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Abstract

Background Since diet is a known modulator of in□ammation, the Dietary In□ammatory Index (DII), which quanti□es the in□ammatory potential of an individual's diet, becomes a signi□cant parameter to consider. Chronic diarrhea is commonly linked to in□ammatory processes within the gut. Thus, this study aimed to explore the potential link between DII and chronic diarrhea.

Methods This research utilized data from the National Health and Nutrition Examination Survey (NHANES) 2005–2010. The DII was calculated according to the average intake of 28 nutrients using information gathered from two 24-hour recall interviews. The Bristol Stool Form Scale (BSFS) was adopted to describe chronic diarrhea, identifying

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Introduction

Chronic diarrhea a ects up to 5% of the world's population [1]. It can be de ned by stools' frequency, thinness, volume, or weight. However, quantifying this in clinical settings poses challenges. Typically, clinicians rely on tools like the Bristol Stool Form Scale (BSFS) to evaluate chronic diarrhea [2]. Chronic diarrhea is the primary symptom of both irritable bowel syndrome (IBS) [3] and in ammatory bowel disease (IBD) [4]. Distinguishing between patients with chronic diarrhea hinges on identifying whether the cause is functional or organic. In addition, certain dietary components can trigger or exacerbate chronic diarrhea [2]. Individuals with diarrhea often tend to consume more unhealthy plant-based foods like fruit juices and re ned grains, leading to a reduction in gut microbiota diversity and a slight increase in pro-in ammatory bacterial strains [5]. Dietary guidelines recommend adopting regular meal patterns, limiting high- ber food intake, and reducing alcohol, ca eine, and carbonated beverage consumption to alleviate IBS symptoms in about half of patients [6]. us, obtaining a

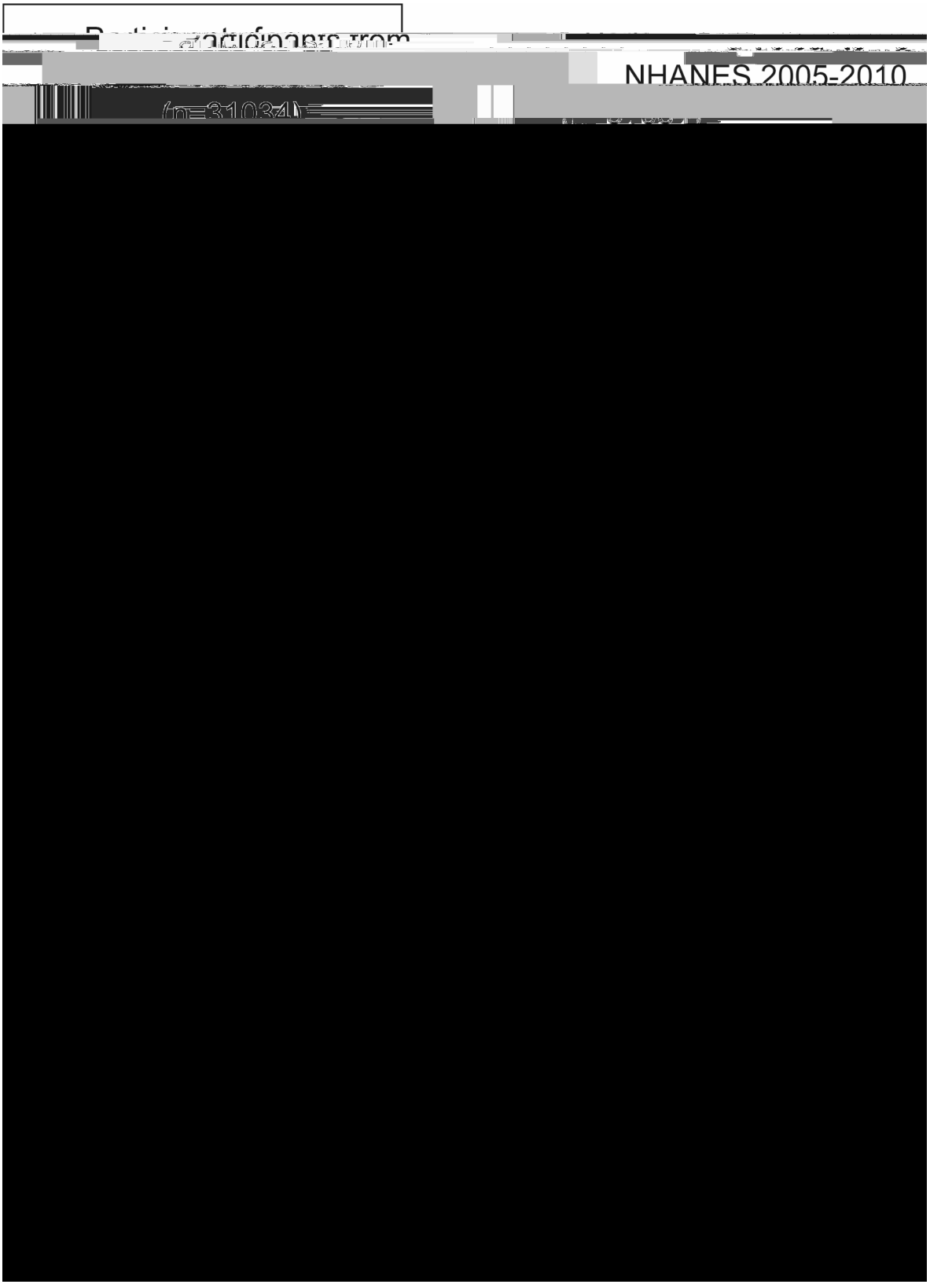

Fig. 1 Flowchart showing how research participants were chosen from NHANES 2005–2010

referring to the relevant numbers on a card that featured graphic images of the seven BSFS types. Individuals who identi ed their typical or most frequent type of stool as either Type 1 (separate hard lumps resembling nuts) or Type 2 (sausage-like, yet lumpy) were classi ed as experiencing chronic constipation. Conversely, individuals who identi ed with Type 6 (u y pieces with ragged edges, a mushy stool) or Type 7 (characterized by a watery consistency, no solid pieces) were considered to be exhibiting symptoms of chronic diarrhea [24, 25].

Dietary in□ammatory index

e NHANES Nutrition Methods Workgroup collected dietary information through 24-hour recall interviews at the MEC, and we used the average nutrient intake from

Table 1 (continued)

Characteristics	Overall	Quartiles of DII score				*p* value
		Q1 (-4.94–0.07)	Q2 (0.07–1.38)	Q3 (1.38–2.48)	Q4 (2.48–4.69)	
	N = 11,219	N = 2805	N = 2804	N = 2805	N = 2805	
Cotinine (ng/mL)	60.08 ± 130.89	37.84 ± 106.00	55.54 ± 127.49	61.48 ± 131.14	86.05 ± 151.04	< 0.001***
C-reactive protein (mg/dL)	0.43 ± 0.81	0.33 ± 0.71	0.40 ± 0.61	0.46 ± 0.87	0.52 ± 0.98	< 0.001***

PIR, poverty–income ratio; BMI, body mass index; CRP, C-reactive protein. Mean ± SE for continuous variables: *P* value was calculated by weighted linear regression model. % for categorical variables: *P* value was calculated by weighted chi-square test. **P* value < 0.05, ***P* value < 0.01, ****P* value < 0.001

Table 2 Logistic regression analysis on the association between DII and chronic diarrhea

Characteristics	Model 1 OR (95% CI)	*p* value	Model 2 OR (95% CI)	*p* value	Model 3 OR (95% CI)	*p* value
Total (*n* = 11,219)						
Continuous	1.08 (1.04, 1.13)	0.0005***	1.08 (1.03, 1.13)	0.0012**	1.00 (0.96, 1.05)	0.8501
DII Quartile						
Q1	1.0		1.0		1.0	
Q2	1.10 (0.89, 1.37)	0.3754	1.08 (0.87, 1.34)	0.4867	0.96 (0.77, 1.20)	0.7189
Q3	1.47 (1.20, 1.81)	0.0002***	1.40 (1.14, 1.73)	0.0015**	1.20 (0.97, 1.49)	0.1008
Q4	1.53 (1.24, 1.87)	< 0.0001***	1.40 (1.14, 1.73)	0.0015**	1.04 (0.83, 1.30)	0.7221
P for trend		< 0.0001***		0.0002***		0.3727
Male (*n* = 5,556)						
Continuous	1.02 (0.95, 1.08)	0.6275	1.01 (0.94, 1.07)	0.8420	0.94 (0.88, 1.01)	0.0814
DII Quartile						
Q1	1.0		1.0		1.0	
Q2	1.14 (0.86, 1.51)	0.3776	1.14 (0.86, 1.51)	0.3729	1.02 (0.76, 1.37)	0.8880
Q3	1.45 (1.09, 1.93)	0.0097**	1.43 (1.07, 1.90)	0.0141*	1.22 (0.90, 1.64)	0.1929
Q4	0.94 (0.67, 1.32)	0.7158	0.90 (0.64, 1.28)	0.5656	0.64 (0.44, 0.93)	0.0205*
P for trend		0.4056		0.5472		0.2217
Female (*n* = 5,663)						
Continuous	1.15 (1.08, 1.23)	< 0.0001***	1.15 (1.08, 1.22)	< 0.0001***	1.07 (1.00, 1.15)	0.0527
DII Quartile						
Q1	1.0		1.0		1.0	
Q2	1.05 (0.75, 1.47)	0.7822	1.05 (0.75, 1.47)	0.7847	0.95 (0.67, 1.36)	0.7972
Q3	1.45 (1.06, 1.97)	0.0197*	1.45 (1.06, 1.98)	0.0199*	1.26 (0.91, 1.75)	0.1585
Q4	1.78 (1.32, 2.39)	0.0001***	1.76 (1.31, 2.37)	0.0002***	1.34 (0.97, 1.84)	0.0753
P for trend		< 0.0001***		< 0.0001***		0.0192*

Model 1: Non-adjusted; Model 2: Adjusted for age, gender, race/ethnicity; Model 3: Adjusted for age, gender, race/ethnicity, education level, marital status, poverty–income ratio, BMI, vigorous physical activity, drinking status, hypertension, diabetes, depression, cotinine, and C-reactive protein. **P* value < 0.05, ***P* value < 0.01, ****P* value < 0.001

drinking status, hypertension, diabetes, and depression (Table 4). Only the subgroup with a normal BMI showed a statistically signi cant negative connection between chronic diarrhea and DII among the BMI-strati ed subgroups ($P < 0.05$). Moreover, there was a positive link between the two in overweight and obese participants, but it lacked statistical signi cance, with ORs of 1.02 (95% CI, 0.94–1.11) and 1.05 (95% CI, 0.97–1.13), respectively (all *P* values > 0.05). No signi cant correlation between DII and chronic diarrhea was detected in the other subgroups (all *P* values > 0.05). e interaction between chronic diarrhea and DII demonstrated a statistically signi cant gender di erence, according to the ndings of the interaction tests (*P* interaction < 0.05).

Discussion

is cross-sectional study delved into the relationship between DII and chronic diarrhea within a U.S. population. It revealed an L-shaped relationship between DII and chronic diarrhea, indicating that DII levels were substantially linked to a heightened risk of chronic diarrhea within a speci c range. ese ndings underscore the signi cance of maintaining a balanced diet that mitigates in ammation, potentially aiding in alleviating chronic diarrhea.

Chronic diarrhea can stem from various factors, including infection, abnormal immune responses, gastrointestinal protein loss, psychological factors, neuroendocrine tumors, and congenital diarrheal diseases [28]. According to a population-based study, individuals experiencing chronic diarrhea tended to have notably higher average

and enhancing intestinal barrier function by regulating IEC proliferation and differentiation [49]. Furthermore, SCFAs exert anti-inflammatory effects by modulating immune cell function and cytokine production [50]. Butyrate salts can inhibit the expression of inflammatory factors such as MCP-1, IL-6, TNF-α and by activating macrophage GPR41 [51]. Therefore, a pro-inflammatory diet disrupts intestinal homeostasis by inducing intestinal microbiota dysbiosis and damaging the intestinal mucosal barrier. These alterations can elevate the risk of diarrhea and even lead to intestinal inflammation.

This study's primary strengths include its use of a large, nationally representative NHANES dataset, offering valuable insights into dietary factors and health outcomes across the U.S. population, and its control of confounders such as comorbidities and depression, enhancing the findings' reliability. Our findings suggest that dietary interventions could effectively manage chronic diarrhea, particularly for individuals following a pro-inflammatory diet. Clinicians may improve patient management and guide nutritional adjustments by assessing and modifying dietary inflammation levels using the DII. Public health initiatives targeting pro-inflammatory diets could offer preventive support by educating the public on inflammatory dietary components, promoting particularl183 a908>>1ET EMC(a)9(tfing), intt

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