

Machine Learning Analysis of Dietary Patterns and Their Association with Disease Activity in Inflammatory Bowel Diseases

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BACKGROUND

- Diet can influence intestinal inflammation in Crohn's disease (CD) and ulcerative colitis (UC)
- However, data on diverse dietary patterns and their impact on disease activity in inflammatory bowel diseases (IBD) are scarce

AIMS

- To determine typical dietary patterns of individuals with IBD while in remission
- To evaluate the association of these dietary patterns with disease activity

METHODS

- Cross-sectional study of adults with IBD who were surveyed on demographics, disease characteristics, medications, and typical diet during or when last in clinical remission
- An unsupervised machine learning method involving ten-fold k-means clustering was used to define discrete dietary structures
- Flare (active disease) was defined by clinical activity scores: Harvey-Bradshaw Index >4 and Simple Clinical Colitis Activity Index >2
- Uni- and multivariable logistic regression was used to evaluate the relationship between dietary clusters and flare, while adjusting for age, sex, disease duration, medication use, and disease behavior (for CD)

RESULTS

- Patient characteristics for CD (n=248) and UC (n=443) participants are shown in **Table 1**.
- Five dietary clusters were identified (**Figures 1 and 2**)

Table 1: Patient Characteristics

	CD	UC	P
Age, years (SD)	36.0 (12.0)	37.5 (12.8)	0.12
Female, %	75.4	75.2	0.98
Disease duration, years (SD)	8.8 (9.4)	7.6 (8.5)	0.09
Behavior, %			N/A
Inflammatory	47.2	N/A	
Stricturing	33.1	N/A	
Fistulizing	34.3	N/A	
Perianal disease, %	25.5	N/A	N/A
Location, %			N/A
Ileum only	32.7	N/A	
Colon only	30.2	N/A	
Ileum and colon	20.6	N/A	
Upper GI	16.5	N/A	
Extent, %			N/A
Left-sided	N/A	70.2	
Extensive	N/A	29.8	
Prior surgery, %			
None	78.2	97.1	<0.01
Small bowel	14.9	1.1	<0.01
Colectomy	6.5	1.8	<0.01
Current therapy, %			
None	24.2	19.9	<0.01
Aminosalicylate	16.9	57.3	<0.01
Immunomodulator	26.2	15.1	<0.01
Biologic	59.3	31.6	<0.01

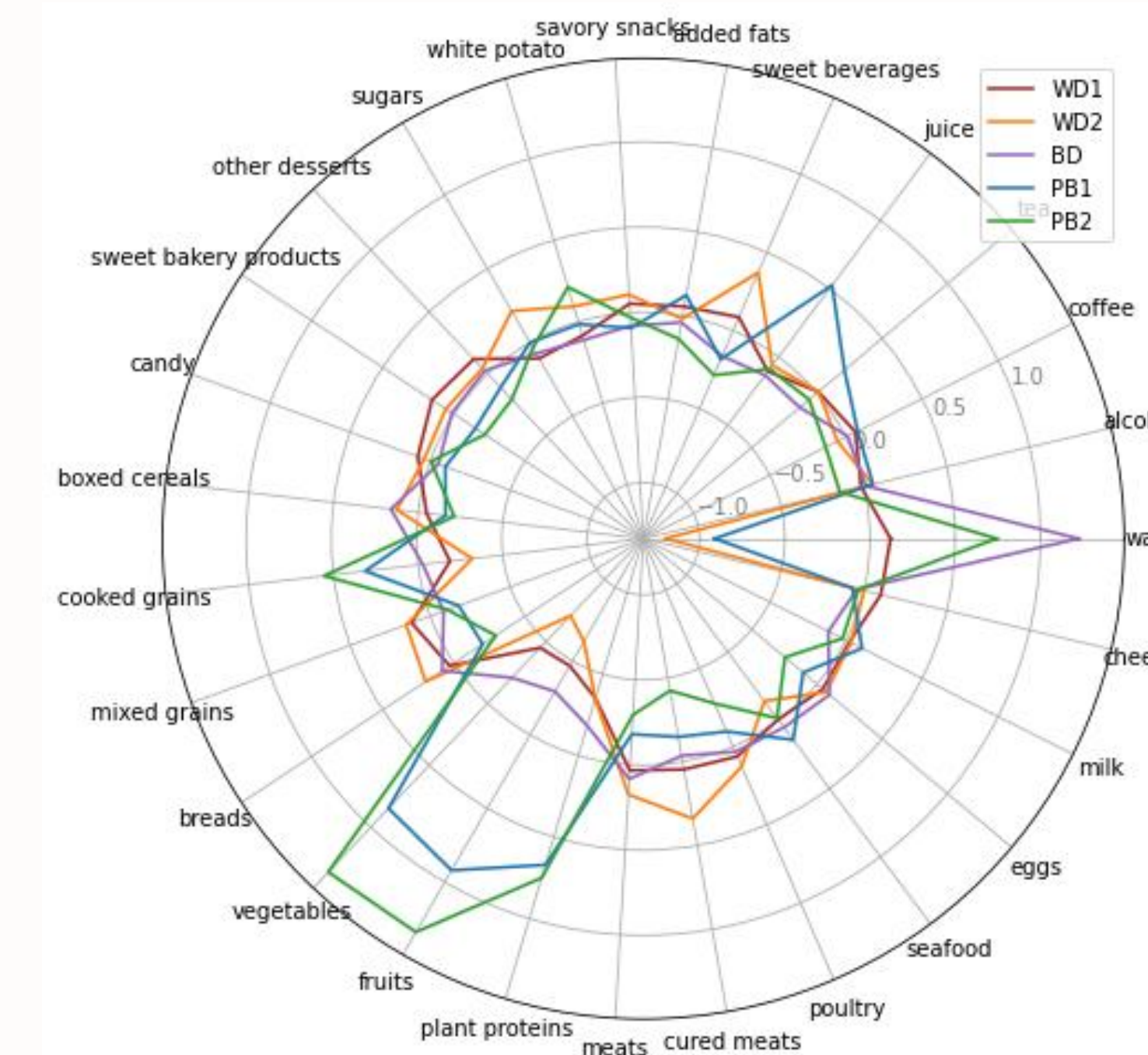


Figure 1: Radar Plot of Dietary Clusters

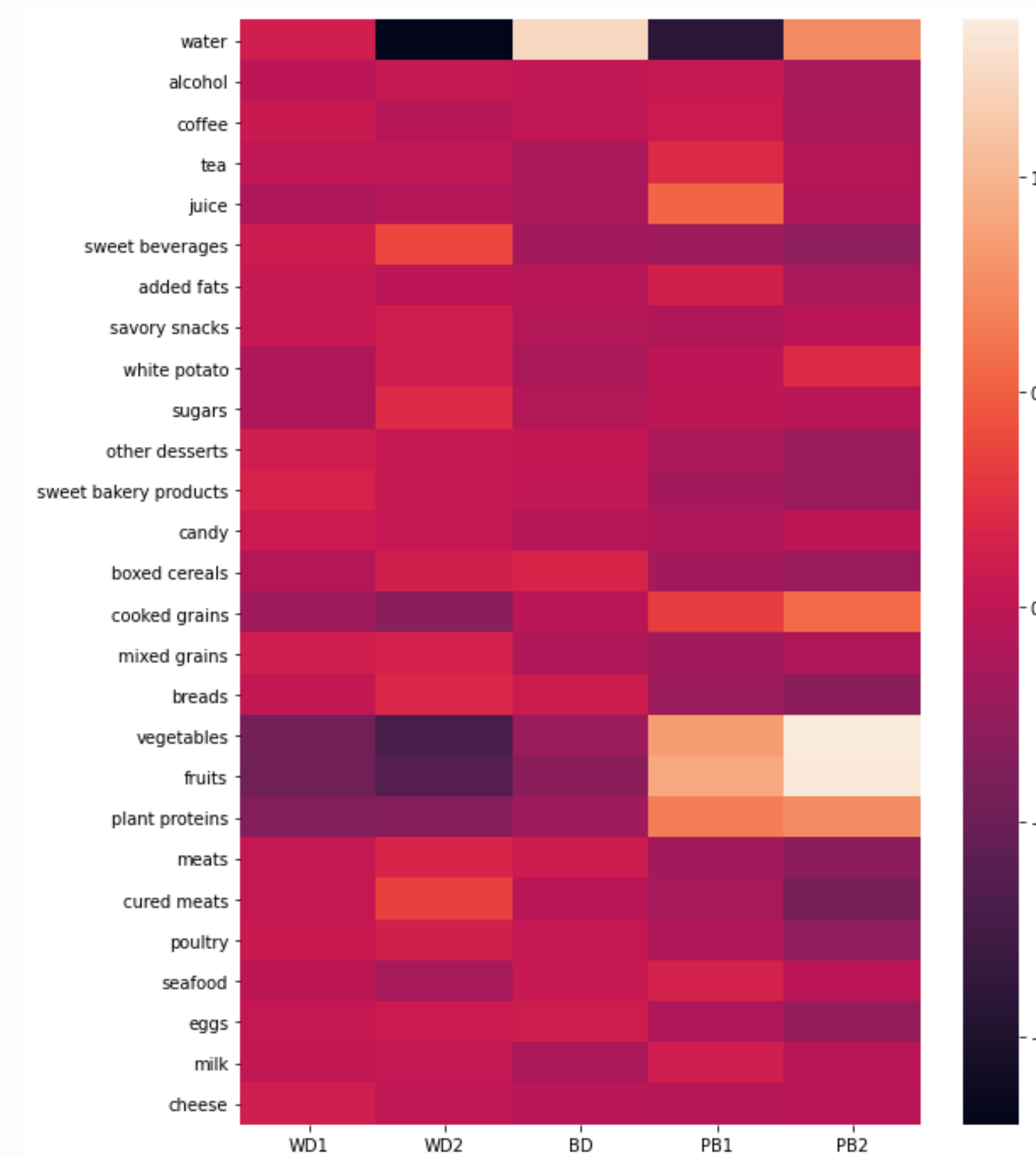


Figure 2: Heatmap of Dietary Clusters

- Of the five dietary clusters, two were Western-type diets (WD1, WD2), one was a balanced diet (BD), and two were plant-based diets (PB1 and PB2)
- Diet PB1 was associated with lower odds of flare in UC, but not CD. Diet PB2 was associated with lower odds of flare in UC and CD. Other diets were not associated with flare in UC or CD (**Table 2**)

Table 2: Dietary Patterns and Flares

	Flare, %	Odds Ratio (95% CI)	P
Overall			
Diet WD1	76.2	Ref	Ref
Diet WD2	76.4	1.09 (0.64 – 1.84)	0.75
Diet BD	73.0	0.83 (0.50 – 1.38)	0.47
Diet PB1	64.5	0.59 (0.34 – 1.02)	0.06
Diet PB2	51.6	0.32 (0.18 – 0.55)	<0.01
Crohn's disease			
Diet WD1	74.2	Ref	Ref
Diet WD2	85.2	2.48 (0.91 – 6.74)	0.07
Diet BD	76.2	1.08 (0.46 – 2.52)	0.86
Diet PB1	73.0	0.95 (0.36 – 2.51)	0.92
Diet PB2	50.0	0.32 (0.12 – 0.83)	0.02
Ulcerative colitis			
Diet WD1	77.4	Ref	Ref
Diet WD2	71.8	0.81 (0.42 – 1.54)	0.51
Diet BD	71.0	0.68 (0.36 – 1.31)	0.25
Diet PB1	60.3	0.45 (0.23 – 0.90)	0.02
Diet PB2	52.4	0.31 (0.15 – 0.62)	<0.01

CONCLUSION

- Plant-based diets were associated lower odds of flare in IBD
- Increase of fruits and vegetables alone was not sufficient for reducing the odds of flare for CD