

Improved Diet Quality and Increased Nutrient Intakes Associated with Grape Product Consumption by U.S. Children and Adults: National Health and Nutrition Examination Survey 2003-2008

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Abstract

The associations between grape product consumption (defined as fresh grapes, raisins or 100% grape juice) and dietary intake were examined in children (2-19 years) and adults (20+ years) using National Health and Nutrition Examination Survey 2003-2008 data. Grape consumers (GC) (n=2,975) were individuals who mentioned grape products during the 24-hour dietary recall interviews. Least square mean food groups and nutrient intakes by GC and non-grape consumers (NGC) (n=18,898) were compared. There were no significant differences between GC and NGC in energy intake. Healthy Eating Index-2005 scores by GC were higher (p<0.01) than NGC among children (54.6±0.7 vs 49.4±0.3) and adults (57.5±0.5 vs 51.2±0.3). Among both age groups, GC had higher intakes of total fruit and whole fruit (p<0.01) than NGC, and lower intakes of solid fat (p<0.05 children, p<0.01 adults), added sugars (p<0.01) and calories from solid fat/alcohol/added sugars (SoFAAS) (p<0.01). Adult GC had higher intakes than NGC of total and dark green/orange vegetables (p<0.01). Children and adult GC had higher intakes than NGC of dietary fiber, vitamin A, vitamin C, calcium, magnesium and potassium (p<0.01) and vitamin B6 (p<0.05 children, p<0.01 adults). Adult GC had lower intakes of total fat, saturated fat (p<0.01) and cholesterol (p<0.05) and higher intakes of vitamin E, thiamin, folate and iron (p<0.01). Children and adult GC had significantly greater intakes of three nutrients of concern from the 2010 Dietary Guidelines for Americans: dietary fiber, calcium and potassium. Grape product consumption is associated with increased nutrient intakes and a healthier dietary pattern among the U.S. population. Supported by National Grape & Wine Initiative

Background

- The Dietary Guidelines for Americans 2010 (DGA 2010) encourage increased intakes of fruit and vegetables.¹
- Consumption of 100% fruit juice, grapes and dried fruit has been associated with improved diet quality in children and adults^{2,3}
- Previous NHANES analyses have reported increased nutrient intakes and improved dietary patterns in children and adult purple/blue produce and grape juice consumers.³

Purpose

To examine the relationship between consumption of grapes, in the non-alcoholic forms most commonly consumed – fresh grapes, raisins and 100% grape juice – and diet quality or nutrient intakes in a recent, nationally representative sample of US children and adults.



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Results

Table 1. Healthy Eating Index (HEI) and adjusted^a mean^b food group servings by consumption of grapes, raisins or grape juice at least once in 2 days^c

Food Group	Children 2-19 years		Adults 20+ years	
	Consumers (n=1,400)	Non-consumers (n=8,222)	Consumers (n=1,575)	Non-consumers (n=10,676)
HEI-2005	54.6±0.7**	49.4±0.3	57.5±0.5**	51.2±0.3
Total Fruit (cup)	1.64±0.05**	0.99±0.03	1.64±0.06**	0.89±0.03
Whole Fruit (cup)	0.94±0.06**	0.48±0.02	1.05±0.04**	0.56±0.02
Total Vegetables (cup)	1.00±0.04	1.06±0.02	1.79±0.05**	1.60±0.02
Dark Green/Orange Vegetables (cup)	0.10±0.01	0.09±0.01	0.25±0.02**	0.17±0.01
Total Grains (oz)	6.59±0.11*	6.86±0.07	6.68±0.10	6.73±0.05
Whole Grains (oz)	0.54±0.04	0.48±0.02	0.87±0.05**	0.66±0.02
Milk Group (cup)	2.26±0.06	2.17±0.03	1.59±0.04	1.57±0.03
Meat Group (oz)	4.34±0.12	4.14±0.06	6.04±0.15	6.08±0.07
Nuts & Seeds (oz)	0.36±0.04	0.41±0.03	0.86±0.09*	0.61±0.03
Solid Fat (g)	45.5±0.06*	47.1±0.4	42.7±0.5**	46.8±0.3
Added Sugars (tsp)	18.3±0.5*	21.6±0.3	16.8±0.4**	18.9±0.4
SoFAAS (kcal)	709±12**	775±4	738±10**	822±6

^aCovariates in analyses of food groups include energy, gender, race-ethnicity, and age. ^bMean ± Standard Error of the Mean (SEM). ^cNHANES 2003-2008 participants completing 2 recalls, excluding pregnant/lactating females. *p<0.05. **p<0.01 for difference between consumers and nonconsumers

Table 2. Adjusted^a mean^b nutrient intake by consumption of grapes, raisins or grape juice at least once in 2 days^c

Nutrient	Children 2-19 years		Adults 20+ years	
	Consumers (n=1,400)	Non-consumers (n=8,222)	Consumers (n=1,575)	Non-consumers (n=10,676)
Food Energy (Kcal) ^d	2,067±28	2,026±14	2,196±31	2,161±15
Protein (g)	72.2±0.9	70.6±0.4	83.0±0.8	83.0±0.4
Total fat (g)	74.3±0.6	75.7±0.4	79.5±1.0**	83.0±0.4
Saturated fat (g)	26.2±0.3	26.6±0.2	26.0±0.4**	27.6±0.1
Cholesterol (mg)	231±9	225±3	276±8*	293±3
Carbohydrate (g)	274±2	272±1	272±3**	259±1
Dietary Fiber (g)	13.9±0.3**	12.8±0.1	17.8±0.3**	15.4±0.2
Vitamin A (µg RAE)	621±17**	571±9	670±14**	605±10
Vitamin E (mg AI)	5.8±0.1	6.0±0.1	8.1±0.2**	7.3±0.1
Vitamin C (mg)	100.2±3.0**	82.7±1.6	116.4±4.1**	81.0±1.6
Thiamin (mg)	1.62±0.03	1.57±0.01	1.77±0.03**	1.64±0.02
Riboflavin (mg)	2.22±0.04*	2.12±0.02	2.28±0.03	2.24±0.01
Niacin (mg)	21.5±0.4	21.3±0.2	25.5±0.4	25.0±0.2
Vitamin B6 (mg)	1.81±0.04*	1.71±0.02	2.09±0.03**	1.94±0.02
Total Folate (µg)	391±8	379±3	431±8**	399±4
Vitamin B12 (µg)	5.3±0.1	5.1±0.1	5.3±0.2	5.3±0.1
Calcium (mg)	1,053±19**	996±10	954±13**	911±10
Phosphorous (mg)	1,284±16**	1,244±7	1,355±11	1,333±7
Magnesium (mg)	241±3**	228±2	315±3**	289±3
Iron (mg)	14.9±0.2	14.7±0.1	16.5±0.2**	15.5±0.1
Zinc (mg)	11.0±0.2	10.9±0.1	12.1±0.1	12.3±0.1
Sodium (mg)	3,072±38	3,144±3	3,421±42	3,476±15
Potassium (mg)	2,414±32**	2,189±18	2,931±29**	2,664±17

^aCovariates in analyses of nutrients include energy, gender, race-ethnicity and age. ^bMean ± Standard Error of the Mean (SEM). ^cNHANES 2003-2008 participants completing 2 recalls, excluding pregnant/lactating females. ^dGender, race-ethnicity and age were covariates in analysis of energy (Kcal). *p<0.05. **p<0.01 for difference between consumers and nonconsumers

Methods

Subjects

- 2003-2008 NHANES participants age 2 years and older (n = 21,873) with reliable 24-hour dietary interviews meeting minimum criteria.
- Participants were divided into two age groups: (1) children and adolescents 2 to 19 years of age (n=9,622) and (2) adults 20 years and older (n=12,251)

Description of Dataset

- NHANES is a continuous survey conducted by the National Center for Health Statistics with survey data released every two years.
- The grape category included fresh grapes, raisins and 100% grape juice
- Grape consumers were defined as those who mentioned any of the items in the grape category during the 24-hour dietary recall

Analysis

- Sample-weighted data were used in all statistical analyses, and all analyses were performed using SUDAAN Release 10.0.1 (Research Triangle Institute, Research Triangle Park, NC) to adjust the variance for the clustered sample design.
- Least square means and standard errors of the mean were calculated and analysis of variance was conducted to discern differences in the mean level of these parameters, after adjusting for covariates
- Healthy Eating Index 2005 (HEI-2005) was calculated based on each individual's intake of MyPyramid food groups and nutrients to limit

Conclusions

- Consumers of grape products (fresh grapes, raisins and 100% grape juice) had higher HEI-2005 scores along with increased intakes of total and whole fruit, dietary fiber, vitamins A, C, B6, calcium, magnesium and potassium
- Children and adult grape consumers had lower intakes of solid fat, added sugars and calories from SoFAAs
- Adult grape consumers also had increased intakes of vegetables, whole grains, and nuts and seeds along with lower intakes of total fat, saturated fat and cholesterol
- Grape consumers had greater intakes of three nutrients of concern from the DGA 2010: dietary fiber, calcium and potassium
- Grape product consumption is associated with increased nutrient intakes and a healthier dietary pattern among the U.S. population.

References

1. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th Edition, Washington, DC: U.S. Government Printing Office, December 2010.
2. Keast DR, O'Neil CE, Jones JM. 2011. Dried fruit consumption is associated with improved diet quality and reduced obesity in US adults: National Health and Nutrition Examination Survey, 1999-2004. Nutr Res.31:460-467.
3. McGill CR, Wightman JD, Fulgoni SA, Fulgoni III VL. Consumption of purple/blue produce is associated with increased nutrient intake and reduced risk for metabolic syndrome: results from the National Health and Nutrition Examination Survey 1999-2002. Am J Lifestyle Med. 2011;5:279-90.