How have the national estimates of dietary sugar consumption changed over time among specific age groups from 2007 to 2012?

DATA FROM THE NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY (NHANES) CYCLES 2007-2008, 2009-2010 & 2011-2012

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NHANES Research Project

NTR 555 Nutrition in Epidemiology

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Background & Rationale

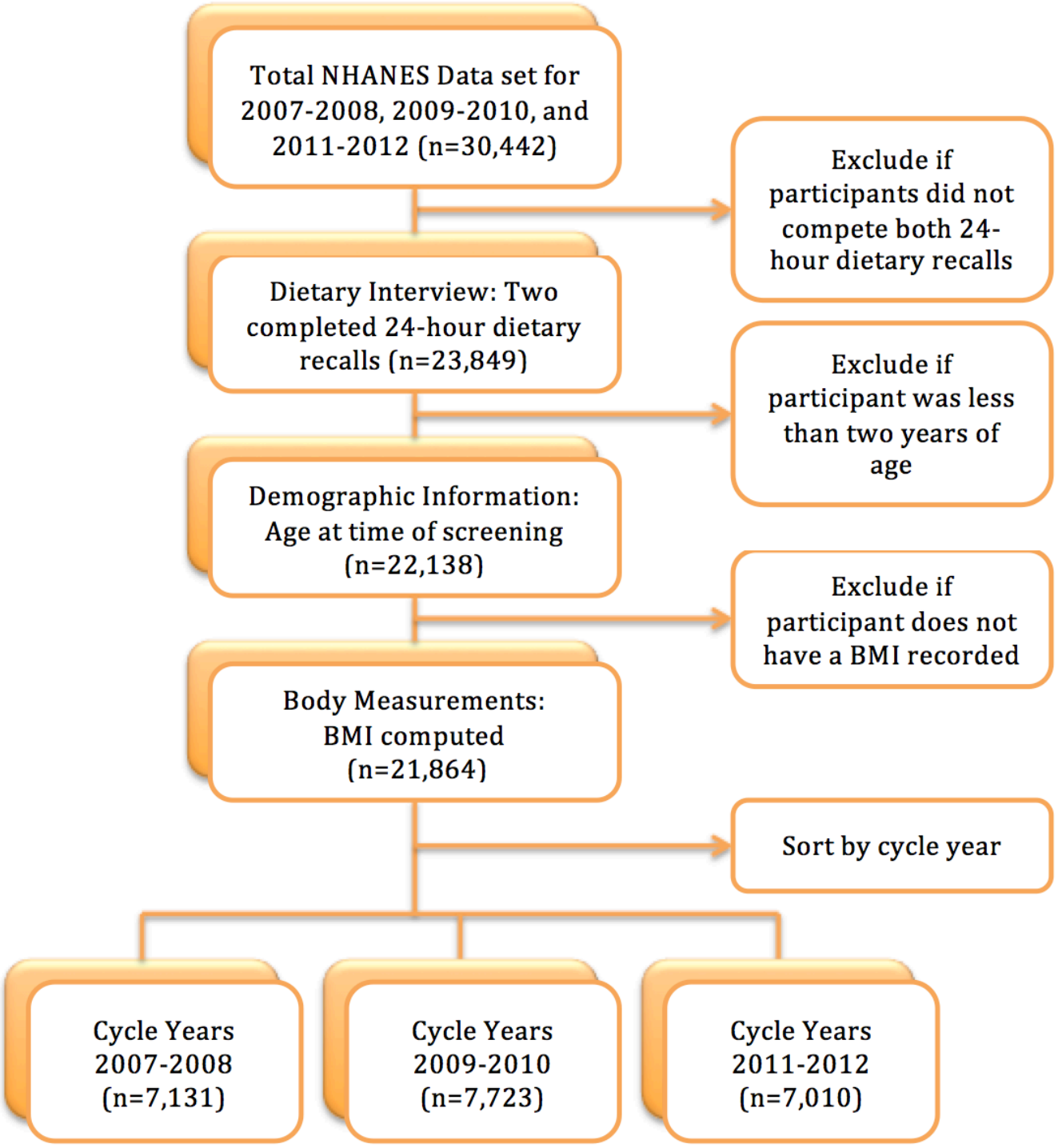
- In 2009-2010, the prevalence of obesity was 35.5% among adult men and 35.8% among adult women [7]
- In children and adolescents, the prevalence of high weight-for-recumbent weight was 9.7% for infants and toddlers and 16.9% of children between the ages of 2 and 18 were obese [8]
- There were no significant changes in the prevalence of obesity in US adults from 1999 to 2008 [7]
- There was a significant increase in prevalence of obesity in boys from 1999 to 2008 [8]

Objectives

1. To determine the changes over time of sugar intake (as a percentage of calories from sugar) using a nationally representative sample of the United States population (NHANES 2007-2012).

2. To examine the demographic distribution of participants and differences in sugar consumption between demographic variables using a nationally representative sample of the United States population (NHANES 2007-2012).

Study Sample



Outcome Variables

- **Gender**
  - Responses to RIAGENDR
    - 1 = male
    - 2 = female
- **Age**
  - Responses to RIDAGEYR
  - Number of Years ≥ 2 and collapsed
    - 1 = 2-5 years
    - 2 = 6-11 years
    - 3 = 12-17 years
    - 4 = 18-34 years
    - 5 = 35-54 years
    - 6 = ≥ 55 years
- **Race/Ethnicity**
  - Responses to RIDRETH1
    - 1 = Non-Hispanic White
    - 2 = Non-Hispanic Black
    - 3 = Mexican American
    - 4 = Other Hispanic
    - 5 = Other Race
- **Education Level**
  - Responses to DMDEDUC2 (Reference Adult)
    - 1 = Less than 9th grade
    - 2 = 9-11th grade
    - 3 = High school graduate/GED
    - me college or AA graduate
    - 5 = College graduate or above
- **BMI Classification**
  - Responses to BMXBMI
  - Range of values from 12.4 to 82.1 (collapsed)
    - 1 = Underweight (<18.5)
    - 2 = Normal (18.5-24.9)
    - 3 = Overweight (25.0-29.9)
    - 4 = Obese Class I (30.0-34.9)
    - 5 = Obese Class II (35.0-39.9)
    - 6 = Extreme Obesity (≥40.0)

Data Analysis

- Frequencies [n, (%)] were used to determine demographic characteristics for the categorical variables
- Objective 1: ANOVA tests were performed to examine the differences of sugar intake (represented as a percent of calories from sugar) in each age group between the cycle years
- Objective 2: ANOVA tests were performed to examine differences in sugar intake (represented as a percent of calories from sugar) among demographic variables

Table 1: Demographic Variables Defined by Cycle Year (n=21,864)

	2007-2008 (n = 7,131)	2009-2010 (n= 7,723)	2011-2012 (n= 7,010)
Gender, n (%)			
Male	3519 (49.3)	3771 (48.8)	3451 (49.2)
Age, n (%)			
2-5 years	650 (9.1)	700 (9.1)	693 (9.9)
6-11 years	897 (12.6)	960 (12.4)	1,025 (14.6)
12-17 years	757 (10.6)	833 (10.8)	798 (11.4)
18-34 years	1,240 (17.4)	1,449 (18.8)	1,366 (19.5)
35-54 years	1,564 (21.9)	1,773 (23.0)	1,455 (20.8)
≥ 55 years	2,023 (28.4)	2,008 (26.0)	1,673 (23.9)
Race/Ethnicity, n (%)			
Non-Hispanic White	3,074 (43.1)	3,424 (44.3)	2,284 (32.6)
Non-Hispanic Black	1,572 (22.0)	1,395 (18.1)	1,930 (27.5)
Mexican American	1,393 (19.5)	1,655 (21.4)	930 (13.3)
Other Hispanic	830 (11.6)	808 (10.5)	725 (10.3)
Other Race	262 (3.7)	441 (5.7)	1,141 (16.3)

Education Level[□], n (%)	**(n=4,618)**	**(n=4,982)**	**(n=4,252)**
Less than 9th Grade	565 (7.9)	576 (7.5)	358 (5.1)
9-11th Grade (includes 12th grade with no diploma)	792 (11.1)	764 (9.9)	581 (8.3)
High School Grad/GED or equivalent	1,154 (16.2)	1,135 (14.7)	874 (12.5)
Some College of AA Degree	1,212 (17.0)	1,434 (18.6)	1,303 (18.6)
College Graduate of Above	895 (12.6)	1,073 (13.9)	1,136 (16.2)
Household Income, n (%)	**(n=6,911)**	**(n=7,379)**	**(n=6,738)**
< $20,000	1,573 (22.1)	1,599 (20.7)	1,624 (32.2)
$20,000-$54,999	3,008 (42.2)	3,207 (41.5)	2,734 (39.0)
< $55,000	2,330 (32.7)	2,573 (33.3)	2,380 (34.0)
BMI Classification[†], n (%)	**(n=4827)**	**(n=5230)**	**(n=4494)**
Underweight (<18.5)	86 (1.8)	82 (1.6)	94 (2.1)
Normal (18.5-24.9)	1,325 (27.4)	1,407 (26.9)	1,343 (29.9)
Overweight (25.0-29.9)	1,654 (34.1)	1,741 (33.3)	1,425 (31.7)
Obese Class I (30.0-34.9)	1,021 (21.2)	1,126 (21.5)	904 (20.1)
Obese Class II (35.0-39.9)	445 (9.2)	500 (9.6)	406 (9.0)
Extreme Obesity (≥40.0)	296 (6.1)	374 (7.2)	322 (7.2)

[◇]PIR – Poverty-to-Income Ratio; <1.3 is low income, 1.3-3.5 is middle income, and >3.5 is high income.

[□]Education Level includes only participants 20 years and older.

† Only BMI for participants 18 years and older will be used for BMI classifications.

Table 2: Changes in Sugar Intake Over Time Categorized by Age Group (n=21,853)

	Cycle 2007-2008		Cycle 2009-2010		Cycle 2011-2012	
	Sample (n)	Percent of Calories from Sugar, Mean (SD)	Sample (n)	Percent of Calories from Sugar, Mean (SD)	Sample (n)	Percent of Calories from Sugar, Mean (SD)
2-5 years	650	28.5 (7.0)[a]	695	28.5 (6.7)[b]	687	27.0 (6.6)[a, b]
6-11 years	897	26.2 (6.9)[a]	960	25.8 (6.4)[b]	1,025	25.1 (6.2)[a, b]
12-17 years	757	25.3 (8.1)[a]	833	24.7 (7.7)[b]	798	23.7 (7.5)[a, b]
18-34 years	1,240	23.6 (8.8)[a]	1,449	23.4 (9.3)[b]	1,366	22.1 (8.7)[a, b]
35-54 years	1,564	22.2 (9.2)	1,773	22.3 (9.2)[b]	1,455	21.4 (9.4)[b]
≥ 55 years	2,023	21.9 (8.1)	2,008	21.7 (8.2)	1,673	21.5 (8.0)

Significance is set at $p < .05$; a denotes a significant difference between cycle 2007-2008 and cycle 2011-2012; b denotes a significant difference between cycle 2007-2008 and cycle 2011-2012

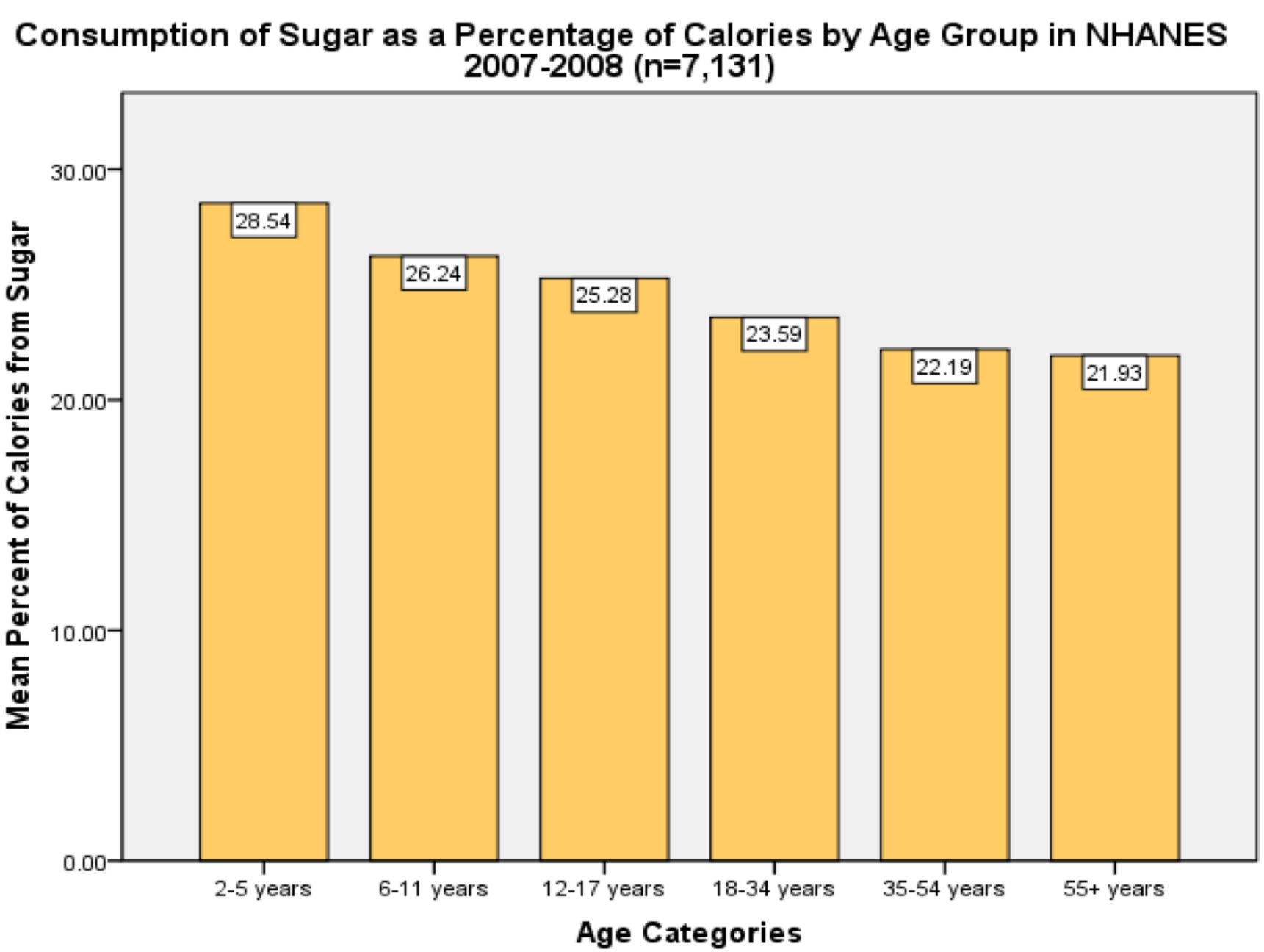


Figure 1. ANOVA analysis indicates a significant difference between age categories (2-5 years, 6-11 years, 12-17 years, 18-34 years, 35-54 years, and $\geq$ 55 years) and sugar intake as a percent of calories ($p < .001$).

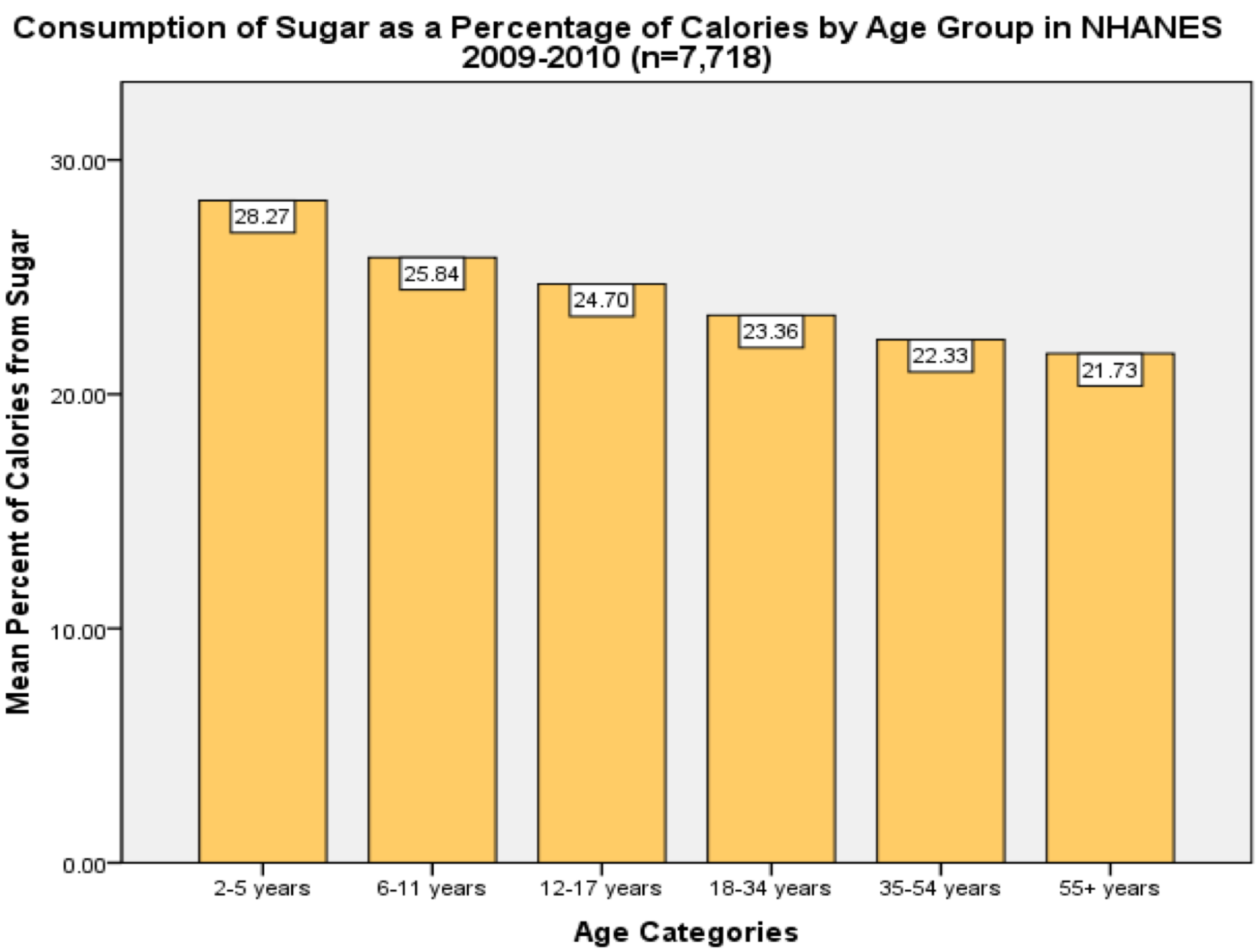


Figure 1. ANOVA analysis indicates a significant difference between age categories (2-5 years, 6-11 years, 12-17 years, 18-34 years, 35-54 years, and $\geq$ 55 years) and sugar intake as a percent of calories in NHANES 2009-2010 data ($p < .001$).

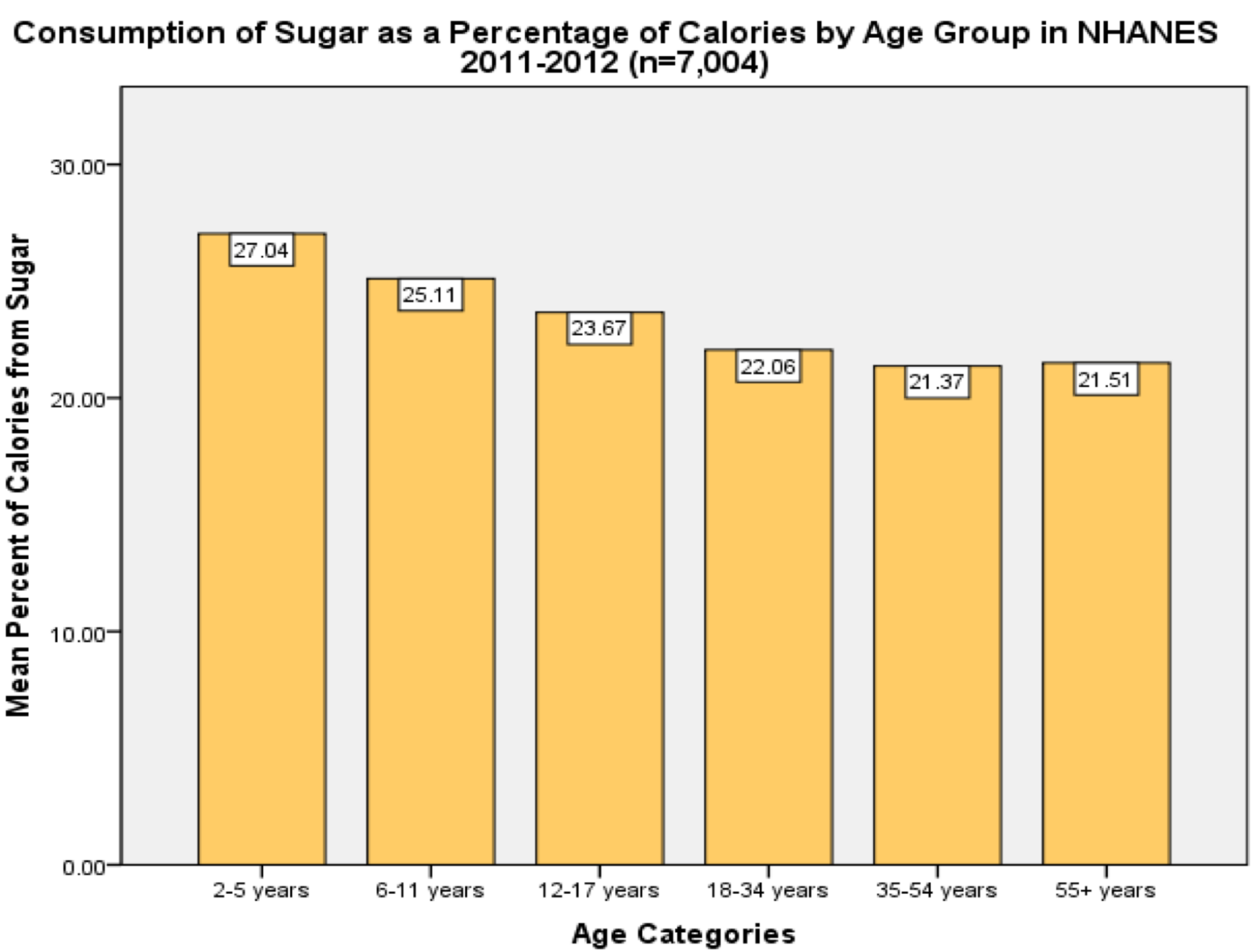


Figure 1. ANOVA analysis indicates a significant difference between age categories (2-5 years, 6-11 years, 12-17 years, 18-34 years, 35-54 years, and $\geq$ 55 years) and sugar intake as a percent of calories in NHANES 2011-2012 data ($p < .001$).

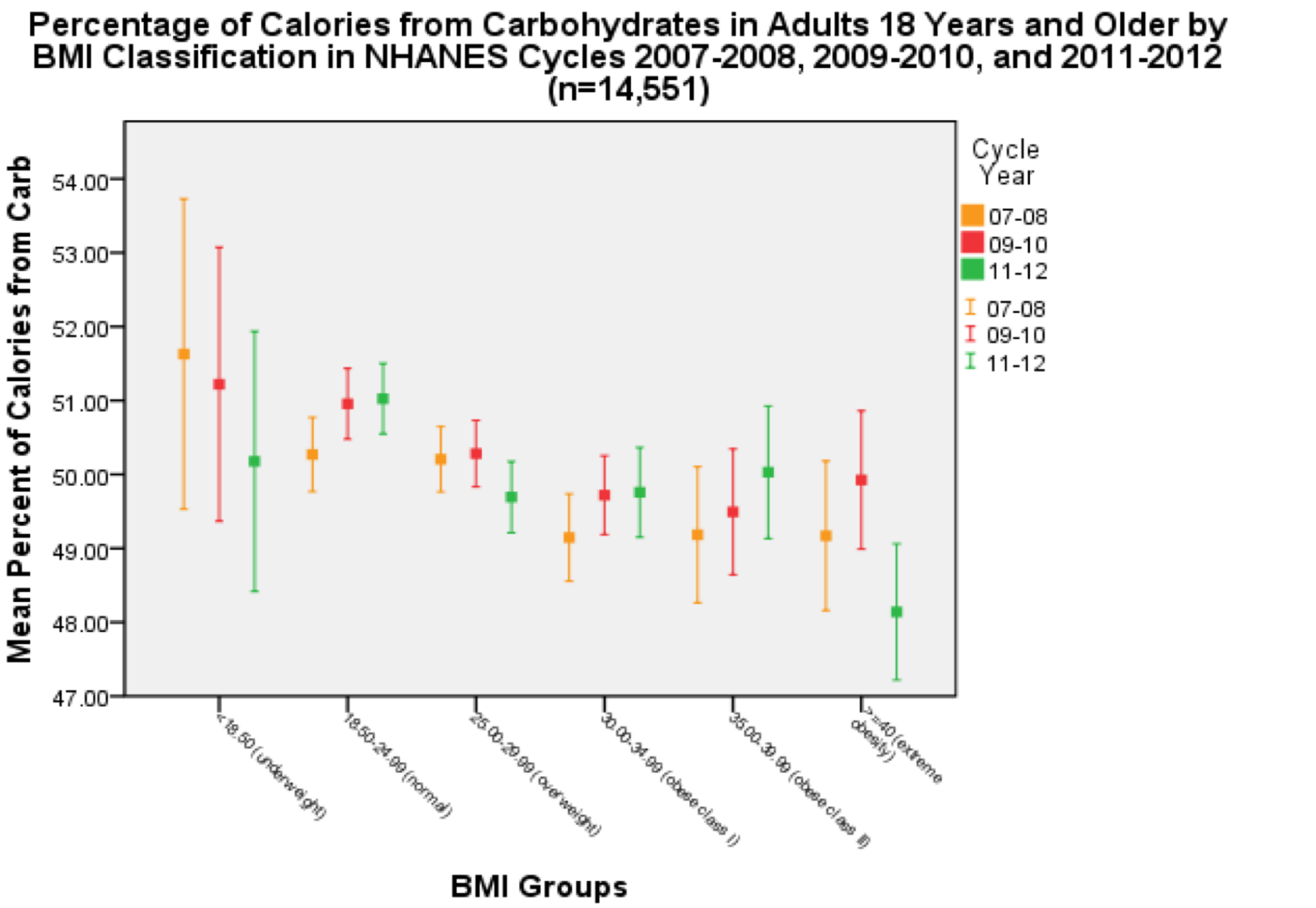


Figure 1. ANOVA analysis indicates a significant difference between BMI categories (underweight, normal, overweight, obese class I, obese class II, and morbid obesity) and carbohydrates as percent of calories in NHANES 2007-2008 ($p = .003$), 2009-2010 ($p = .006$), and 2011-2012 ($p < .001$).

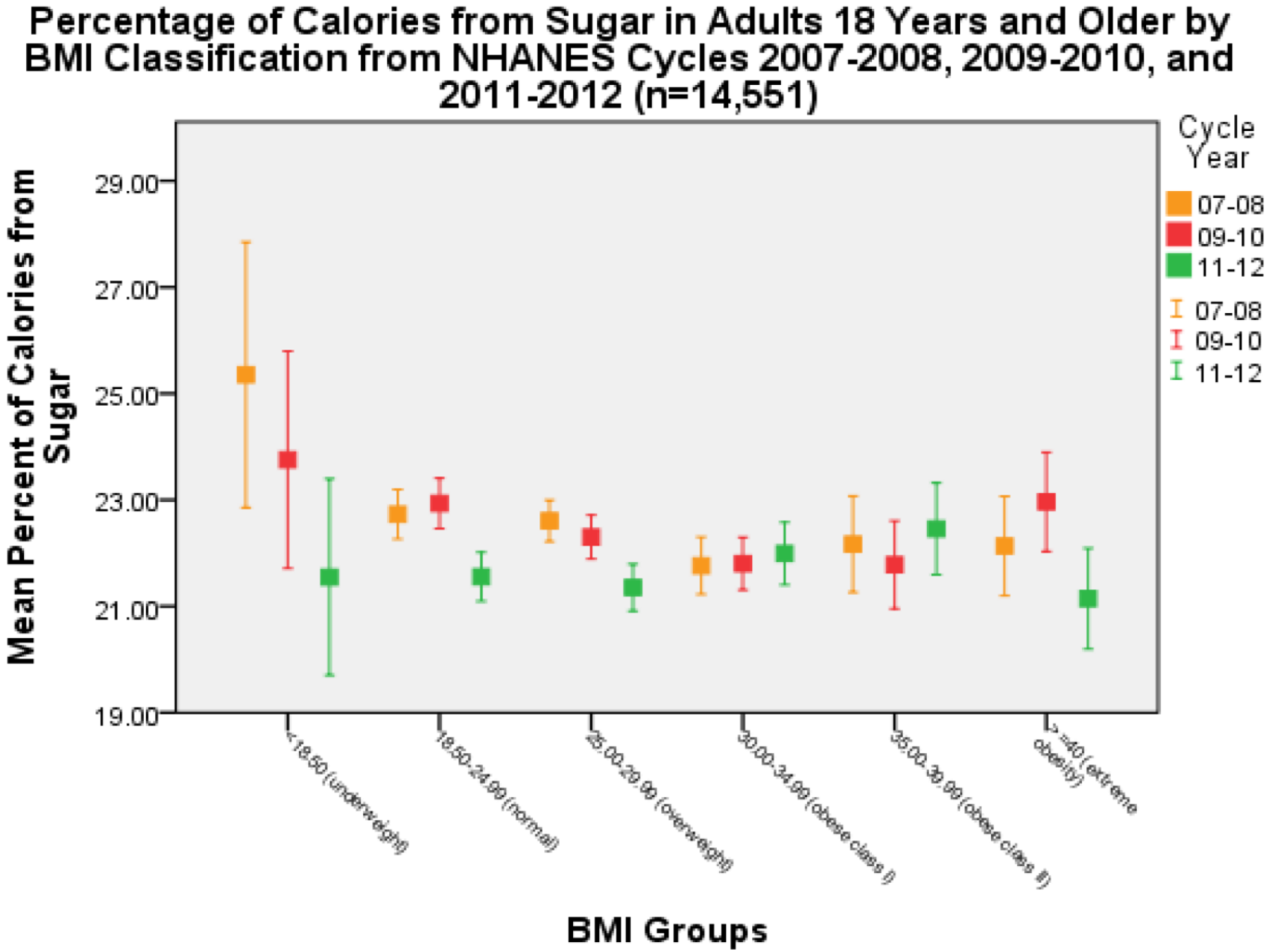


Figure 1. ANOVA analysis indicates a significant difference between BMI categories (underweight, normal, overweight, obese class I, obese class II, and morbid obesity) and sugar intake as percent of calories in NHANES 2007-2008 ($p = .002$) and 2009-2010 ($p = .006$).

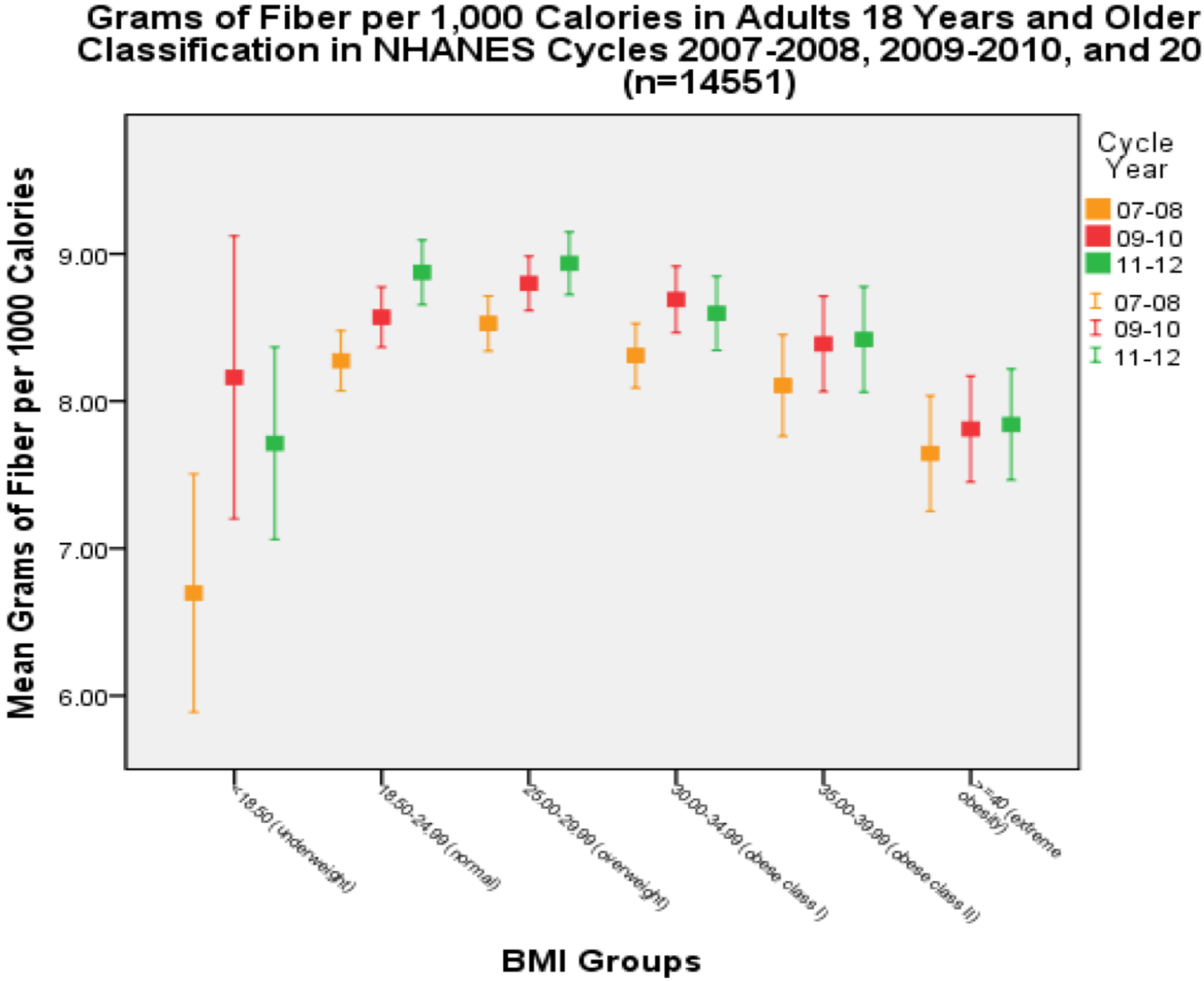


Figure 1. ANOVA analysis indicates a significant difference between BMI categories (underweight, normal, overweight, obese class I, obese class II, and morbid obesity) and fiber in grams per 1,000 calories in NHANES 2007-2008 ($p < .001$), 2009-2010 ($P < .001$), and 2011-2012 ($p < .001$).

Discussion

- From NHANES 2007-2008 cycle to 2011-2012 cycle, sugar as a percentage of total calories decreased in all age groups
- Percent of calories from sugar is higher in lower BMI classifications
  - Mean sugar intake of adults with a BMI < 18.5 (25.4 $\pm$ 11.7 percent, n=86) was significantly higher than the mean sugar intake of adults with a BMI of 30.0-34.9 (21.8 $\pm$ 8.8 percent, n=1021), (p = .017)

Conclusion

- Sugar consumption as a percent of total calories is highest in children aged 2-5
- Obesity has significantly increased in adolescent boys
  - Dietetic professionals can target these two group
- Additional studies need to examine the long-term effects of increased sugar consumption, especially considering the high percentages of calories from sugar in children.

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