekday	685	32.08	1.32	188	53.25	2.90	<0.001

*P: indicates p-value for t-test of difference between France and U.S.

Results

- Table 2 reveals predicted marginal means for overall fruit and vegetable consumption by gender and country; significant (p<.05) differences between countries are highlighted in green.
- BMI:** A negative correlation between BMI and fruit and vegetable consumption frequency was found for U.S. girls and boys. The differences in predicted marginal means for overall fruit and vegetable consumption across BMI groups were significant for U.S. and French girls and U.S. boys (p < .05).
- In general, when controlling for included covariates and demographic subgroups, the predicted marginal mean frequency of overall fruit and vegetable intake, in addition to fruit intake and vegetable intake separately, shows significant differences between U.S. and French boys as well as U.S. and French girls in the BMI normal and risk of overweight categories.

Table 2. Predicted marginal of fruit and vegetable consumption by gender and country

	Girls		Boys					
	U.S. (NHANES) n = 1135	France (NBS) n = 179	U.S. (NHANES) n = 1122	France (NBS) n = 168				
	Mean	(S.E.)	Mean	(S.E.)	Mean	(S.E.)	Mean	(S.E.)
Body Mass Index (BMI)	P=0.0357		P=0.0455		P=0.0057		P=0.5097	
Normal	2.06	(0.09)	3.27	(0.16)	1.79	(0.16)	2.93	(0.18)
Risk of Overweight	1.63	(0.22)	2.55	(0.27)	1.80	(0.22)	3.13	(0.37)
Overweight	1.56	(0.15)	5.42	(3.47)	1.26	(0.12)	2.08	(0.82)
Day of Intake	P=0.0986		P=0.2733		P=0.2540		P=0.3998	
Weekend	2.02	(0.10)	3.08	(0.20)	1.75	(0.14)	3.08	(0.23)
Weekday	1.67	(0.15)	3.42	(0.24)	1.57	(0.14)	2.80	(0.24)

*P: indicates p-value for significant contribution of this variable to the final regression model

Discussion

- Initial comparison of group demographics showed significant differences in BMI distribution between U.S. and French adolescents.
- The results show that higher consumption frequency is associated with lower levels of BMI for U.S. boys and girls.
- Examination of the predicted marginal mean frequencies supports our hypothesis that, in many instances, French girls and boys consume fruits and vegetables more frequently than their U.S. counterparts, even when demographic and BMI differences are taken into account.
- Survey limitations only permitted us to look at mentions of fruits and vegetables rather than serving sizes; additionally, sample sizes between the two populations varied, which may have masked potential significant differences in the overweight BMI category. Still, this study may be an important first step in determining some of the influential factors that may affect various populations' fruit and vegetable intake.

Implications

- Additional research could help explain the differences found in fruit and vegetable consumption frequency.
- Country-specific factors not assessed in these two surveys should include cultural influences and presence of public health initiatives.
- Such research may help suggest policy changes and interventions that could help increase overall fruit and vegetable intake among adolescents.

Acknowledgments

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*Complete reference list available upon request.

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