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Narrative nutrition: Constructing a theoretical framework and exploratory cross-sectional study on disease-specific dietary phenotypes

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ABSTRACT

Background and Objectives: Clinical nutrition has traditionally relied on a biomedical paradigm that prioritizes nutrient metabolism and quantitative standardization. However, this approach often overlooks the psychological motivations, cultural memories, and social contexts driving dietary behaviors. This study introduces the concept of Narrative Nutrition, and an interdisciplinary framework that integrates narrative medicine with nutrition science to better understand multidimensional dietary behaviors. **Methods and Study Design:** We proposed a multidisciplinary framework integrating narrative medicine, anthropology, and psychology. To empirically validate this framework, a cross-sectional exploratory study was conducted among 100 hospitalized patients (mean age 59.1 ± 15.2) across four disease groups (type 2 diabetes mellitus, non-alcoholic fatty liver disease, chronic kidney disease, and malignant tumors). A 20-item Narrative Nutrition Questionnaire was administered, and data were analyzed using principal component analysis (PCA) and one-way analysis of variance (ANOVA). **Results:** PCA identified three distinct dimensions of dietary narrative: *Dietary Compliance (Dimension 1)*, *Emotional Eating (Dimension 2)*, and *Socio-cultural Influence (Dimension 3)*. ANOVA revealed significant heterogeneity across disease types ($p < 0.01$). Specifically, diabetes patients showed higher rigidity in compliance ($F=28.79$, $p < 0.001$), while non-alcoholic fatty liver disease patients were more susceptible to socio-cultural pressures. **Conclusions:** The findings support the multidimensional nature of dietary behaviors and provide preliminary empirical evidence for the Narrative Nutrition framework. Recognizing narrative dimensions of eating may facilitate more patient-centered dietary interventions in clinical practice. Future implementation leveraged by digital tools holds promise for improving clinical outcomes.

Key Words: narrative nutrition, dietary behavior, clinical practice, cultural context, narrative medicine

INTRODUCTION

Clinical nutrition has long been established on the biomedical paradigm, prioritizing nutrient metabolism, energy balance, and disease prevention through evidence-based methodologies. Quantitative nutritional assessments remain essential components of clinical practice. These approaches are highly effective in acute disease management and metabolic stabilization. While effective for acute management, this model often exhibits limitations in addressing chronic disease and behavioral changes due to its tendency toward over-quantification.^{1,2} It

frequently neglects the psychological motivations, cultural memories, and social contexts that underpin dietary behaviors. Eating behaviors are complex and cannot be explained solely by nutrient intake or metabolic indicators. Psychological motivations, cultural traditions, and social environments also play a critical role in shaping food choices.

The rising burden of diet-related non-communicable diseases (NCDs) in the Asia-Pacific region necessitates a paradigm shift from prescriptive advice to patient-centered care.³ In China, where dietary habits are interwoven with familial dynamics, social obligations (e.g., *guanxi* and banquet culture), and traditional food symbolism, standard nutritional guidelines often yield poor long-term adherence because they fail to resonate with patients' lived experience.²

In this context, Narrative Nutrition emerges as an extension of Narrative Medicine into the nutritional domain. Inspired by Rita Charon's advocacy for "honoring the stories of illness" and integrating patients' narratives into clinical care,^{4,5} narrative nutrition aims to explore the physiological-psychological-sociocultural nexus of eating. By actively listening to and analyzing a patient's dietary life history, clinicians can uncover hidden barriers to adherence such as emotional triggers caused by psychological distress⁴. While previous nutritional research has primarily focused on physiological and quantitative dietary assessments,⁶ limited attention has been given to the narrative and experiential dimensions that shape eating behaviors.⁷

Therefore, the present study aims to: (1) construct a theoretical framework for narrative nutrition; and (2) empirically validate the multidimensional nature of dietary behaviors through an exploratory quantitative study in a Chinese clinical setting. Ultimately, we seek to identify whether distinct "narrative phenotypes" may exist among different chronic disease populations and whether these phenotypes could inform future precision behavioral interventions.

Theoretical framework

Narrative nutrition draws on multidisciplinary theories:

-Narrative Medicine Foundation: Grounded in Charon's theory, it emphasizes "narrative competence" - the ability to acknowledge, absorb, interpret, and act on the stories of others.⁴ In nutrition, the "dietary story" becomes a medium to integrate scientific data (e.g., GI index) with the patient's lived experience.

-Anthropological Perspective: Food is viewed not merely as a carrier of nutrients but as a symbol of cultural identity and social relations.⁸ For example, in Chinese culture, specific foods may symbolize belonging or filial piety, which can conflict with dietary restrictions.

-Psychological Dimension: Acknowledging that eating is influenced by emotional states and cognitive patterns.⁹ Narrative methods could help identify mechanisms such as "emotional eating" or conflicts of self-control.⁴

-Sociological Context: Following Bourdieu's concept of distinction, dietary choices reflect social class and family power dynamics.¹⁰ Narrative analysis reveals how structural factors constrain dietary health.

The integration of narrative nutrition is not merely a methodological innovation; it deeply resonates with the global health paradigm shift toward 'patient-centered care'.¹¹ In the long-term management of chronic conditions, this model emphasizes that patients should not be treated merely as passive carriers of biological markers, but as active decision-makers with unique life histories and socio-cultural contexts. This approach may contribute to the development of more patient-centered nutritional interventions, particularly in culturally diverse healthcare settings.

MATERIALS AND METHODS

Study design

A cross-sectional exploratory study was employed to investigate the multidimensional nature of dietary narratives and to identify disease-specific behavioral phenotypes. Unlike confirmatory approaches, this exploratory design was chosen to capture the latent psychological and socio-cultural structures underlying dietary behaviors in a clinical Chinese population.

Ethical approval and informed consent

The study was approved by the Ethics Committee of the First Hospital of Hebei Medical University (Approval No. [2024] Research Ethics Review No. 194). The study was conducted in accordance with the approved protocol and applicable ethical principles. Informed consent was obtained from all participants before participation.

Participants and setting

Participants were recruited from the First Hospital of Hebei Medical University between December 2025 and January 2026. Eligible participants were adults aged 18 years or older

with a confirmed diagnosis of a chronic disease requiring dietary management. To ensure adequate phenotypic variability for exploratory analysis, participants were selected from four distinct clinical profiles ($n = 25$ per group): Type 2 Diabetes Mellitus (T2DM), Non-Alcoholic Fatty Liver Disease (NAFLD), Chronic Kidney Disease (CKD), and Malignant Tumors (Cancer). Participants were required to have sufficient cognitive ability to complete a self-administered questionnaire. Individuals with severe cognitive impairment or acute medical instability were excluded.

Data collection and measurements

The Narrative Nutrition Questionnaire (NNQ) was utilized as the primary investigative tool. This 20-item instrument probes three hypothesized domains derived from our theoretical framework: dietary rule adherence, emotional-dietary coupling, and social eating pressures, and narrative acceptance in clinical nutrition counseling. Items were scored on a Likert scale.

Questionnaire development

The questionnaire consisted of three components:

- (1) demographic and clinical characteristics,
- (2) basic dietary behaviors, and
- (3) The Narrative Nutrition Scale

Demographic and clinical variables

Demographic information included age, sex, education level, employment status, and living arrangement. Clinical variables included self-reported disease type.

Basic dietary behavior measures

Basic dietary behaviors were assessed using seven items, including appetite status, meal regularity, daily vegetable and fruit intake, perceived understanding of disease-specific dietary principles, frequency of insufficient food intake in the past week, and frequency of receiving professional dietary guidance during hospitalization. These items were treated as descriptive or outcome-related variables rather than components of the narrative nutrition construct.

Narrative nutrition scale

The Narrative Nutrition Scale was developed based on narrative medicine theory, sociocultural nutrition frameworks, and a review of existing qualitative literature on food-related experiences in chronic illness. The scale aimed to operationalize narrative dimensions of nutrition that are not captured by conventional dietary assessments.

Although the NNQ contained 20 items, not all items were intended for latent structure extraction. The scale comprised 12 items (Q8-Q19), each rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Items were grouped a priori into four theoretically informed domains:

- Cultural and family narratives (3 items): assessing the influence of family traditions, cultural food practices, and illness-related changes in food meaning.
- Emotional and psychological narratives (3 items): assessing anxiety, emotional influences on appetite, and loneliness during eating.
- Social and environmental constraints (3 items): assessing economic limitations, environmental barriers, and willingness to share dietary stories.
- Healthcare communication and narrative acceptance (3 items): assessing perceived understanding by healthcare professionals and acceptance of narrative-based dietary communication.

An additional item (Q20) assessed perceived barriers to dietary implementation using multiple-choice responses and was analyzed descriptively but not included in the scale score. Items not included in the PCA were analyzed descriptively to characterize participants' dietary context and perceived barriers to dietary implementation.

Statistical analysis

Data analysis followed a two-stage exploratory framework using Python (v3.8). Missing values (1%) were handled via median imputation to preserve statistical power. Missing data were minimal (e.g., <5% for item Q15) and were handled using median imputation to preserve the sample size without introducing significant variance bias. Raw scores were transformed using Z-score standardization. Prior to conducting PCA, the suitability of the data for structure detection was confirmed. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy indicated acceptable data suitability (KMO >0.6), and Bartlett's test of sphericity was statistically significant ($p < 0.05$), confirming that the item correlation matrix was appropriate for factor extraction.

Construct Validity: PCA was conducted to extract latent factors underlying the questionnaire. **Phenotyping and Group Comparisons:** To explore whether distinct "narrative phenotypes" exist, ANOVA was performed on the extracted factor scores across the four disease groups. Tukey's HSD post-hoc test were subsequently applied to delineate specific pairwise contrasts while controlling for family-wise error rates. Statistical significance was defined as two-tailed $p < 0.05$.

Statistical analyses were performed using standard exploratory psychometric and correlational approaches. Descriptive statistics were calculated for demographic variables, dietary behaviors, and individual narrative nutrition items, including means and standard deviations for continuous variables and frequencies and percentages for categorical variables. Internal consistency reliability of the Narrative Nutrition Scale was evaluated using Cronbach's alpha for the overall scale and for each theoretically defined domain. Given the exploratory nature of scale development and the multidimensional, context-dependent characteristics of narrative constructs, alpha values were interpreted descriptively rather than as strict cut-off criteria.

Exploratory associations between the Narrative Nutrition Score and dietary behavior variables (appetite status, meal regularity, frequency of insufficient intake, and frequency of receiving dietary guidance) were examined using correlation analyses. Correlation coefficients were interpreted in terms of both statistical significance and clinical relevance. All analyses were conducted using two-tailed tests, and statistical significance was set at $p < 0.05$.

RESULTS

Demographic characteristics of participants

A total of 100 participants completed the survey and were included in the final analysis. The study population included 63 males and 37 females, with a mean age of 59.1 ± 15.2 years. The majority (72%) had a primary or junior high school education, and 76.5% lived with family members. Descriptive characteristics of the sample are presented in Table 1.

Construct validity of the narrative nutrition scale

Exploratory principal component analysis (PCA) was conducted on the 12 items of the Narrative Nutrition Scale. Sampling adequacy was confirmed with a Kaiser-Meyer-Olkin value exceeding 0.60, and Bartlett's test of sphericity was statistically significant ($p < 0.001$), indicating suitability for factor analysis.

Three components with eigenvalues greater than 1 were extracted, collectively explaining 46.9% of the total variance. Given the sample size and exploratory design, these components should be interpreted as preliminary narrative dimensions rather than as a definitive validated factor structure.

The three dimensions were interpreted as:

- Dimension 1: Dietary Compliance and Control (Loading from Q4, Q12-17)

This dimension reflects strict adherence to dietary rules and perceived self-control over food choices.

- Dimension 2: Emotional Eating and Awareness (Loading from Q1-3)

This dimension captures the influence of emotional states such as anxiety, loneliness, or psychological distress on eating behavior.

- Dimension 3: Socio-cultural Influence (Loading Q8-11, Q18)

This dimension represents the impact of social dining environments, family expectations, and cultural food practices on dietary decision-making.

Reliability analysis

Internal consistency of the Narrative Nutrition Scale was evaluated using Cronbach's alpha. The overall scale demonstrated moderate internal consistency ($\alpha=0.46$). Given the exploratory nature of the instrument and the multidimensional characteristics of narrative constructs, the reliability coefficient was interpreted cautiously. Narrative experiences related to food are inherently heterogeneous and context-dependent, which may reduce internal homogeneity across items.

Disease-specific narrative phenotypes

One-way ANOVA was performed to examine differences in factor scores among four disease groups. Significant heterogeneity was observed across disease types for all three dimensions ($p < 0.01$), suggesting that dietary narratives differ according to clinical condition.

- The "Right Control" Phenotype in Metabolic & Renal Diseases: Patients with T2DM and CKD exhibited a dominant "Control" phenotype, characterized by high Dimension 1 scores. As illustrated in Figure 3, the T2DM group scored significantly higher on Compliance compared to the Cancer group (Mean Difference = 2.85, $p < 0.001$). A similar high degree of control was observed in the CKD cohort ($p < 0.001$ vs. Cancer).

- The "Disengaged" Phenotype in Oncology: In contrast, the Cancer group demonstrated significantly lower scores in Compliance [$F(3,96) = 28.02$, $p < 0.001$]. The dispersed, lower-

end distribution in Figure 3 suggests an oncology narrative characterized by "dietary fatigue", where patients may prioritize comfort and psychological relief over strict biological dietary adherence.

-Contextual Vulnerability in NAFLD: Exploratory comparisons on Dimension 3 (Social Influence) indicated significant heterogeneity [$F(3, 96) = 4.66, p = 0.004$], suggesting that groups such as NAFLD patients may be uniquely vulnerable to external socio-cultural pressures during dining, highlighting the need for context-aware counseling.

These findings suggest the presence of disease-specific narrative phenotypes that may influence dietary adherence and behavioral patterns.

DISCUSSION

This study employed an exploratory quantitative analysis to empirically validate the "Narrative Nutrition" theoretical framework within a Chinese clinical population. Our findings reveal significantly distinct "dietary narrative phenotypes" among patients with chronic diseases. This discovery not only confirms the multidimensional and disease-specific nature of dietary behaviors but also introduces a vital complementary perspective to the prevailing biomedical paradigms in clinical nutrition.

Our results clearly emphasize that narrative nutrition is not intended to negate biomedical indicators (e.g., blood glucose, creatinine); rather, it provides an indispensable contextual interpretation of them. PCA extracted three latent dimensions (Dietary Compliance and Control, Emotional Eating, and Socio-cultural Influence), which collectively constitute a narrative lens for understanding patient behavior. The highly significant heterogeneity observed across disease-specific profiles ($p < 0.001$ for all dimensions) robustly challenges the efficacy of "one-size-fits-all" dietary advice in long-term chronic disease management.

The exploratory analysis revealed profound behavioral dichotomies: the "Rigid Control" phenotype dominated by hyper-vigilance in metabolic and renal disease, versus the "Disengaged" phenotype characterized by dietary fatigue in oncology. For instance, the high compliance scores in diabetes patients may mask underlying "dietary burnout," which narrative inquiry can uncover. Recent epidemiological evidence highlights that diabetes distress and fear of hypoglycemia significantly impair self-care behaviors and quality of life in Chinese adults.¹² Therefore, narrative intervention for T2DM and CKD patients should focus on psychological offloading and reducing moral guilt associated with food. By actively listening to patients' food-related anxieties, dietitians can help mitigate the moral guilt

associated with occasional dietary deviations. This transforms dietary management from an externally imposed, anxiety-driven regimen into a flexible, intrinsically motivated lifestyle.

Conversely, the disengagement seen in the Cancer group suggests that oncology nutrition must prioritize restoring patient agency and integrating comfort foods to combat cachexia, rather than imposing strict, alienating dietary restrictions.¹³ Therefore, supportive strategies in oncology nutrition require a fundamental paradigm shift from imposing alienating restrictions to restoring patient agency. Narrative approaches enable clinicians to identify "comfort foods" that hold emotional and cultural significance. Crucially, this does not imply abandoning nutritional standards; rather, it allows clinicians to tactfully integrate high-density medical nutrition therapy into culturally meaningful meals, thereby combating cachexia while enhancing treatment tolerance.

The NAFLD group showed greater sensitivity to socio-cultural dietary influence, which is consistent with the behavioral demands of NAFLD management. Current guidance identifies lifestyle modification and weight management as central to NAFLD care.¹⁴ This highlights a critical need for context-aware counseling, equipping patients with social negotiation skills to navigate Chinese communal dining environments without compromising their health goals. Anthropological and public health research in China has demonstrated that in these settings, the sharing of rich foods and alcohol is deeply intertwined with the establishment of Guanxi (social networks and interpersonal trust). In China, communal dining, banquet culture, alcohol-related hospitality, and guanxi-based obligations may intensify the difficulty of refusing energy-dense foods or alcohol in social settings.¹⁵ Chinese qualitative studies have similarly shown that NAFLD weight management is constrained by social entertainment, insufficient attention to NAFLD, food used as reward or compensation, diet environment, psychological stress, and limited coping strategies.^{16,17}

Importantly, social-cultural pressure should not be framed as exclusive to China or the Asia-Pacific region. The specific expression of social pressure is culturally situated, but the underlying mechanism is globally relevant: lifestyle adherence is embedded in patients' resources, relationships, health beliefs, and lived environments. Studies from the United States, Hispanic/Latino populations, the United Kingdom, and Northern Europe have identified low disease knowledge, limited social support, food cost, lack of time, lack of exercise space, family norms, environmental barriers, life stressors, and poor understanding of NAFLD as barriers to dietary and physical activity change.¹⁸⁻²¹ A recent scoping review further confirmed that lack of time, limited knowledge, financial constraints, comorbidities, negative perceptions of diet and exercise prescriptions, lack of family cooperation, inflexible

work schedules, and socio-cultural influences recur across NAFLD studies.²² Thus, guanxi-based dining is best understood as a culturally specific manifestation of a broader global adherence problem.

This socio-cultural dilemma highlights a critical void in current nutritional education, which typically focuses solely on biological metrics and individual willpower. Adopting dietary changes in such environments is not simply a metabolic adjustment, but a complex process of 'social negotiation' where patients must balance their health autonomy with group belonging.²³ Future counseling must extend beyond standard metabolic education to embrace narrative-based, patient-centered models.³ Addressing the socio-cultural narratives behind dietary choices enhances not only individual clinical adherence but also aligns with broader holistic health objectives. By acknowledging the psychological security associated with food accessibility and cultural choices, this multidimensional nutritional strategy contributes to the broader goals of sustainable, patient-centered well-being.²⁴

This study presents several limitations. A primary limitation of this study is the moderate sample size ($N = 100$) drawn from a single center, which constrains our statistical power to capture subtle behavioral variations and limits generalizability. Furthermore, the cohort's baseline demographic profile is heavily skewed toward a low socioeconomic or educational background, with 72% of participants having completed primary or junior high school education. Consequently, these findings may not fully translate to highly educated urban populations who possess different health-seeking behaviors and dietary resources. However, as an exploratory cross-sectional design, the primary objective was to uncover latent structural patterns in disease-specific dietary narratives rather than to validate a definitive clinical psychometric tool. The current sample size proved statistically robust enough to demonstrate highly significant inter-group heterogeneity ($p < 0.01$), providing a solid foundation for future large-scale confirmatory studies. Furthermore, its cross-sectional design precludes causal inferences between narrative phenotypes and clinical outcomes. Besides, PCA was used for exploratory structure detection rather than definitive psychometric validation. Moreover, the moderate internal consistency of the NNQ ($\alpha = 0.46$) reflects the inherently heterogeneous and multidimensional nature of narrative constructs, underscoring the need for further psychometric refinement in larger, diverse cohorts. Future studies should follow established measurement-property standards, including content validity assessment, confirmatory factor analysis, test-retest reliability, and measurement invariance testing across disease groups cultural settings.²⁵

Future directions: Digital empowerment and AI-assisted narrative analysis

To strengthen the translational potential of narrative nutrition, future studies may integrate Artificial Intelligence (AI)-assisted and Natural Language Processing (NLP)-based narrative analysis with clinician-led interpretation. De-identified dietary narratives, food diaries, and counseling transcripts could first be coded by trained dietitians or qualitative researchers using a theory-informed codebook derived from the dimensions identified in this study, including dietary compliance and control, emotional eating and awareness, socio-cultural influence, family expectations, healthcare communication, dietary fatigue, and social negotiation. These annotated data could then be used to train and validate supervised NLP models that identify clinically actionable narrative themes and generate structured prompts for dietitians. For instance, patients whose narratives repeatedly show social negotiation difficulties may benefit from counseling on refusal skills and culturally acceptable alternatives during communal dining, whereas patients with dietary fatigue may require flexible goal-setting and emotional support. Recent scoping evidence suggests that AI applications have growing potential to support dietary assessment, but challenges remain regarding accuracy, bias, privacy, and interpretability.²⁶ Accordingly, AI/NLP tools could be developed as human-in-the-loop decision-support systems that enhance, rather than replace, empathic narrative listening and professional nutritional judgment.

Conclusion

Narrative nutrition represents a promising interdisciplinary approach that bridges the gap between objective nutritional science and subjective patient experience. This exploratory study provides preliminary evidence that dietary behaviors may be multidimensional and disease-specific. By identifying dimensions of dietary control, emotional eating, and socio-cultural influence, narrative nutrition may support more patient-centered and context-aware dietary counseling. Further multicenter studies with larger samples, refined measurement tools, and longitudinal outcome assessment are needed before this framework can be recommended for routine clinical implementation.

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CONFLICT DISCLOSURE ON THE USE OF AI AND AI-ASSISTED TECHNOLOGIES

No artificial intelligence-assisted technology was used in the article.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

The authors declare no conflict of interest.

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Table 1. Participants characteristics

Variables	Mean $\pm$ SD or n (%)
Age	59.1 $\pm$ 15.2
Gender	
Male	63 (63.0%)
Female	37 (37.0%)
Type of disease	
T2DM	25 (25.0%)
Cancer	25 (25.0%)
CKD	25 (25.0%)
NAFLD	25 (25.0%)
Education level	
Primary school or junior high school	72 (72.0%)
Senior high or technical school	16 (16.0%)
College	3 (3.0%)
Bachelor's degree	8 (8.0%)
Master's degree or above	1 (1.0%)
Employment status	
Employed	47 (47.0%)
Unemployed	9 (9.0%)
Student	1 (1.0%)
Retired	14 (14.0%)
Other (farmers, homemakers, temporary workers, informal employment)	29 (29.0%)
Living Situation	
Living alone	6 (6.0%)
Living with spouse	18 (18.0%)
Living with family	76 (76.0%)
Institutional living	0 (0%)

SD, standard deviation; T2DM, type 2 diabetes mellitus; CKD, chronic kidney disease; NAFLD, non-alcoholic fatty liver disease
Data presented as mean $\pm$ SD or n (%).

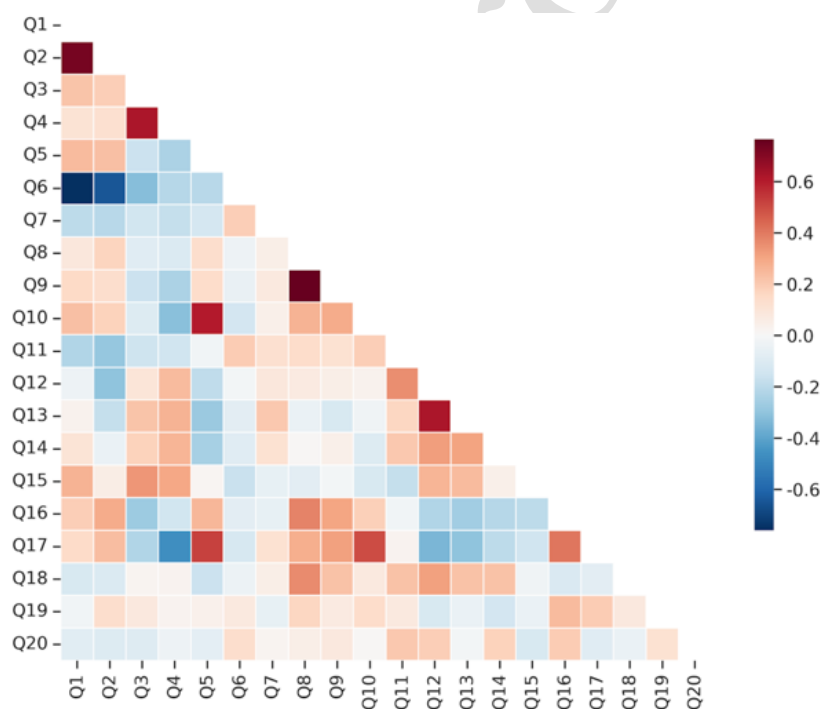


Figure 1. Heatmap of the correlation matrix for the 20-item Narrative Nutrition Questionnaire. The clustering of high-correlation areas (red areas) visually supports the construct validity and the presence of distinct underlying factors.

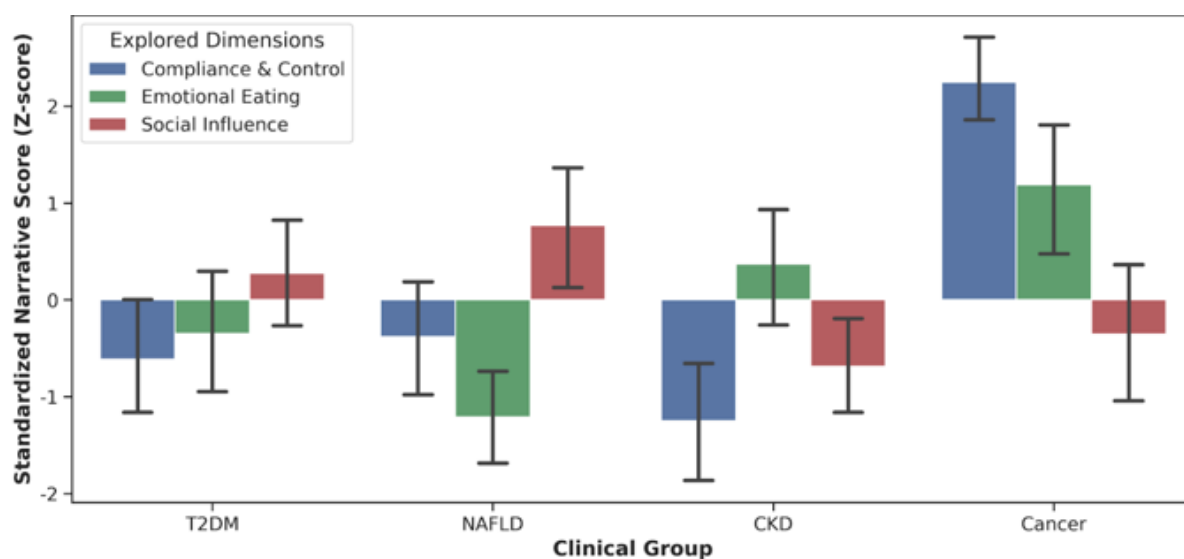


Figure 2. Disease-specific narrative profiles. Mean standardized scores (Z-scores) for the three extracted dimensions across four clinical groups. Error bars represent 95% Confidence Intervals (CI)

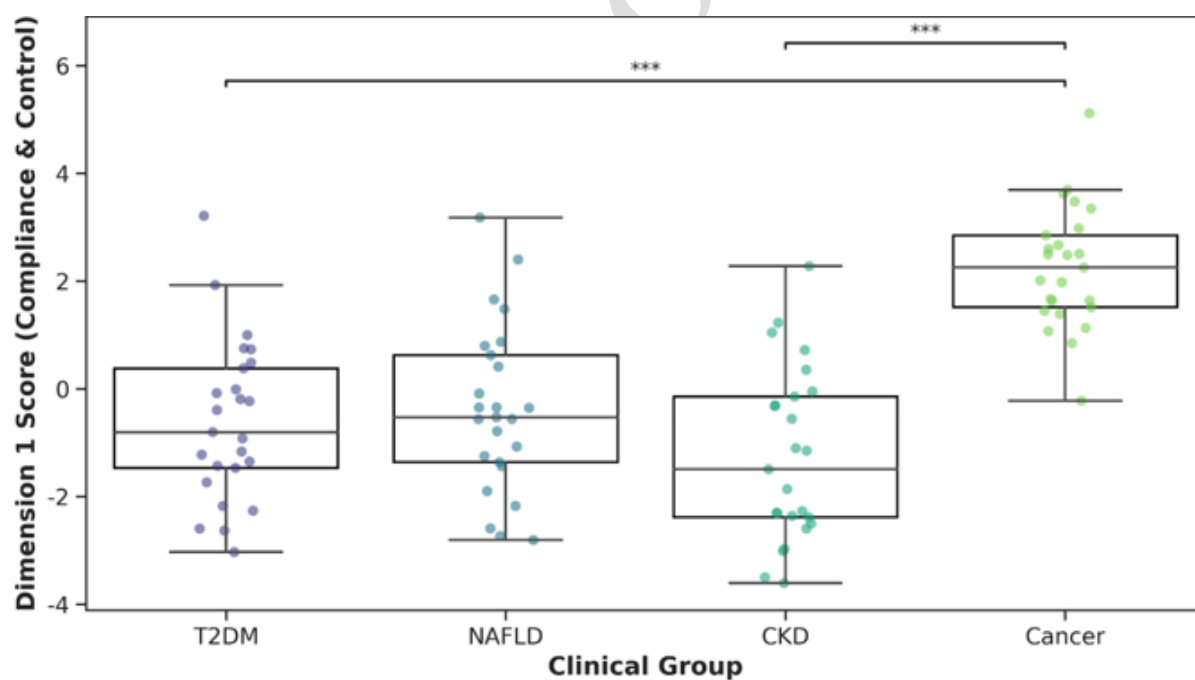


Figure 3. Box plot showing the distribution of Dimension 1 (Dietary Compliance) scores across four disease groups. Individual data points are overlaid to show variability. The asterisks (***) indicate a statistically significant difference between the Type 2 Diabetes Mellitus (T2DM) and Malignant Tumors (Cancer) groups ($p < 0.001$, Tukey's HSD).