The Association Between Avocado Consumption and Diabetes: Results From Encuesta Nacional de Salud y Nutrición (ENSANUT)

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Background

Fruits and vegetables (F&V) have been shown to reduce the risks of diabetes.[1] While understanding the benefits of F&V collectively is valuable, examining the effect of individual F&V is essential because of their unique composition.[2] Avocados contain numerous vitamins, minerals, and phytochemicals, which can support metabolic health (e.g., glycemic response).[3] However, existing studies on avocado and diabetes are limited.

Objective

To examine the association between avocado consumption and diabetes using a subsample of adults (≥ 20 years old) from 2012, 2016, and 2018 Mexico National Survey of Health and Nutrition, known as Encuesta Nacional de Salud y Nutrición (ENSANUT).

Methods

Study population

This is a secondary analysis using a cross-sectional study with a subsample of the Mexican population ≥20 years who were not pregnant or lactating from 2012, 2016, and 2018 ENSANUT.[4-6]

Survey Year	Data Collection Period
2012 ENSANUT	October 2011 to May 2012
2016 ENSANUT-HW (Half-Way)	May to September 2016
2018 ENSANUT	July 2018 to February 2019

Dietary assessment

A validated semi-quantitative food-frequency questionnaire (SFFQ)[7] assessed avocado consumption. Individuals were asked how often in the past seven days (e.g., days per week and times per day) they had consumed avocado and the serving size (e.g., portion size and number of portions) (Figure 1). Those responses were used to calculate grams of avocado consumed per day. We excluded individuals with greater than four standard deviations of the mean, by sex.

Diabetes Medical Diagnosis

Diagnosed diabetes was determined based on the question: "Has a doctor ever told that you have diabetes or high blood sugar?". Participants were considered to have a diagnosis of diabetes if they answered "Yes". A smaller subset of the sample (n=15,349) had either fasting plasma glucose (FPG) or hemoglobin A1c (Hb1AC). Therefore, we conducted a sensitivity analysis using laboratory data. Participants were considered to have a diagnosis of diabetes if Hb1AC ≥ 6.5% or FPG ≥ 126 mg/dL.[8]

Statistical Analysis

Sampling weights were used to account for multiple cycles of complex, multistage surveys for all our statistical analyses. We used logistic regression to examine the association by sex. Model 1 was unadjusted. Model 2 adjusted for age, speaking indigenous language, socioeconomic level, educational level, area of residence, geographic region, marital status, body mass index, physical activity, Healthy Eating Index (HEI − 2015), energy intake, smoker status, alcohol, self-reported diagnosis of hypertension, and self-reported diagnosis of acute myocardial infarction.

Figure 1. Semi-quantitative Food Frequency Questionnaire - Avocado

Results

A total of 25,640 participants were included in the final analysis (Figure 2). There were more women than men (59% vs. 41%). About 45% of the participants were avocado consumers, with an average (standard error) avocado consumption per day of 34.7 (0.9) among men and 29.8 (0.8) among women. Overall, avocado consumers had higher education and socioeconomic levels, were more likely to live in urban areas, and had slightly greater diet quality scores.

Avocado consumers had lower odds of diabetes in both unadjusted and adjusted models among women but not men (Table 1). Findings remained consistent when we used the objective measurement (i.e., FPG or Hb1AC) instead of self-reported diabetes diagnosis to identify those with diabetes (Table 2).

Figure 2. Flow Chart of Eligible Adult Participants

Year 2012 (n=2,824), Year 2016 (n=8,530), Year 2018 (n=16,885) (**n = 28,239**)

Excluded (n = 424)
- Missing diabetes outcome (Year 2012: n=149, Year 2016: n=107, Year 2018: n=168)

Complete diabetes outcome (**n=27,815**)

Excluded (n = 1,781)
- Implausible energy intake (Year 2012: n=257, Year 2016: n=440, Year 2018: n=1,084)

Complete diabetes outcome + plausible energy intake (**n=26,034**)

Excluded (n = 394)
- Implausible avocado intake (>4 standard deviation + mean by sex) (Year 2012: n=0, Year 2016: n=139, Year 2018: n=255)

ENSANUT participants eligible for analysis (Year 2012: n=2,418, Year 2016: n=7,844, Year 2018: n=15,378) (**n=25,640**)

Table 1. Association Analysis Between Avocado Consumption and Diabetes Diagnosis in Mexican Adults

Avocado Consumer	Men		Women	
	Model 1	Model 2	Model 1	Model 2
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	1.192 (0.907-1.566)	0.914 (0.675-1.239)	0.762 (0.639-0.907)	0.792 (0.632-0.993)
P-value	0.2086	0.5641	**0.0023**	**0.0435**

*Diabetes is defined as those who answered yes to "Has a doctor ever told that you have diabetes or high blood sugar?
†Model 1 is unadjusted. Sample sizes were: men (n=10,542) and women (n=15,098).
‡Model 2 adjusted for age, speak indigenous language, socioeconomic level, educational level, area of residence, geographic region, marital status, body mass index, physical activity, health eating index - 2015, energy intake, smoker status, alcohol, hypertension, acute myocardial infarction. Sample sizes were lower because of missing covariates: men (n=8,812) and women (n=12,630).

Table 2. Sensitivity Analysis: Association Analysis Between Avocado Consumption and Diabetes Diagnosis in Mexican Adults

Avocado Consumer	Men		Women	
	Model 1	Model 2	Model 1	Model 2
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	1.063 (0.788-1.434)	1.080 (0.785-1.486)	0.778 (0.629-0.962)	0.712 (0.548-0.924)
P-value	0.6875	0.6365	**0.0206**	**0.0106**

*Diabetes is defined as those with hemoglobin A1c >=6.5 or Glucose≥126
†Model 1 is unadjusted. Sample sizes were: men (n=6,319) and women (n=9,030).
‡Model 2 adjusted for age, speaking indigenous language, socioeconomic level, educational level, area of residence, geographic region, marital status, body mass index, physical activity, health eating index - 2015, energy intake, smoker status, alcohol, hypertension, acute myocardial infarction. Sample sizes were lower because of missing covariates: men (n=5,403) and women (n=7,818).

Conclusions & Future Directions

Nutrition can play a critical role in diabetes risk and management. Avocado consumption was associated with a lower risk of diabetes, which remained significant even when adjusted for relevant covariates. However, this finding was observed in only women, not men, underscoring the importance of personalized nutrition in diabetes care and prevention. Future research is needed to replicate these associations in other populations and with a longitudinal study design.
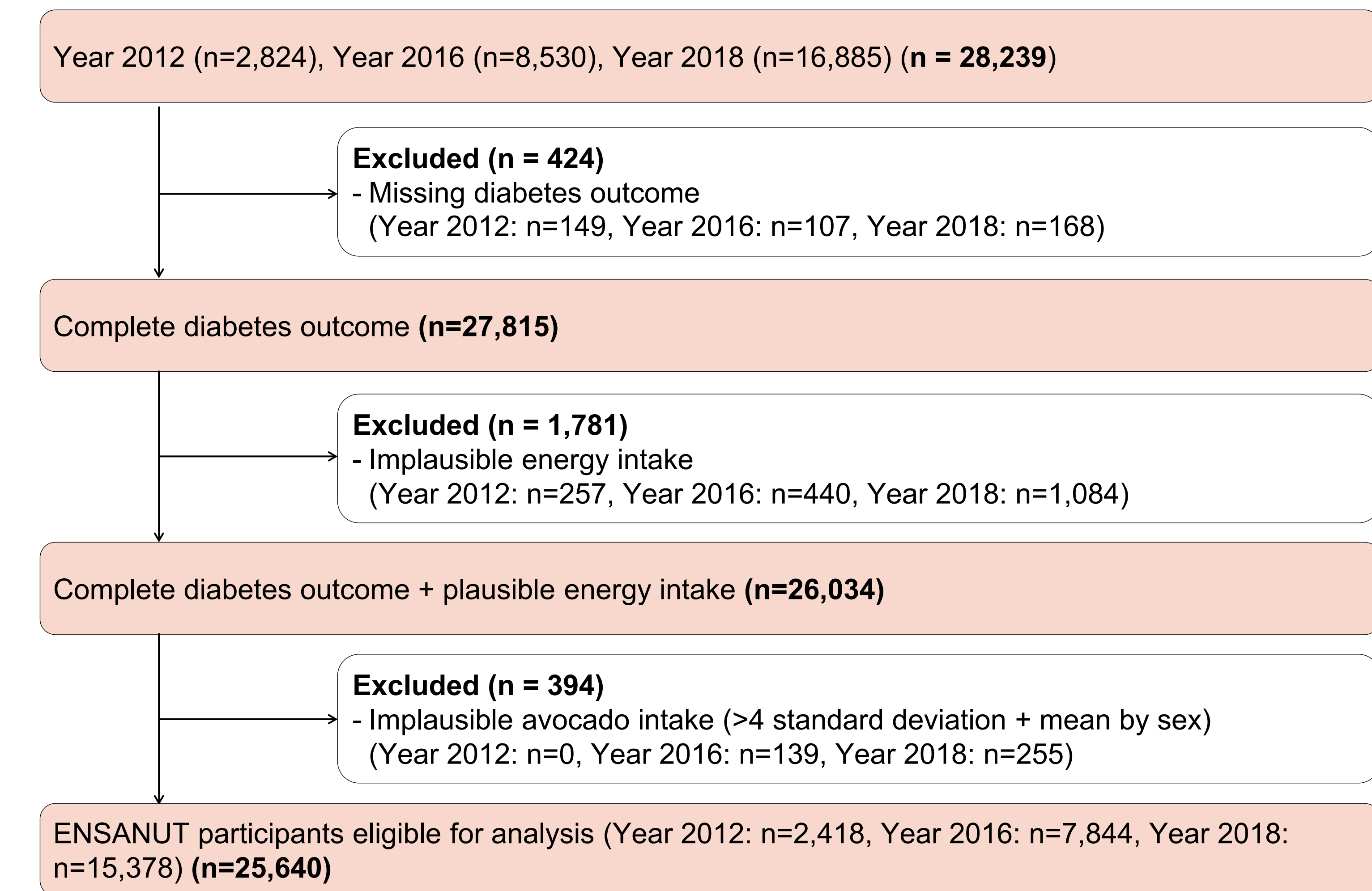
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