

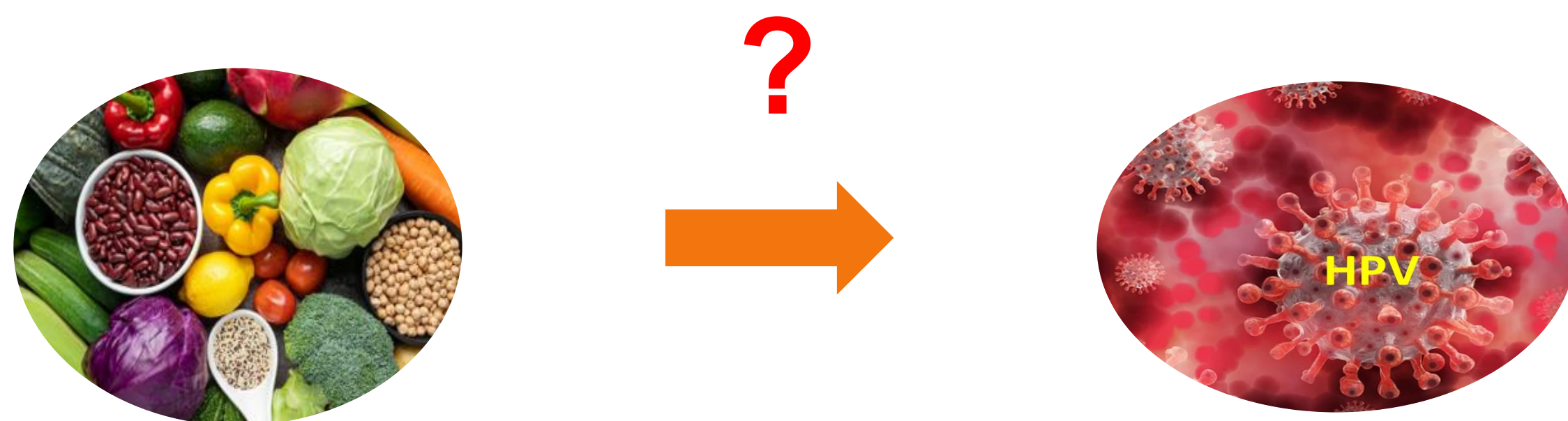
Health eating associated HPV infection in women

Hui-Yi Lin^{1,*}, Qiufan Fu¹, Yu-Hsiang Kao², Tung-sung Tseng², Krzysztof Reiss³, Jennifer E. Cameron⁴, Martin J. Ronis⁵, Joseph Su⁶, Navya Nair⁷, Hsiao-Man Chang⁸, Michael E. Hagensee⁹

Background

- HPV infection is a major risk factor for cervical cancer and precancerous lesions.
- Former study revealed four dietary antioxidants (vitamin A, B2, E, and folate) showed a protective effect on HR-HPV infection among US women.
- However, these dietary antioxidants intake cannot directly reflect eating patterns.

Objectives



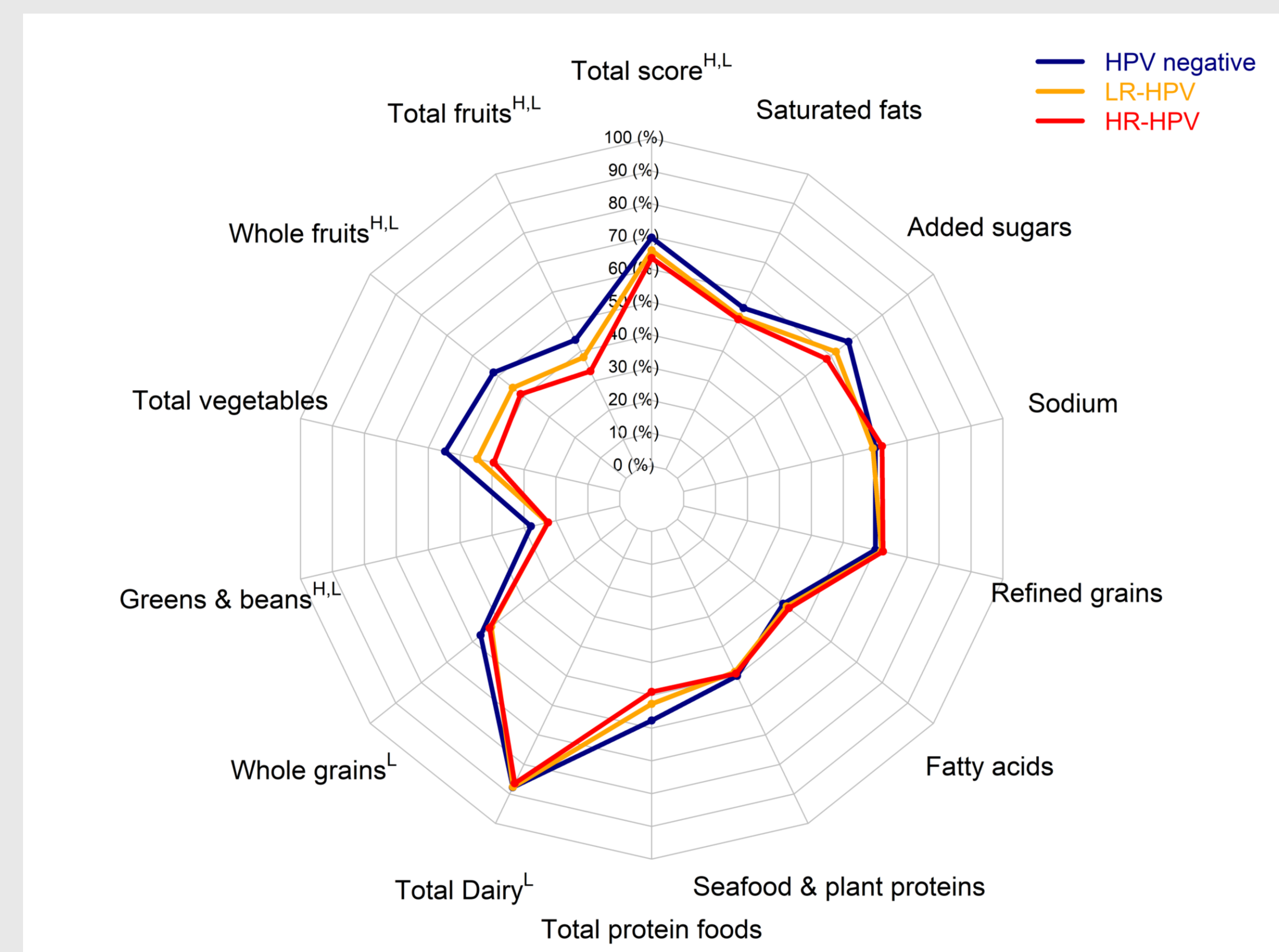
- Evaluate associations between healthy eating quality and genital HPV-infection status among American women.

Methods

- **Study population:** 10543 women aged 18-59 years from the 14-year (2003–2016) National Health and Nutrition Examination Survey (NHANES), satisfying selection criteria
- **Healthy eating quality evaluation:** HEI scores obtained from the 2015 version of calculation guidance, including 13 components and a total score based on key recommendations of the Dietary Guidelines for Americans. Categorization of HEI was based on commonly used cut-points/equal range/quartile
- **HPV infection status:** Defined as High risk if any HR type tested positive; low risk if no high-risk type positive but any low-risk type positive. (As defined by International Agency for Research on Cancer.)
- **Statistical Analysis:** Associations between the HEI scores and HPV infections were evaluated using the survey weighting multinomial logistic regression adjusting for 9 potential confounding factors.

Results

Figure 1. Means of Health Eating Index (HEI %) by HPV infection status in women



H: p < 0.05 for HR-HPV infection; L: p < 0.05 for LR-HPV infection
Based on results of adjusted multinomial logistic models with categorical HEI scores

Table 1. Distribution of HEI scores associated with vaginal HPV infection status in women using NHANES 2003-16

Component (range) ¹	Total N(%) ²	No HPV N(%) ²	Low-risk HPV N(%) ²	High-risk HPV N(%) ²	Chi-sq p-value ³
Greens and beans [0-5]					
0	4560 (43.0)	2266 (53.4)	1120 (23.4)	1174 (23.2)	2.9 × 10 ⁻¹⁴
(0, 2.5)	1759 (16.9)	1041 (62.0)	370 (19.8)	348 (18.1)	
[2.5, 5)	1490 (14.2)	905 (65.0)	319 (20.1)	266 (15.0)	
5	2734 (25.9)	1680 (64.2)	600 (20.3)	454 (15.6)	
Total fruit [0-5]					
0	1592 (15.8)	717 (46.1)	450 (26.8)	425 (27.1)	1.8 × 10 ⁻²³
(0, 2.5)	3931 (38.0)	2135 (58.5)	908 (21.9)	888 (19.5)	
[2.5, 5)	2313 (22.1)	1355 (62.1)	516 (21.2)	442 (16.7)	
5	2707 (24.2)	1685 (66.6)	535 (17.6)	487 (15.8)	
Whole fruit [0-5]					
0	3060 (27.5)	1394 (47.5)	832 (26.1)	834 (26.3)	1.4 × 10 ⁻¹¹
(0, 2.5)	2399 (23.8)	1331 (59.9)	534 (20.7)	534 (19.4)	
[2.5, 5)	1600 (15.1)	951 (63.9)	350 (20.6)	299 (15.4)	
5	3484 (33.5)	2216 (66.5)	693 (18.7)	575 (14.9)	
Whole Grain [0-10]					
0	3660 (31.2)	1853 (54.0)	939 (24.0)	868 (22.0)	0.002
(0, 1)	1369 (12.5)	704 (52.6)	334 (26.4)	331 (21.0)	
[1, 3.5)	2743 (26.6)	1619 (63.7)	577 (18.5)	547 (17.8)	
[3.5, 10]	2771 (29.7)	1716 (63.8)	559 (19.5)	496 (16.7)	
Total dairy [0-10]					
0	2327 (19.7)	1220 (54.8)	587 (25.0)	520 (20.1)	2.5 × 10 ⁻¹²
[2.5, 5)	2970 (26.7)	1632 (57.9)	699 (22.3)	639 (19.8)	
[5, 7.5)	2329 (23.2)	1325 (60.6)	509 (20.2)	495 (19.2)	
[7.5, 10]	2917 (30.4)	1715 (62.4)	614 (19.5)	588 (18.1)	
Total score [0-100]					
[0, 40)	1867 (16.9)	849 (48.1)	509 (26.7)	509 (25.2)	2.5 × 10 ⁻¹²
[40, 60)	5688 (52.8)	3122 (59.3)	1304 (21.4)	1262 (19.2)	
[60, 70)	1870 (18.5)	1176 (63.1)	391 (19.3)	303 (17.6)	
[70, 80)	836 (8.6)	543 (69.1)	160 (17.0)	133 (14.0)	
[80, 100]	282 (3.2)	202 (69.8)	45 (19.9)	35 (10.2)	

¹Parentheses () refer to intervals that do not include the endpoints; square brackets [] refer to intervals that do include the endpoints
²Raw frequency (weighted percentage)
³Compared scores among the 3 HPV groups

Results

Table 2. HEI scores associated with vaginal HPV infection status with and without adjusted other factors in women

Component (range) ¹	Unadjusted		Adjusted ²	
	Low-risk HPV Vs. No HPV OR (95% CI)	High-risk HPV Vs. No HPV OR (95% CI)	Low-risk HPV Vs. No HPV OR (95% CI)	High-risk HPV Vs. No HPV OR (95% CI)
Greens and beans [0-5]				
0	1	1	1	1
(0, 2.5)	0.73 (0.60, 0.89)**	0.68 (0.56, 0.81)**	0.81 (0.63, 1.03)	0.72 (0.57, 0.92)**
[2.5, 5)	0.71 (0.57, 0.87)**	0.53 (0.43, 0.66)**	0.78 (0.61, 0.99)*	0.61 (0.47, 0.80)**
5	0.72 (0.61, 0.85)**	0.56 (0.48, 0.66)**	0.80 (0.66, 0.98)*	0.68 (0.55, 0.83)**
Total fruit [0-5]				
0	1	1	1	1
(0, 2.5)	0.64 (0.52, 0.8)**	0.57 (0.46, 0.70)**	0.76 (0.60, 0.96)*	0.68 (0.51, 0.89)**
[2.5, 5)	0.59 (0.47, 0.73)**	0.46 (0.36, 0.58)**	0.67 (0.52, 0.87)**	0.61 (0.45, 0.85)**
5	0.46 (0.36, 0.57)**	0.40 (0.32, 0.51)**	0.54 (0.41, 0.72)**	0.57 (0.42, 0.78)**
Whole fruit [0-5]				
0	1	1	1	1
(0, 2.5)	0.63 (0.52, 0.76)**	0.58 (0.47, 0.72)**	0.68 (0.56, 0.84)**	0.73 (0.56, 0.95)*
[2.5, 5)	0.59 (0.46, 0.76)**	0.44 (0.34, 0.55)**	0.67 (0.51, 0.88)**	0.57 (0.42, 0.78)**
5	0.51 (0.42, 0.63)**	0.40 (0.32, 0.50)**	0.60 (0.48, 0.76)**	0.62 (0.47, 0.81)**
Whole Grain [0-10]				
0	1	1	1	1
(0, 1)	1.13 (0.92, 1.40)**	0.98 (0.81, 1.19)	1.16 (0.89, 1.50)**	1.12 (0.86, 1.45)**
[1, 3.5)	0.65 (0.55, 0.77)**	0.69 (0.58, 0.81)**	0.67 (0.54, 0.83)**	0.82 (0.66, 1.03)**
[3.5, 10]	0.69 (0.59, 0.80)**	0.65 (0.53, 0.78)**	0.82 (0.69, 0.98)**	0.87 (0.67, 1.12)**
Total dairy [0-10]				
0	1	1	1	1
[2.5, 5)	0.85 (0.72, 1.00)**	0.93 (0.77, 1.13)	0.86 (0.70, 1.06)	1.07 (0.83, 1.38)
[5, 7.5)	0.73 (0.60, 0.89)**	0.86 (0.70, 1.06)	0.76 (0.61, 0.93)**	0.96 (0.74, 1.25)
[7.5, 10]	0.68 (0.57, 0.82)**	0.79 (0.64, 0.98)*	0.74 (0.60, 0.90)**	0.89 (0.70, 1.15)**
Total score [0-100]				
[0, 40)	1.54 (1.30, 1.82)**	1.62 (1.35, 1.94)**	1.36 (1.10, 1.69)**	1.27 (1.01, 1.60)*
[40, 60)	1	1	1	1
[60, 70)	0.85 (0.69, 1.04)	0.86 (0.71, 1.04)	0.89 (0.70, 1.13)	1.01 (0.80, 1.29)
[70, 80)	0.68 (0.52, 0.89)**	0.62 (0.46, 0.84)**	0.77 (0.55, 1.06)	0.87 (0.62, 1.21)
[80, 100]	0.79 (0.46, 1.34)	0.45 (0.26, 0.77)**	1.06 (0.58, 1.94)	0.70 (0.38, 1.31)

*: p < 0.05, **: p < 0.01, ***: p < 0.001 based on multinomial logistic models, bold: adjusted p < 0.05 for high-risk HPV
¹Parentheses () refer to intervals that do not include the endpoints; square brackets [] refer to intervals that do include the endpoints
²multinomial logistic model adjusted for 9 factors (age, race, education, income, marital status, smoking status, lifetime illegal substance use, past 12-month alcohol intake, number of sexual partners in past 12-month).

Conclusions & Discussions

- This study showed that some healthy eating scores (higher score refers to healthier eating pattern) are inversely associated with vaginal HPV infection for US women.
- The women with high-risk HPV infection had the lowest level of HEI total score.
- Women with vaginal HPV infection (both low-risk and high-risk HPVs) reported low fruits and greens/beans intake.
- Women with low-risk HPV also reported a low intake of whole-grain and total dairy.
- These findings based on the large-scale US population are consistent with other dietary and antioxidant studies.
- Our findings support that some healthy patterns may be beneficial to prevent HPV acquisition or persistence based on this **cross-sectional** study.
- Future longitudinal studies will be needed to evaluate the causal protective effect of these diet components on HPV carcinogenesis.