

Table 1. Abbreviated food frequency questionnaire of most commonly consumed foods containing high quantities of dietary vitamin D. Modified from NUTTAB 2011.

Food item	µg/100g Cholecalciferol	Amount per week (g)
Reduced fat milk (vit D added)	2.0	
Malted milk drink powder (Milo)	5	
Cheddar cheese (vit D added)	5.7	
Butter / edible oil spread	10	
Margarine	6.5	
Egg yolk – raw	2.2	
Salmon – raw	20	
Tuna / sardines – canned	2.1	
Gemfish – steamed	2.2	
Mulloway – steamed	2.6	
Shark – deep fried, battered only	7.5	
Atlantic Herring	13	
Calamari – crumbed, fried only	8.6	
Oysters	8.0	
Prawns	3.7	

Supplementary Table 2. Primer pairs used for VDR gene analysed

Gene	Forward primer sequence (5' to 3')	Reverse primer sequence (5' to 3')
VDR	GGACTGCCGCATCACCAA	TCATCTCCCGCTTCCTCT

Supplementary Table 3. Scoring System for Histological Abnormalities in Crohn's Disease Mucosal Biopsy Specimens (adapted from D'Haens et al ²⁸). Each parameter is scored independently (moderate increase, up to twice the number of cells that can normally be expected; severe increase, more than twice the normal number of cells). The additive score was for individual biopsies; an additional parameter, of 'number of biopsy specimens affected', was hence not included in this score.

Parameter	Score	Description
Epithelial damage	0	Normal
	1	Focal pathology
	2	Extensive pathology
Architectural changes	0	Normal
	1	Moderately disturbed (< 50%)
	2	Severely disturbed (\geq 50%)
Infiltration of mononuclear cells in the lamina propria	0	Normal
	1	Moderate increase
	2	Severe increase
Infiltration of polymorphonuclear cells in the lamina propria	0	Normal

	1	Moderate increase
	2	Severe increase
Polymorphonuclear cells in epithelium	1	In surface epithelium
	2	Cryptitis
	3	Crypt abscess
Presence of erosion and/or ulcers	0	No
	1	Yes
Presence of granuloma	0	No
	1	Yes

Supplementary Table 4. Geboes Score for assessment of histological activity in ulcerative colitis ²⁹.

Grade 0 Structural (architectural changes)

Subgrades

0.0	No abnormality
0.1	Mild abnormality
0.2	Mild or moderate diffuse or multifocal abnormalities
0.3	Severe diffuse or multifocal abnormalities

Grade 1 Chronic inflammatory infiltrate

Subgrades

1.0	No increase
1.1	Mild but unequivocal increase
1.2	Moderate increase
1.3	Marked increase

Grade 2 Lamina propria neutrophils and eosinophils

2A Eosinophils

2A.0	No increase
2A.1	Mild but unequivocal increase
2A.2	Moderate increase

2A.3	Marked increase
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2B Neutrophils

2B.0	No increase
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2B.1	Mild but unequivocal increase
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2B.2	Moderate increase
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2B.3	Marked increase
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Grade 3 Neutrophils in epithelium

Subgrades

3.0	None
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3.1	<5% Crypts involved
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3.2	<50% Crypts involved
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3.3	>50% Crypts involved
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Grade 4 Crypt destruction

Subgrades

4.0	None
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4.1	Probable—local excess of neutrophils in part of crypt
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4.2	Probable—marked attenuation
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4.3	Unequivocal crypt destruction
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Grade 5 Erosion or ulceration

Subgrades

5.0 No erosion, ulceration, or granulation tissue

5.1 Recovering epithelium+ adjacent inflammation

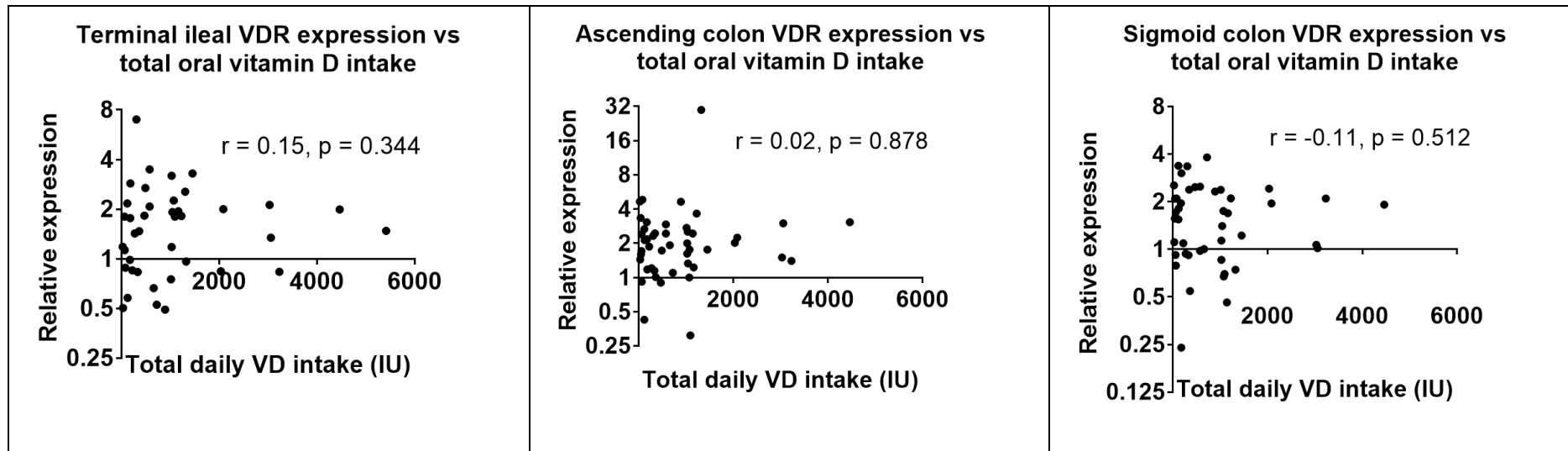
5.2 Probable erosion focally stripped

5.3 Unequivocal erosion

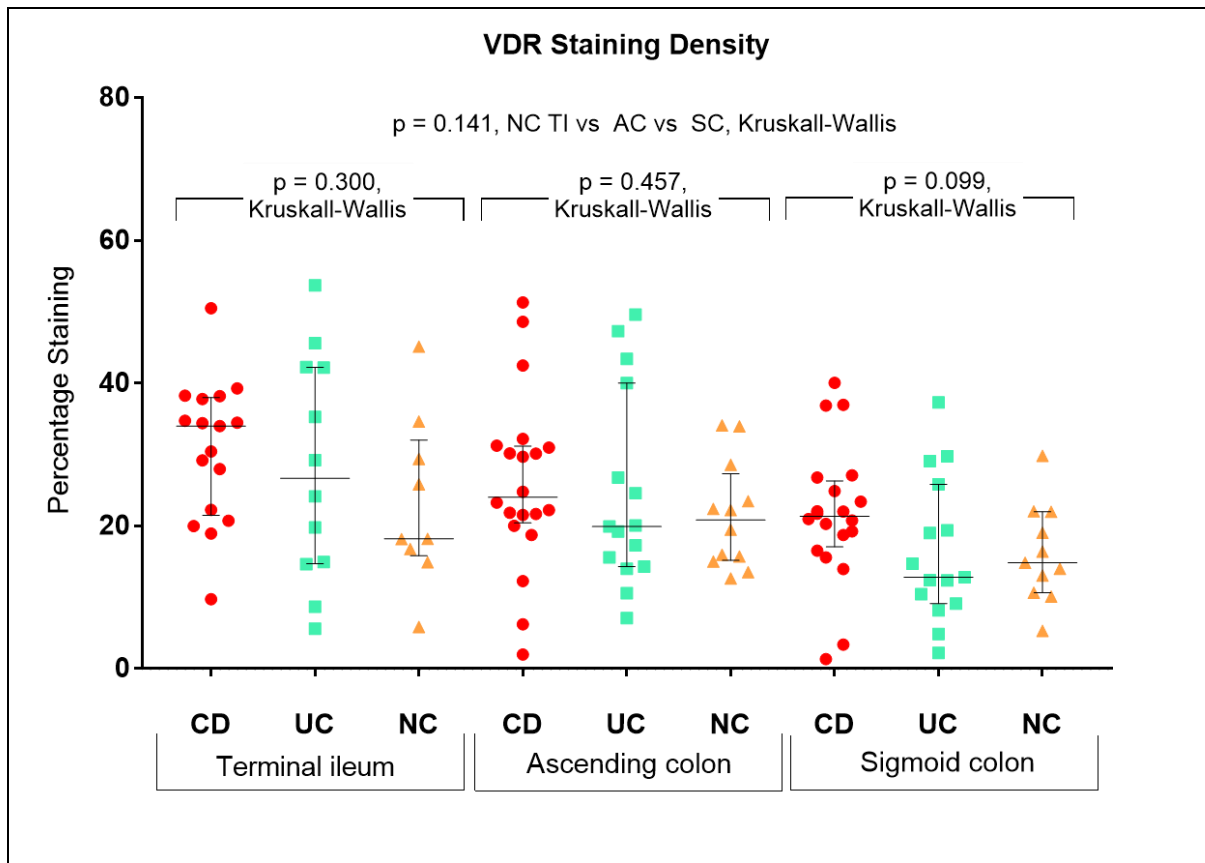
5.4 Ulcer or granulation tissue

Supplementary Figure 1. Correlation of intestinal VDR mRNA expression with total oral vitamin D (VD) intake across all participants.

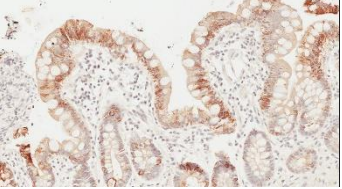
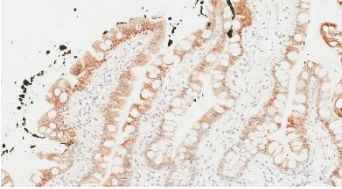
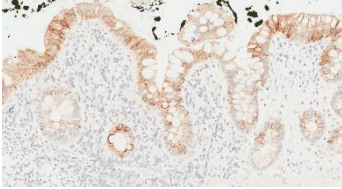
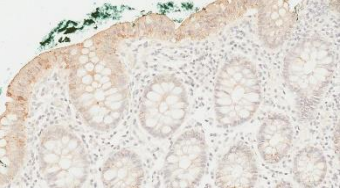
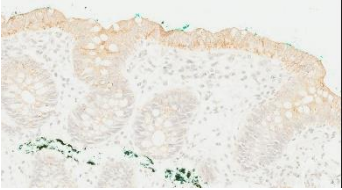
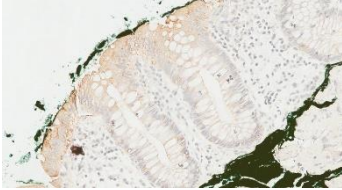
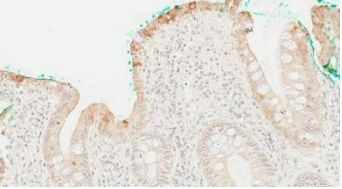
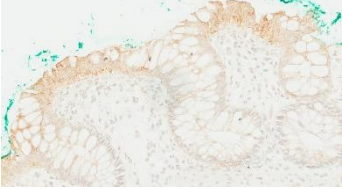
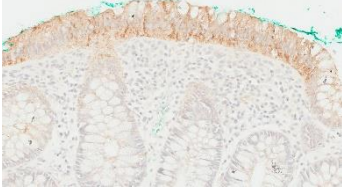
Expression is relative to the median of the non-IBD control terminal ileal specimens.



Supplementary Figure 2. VDR immunohistochemical staining of mucosa of colonoscopic biopsies amongst patients with IBD and non-IBD controls in the terminal ileum, ascending colon and sigmoid colon. Staining is expressed as the percentage of DAB+ particle density identified at an arbitrary detection threshold using Image J image processing software.



Supplementary Figure 3. Representative colonoscopic biopsy mucosal immunohistochemistry images of VDR in the terminal ileum, ascending colon and sigmoid colon amongst patients with CD, UC and non-IBD controls. Images represent samples with the median of the semi-quantification where possible (from supplementary figure 1).

	Crohn's disease	Ulcerative colitis	Non-IBD controls
Terminal ileum			
Ascending colon			
Sigmoid colon			

Supplementary Table 5. Baseline characteristics of patients undergoing intestinal resection. (DM, diabetes mellitus; CKD, chronic kidney disease; BMI, body mass index. Fitzpatrick skin types: I - pale white skin, blue/hazel eyes, blond/red hair, II - fair skin, blue eyes, III - darker white skin, IV - light brown skin, V - brown skin, VI - dark brown or black skin).

	Crohn's disease (n=5)	Ulcerative colitis (n=5)	Non-IBD Controls (n=5)	P value
Age (mean +/- range)	46 (37-54)	45 (23-62)	64 (44-83)	0.102 ^a
Female:Male	4:1	1:4	3:2	0.178 ^a
Type of surgery				
Ileal resection	1			
Ileocaecal resection	1			
Right hemicolectomy			2 ^c	
Ileoproctocolectomy	3			
Subtotal colectomy		3		
Proctocolectomy		2		
Anterior resection (High / Low / ultra-low)			2 ^d	
Right hemicolectomy + anterior resection			1 ^e	
Co-morbid illnesses, n (%)				

Hypertension	2	1	2	
Hyperlipidaemia	0	0	1	
Type 2 DM	0	0	1	
Ischaemic heart disease	0	0	1	
Colorectal adenocarcinoma	0	0	4	
Ethnicity, n (%)				
Australian & New Zealander	4 (80)	4 (80)	4 (80)	
Northern & Western European	0 (0)	0 (0)	8 (20)	
Southern European	1 (0)	0 (0)	0 (0)	
Eastern & South-East Asian	0 (0)	1 (20)	0 (0)	
Fitzpatrick Skin Type, n (%)				
I	0 (0)	0 (0)	1 (20)	
II	4 (80)	4 (80)	3 (60)	
III	1 (20)	1 (20)	1 (20)	
Smoking status, n (%)				
Never smoked	0 (0)	2 (40)	1 (20)	
Ex-smokers	3 (60)	3 (60)	2 (40)	
Current smokers	2 (40)	0 (0)	2 (40)	
BMI (mean +/- CI)	31.8 (22.4-41.3)	26.6 (18.7-34.5)	28.5 (27.3-29.7)	0.381 ^a

Waist circumference, cm (mean +/- CI)	105.2 (78.8-131.6)	93.0 (88.0-98.0)	101.0 (98.7-103.3)	0.433 ^a
Vitamin D supplementation (n)	3	2	1	
Estimated total dietary vitamin D intake (IU/day, median, range)	2170 (31-3679)	127 (63-5125)	274 (56-1062)	0.613 ^b

^a ANOVA

^b Kruskal-Wallis test

^c For adenocarcinoma

^d One patient had rectal cancer, one patient had diverticular high recto-vaginal fistula

^e This patient with sigmoid cancer also had an advanced ascending colon polyp, and elected to undergo a right hemicolectomy in addition to anterior resection.

Supplementary Table 6. Characteristics of patients with IBD undergoing intestinal resection. 5-ASAs, 5-aminosalicylates; 6-MP, 6-mercaptopurine; IFX, infliximab; ADA, adalimumab.

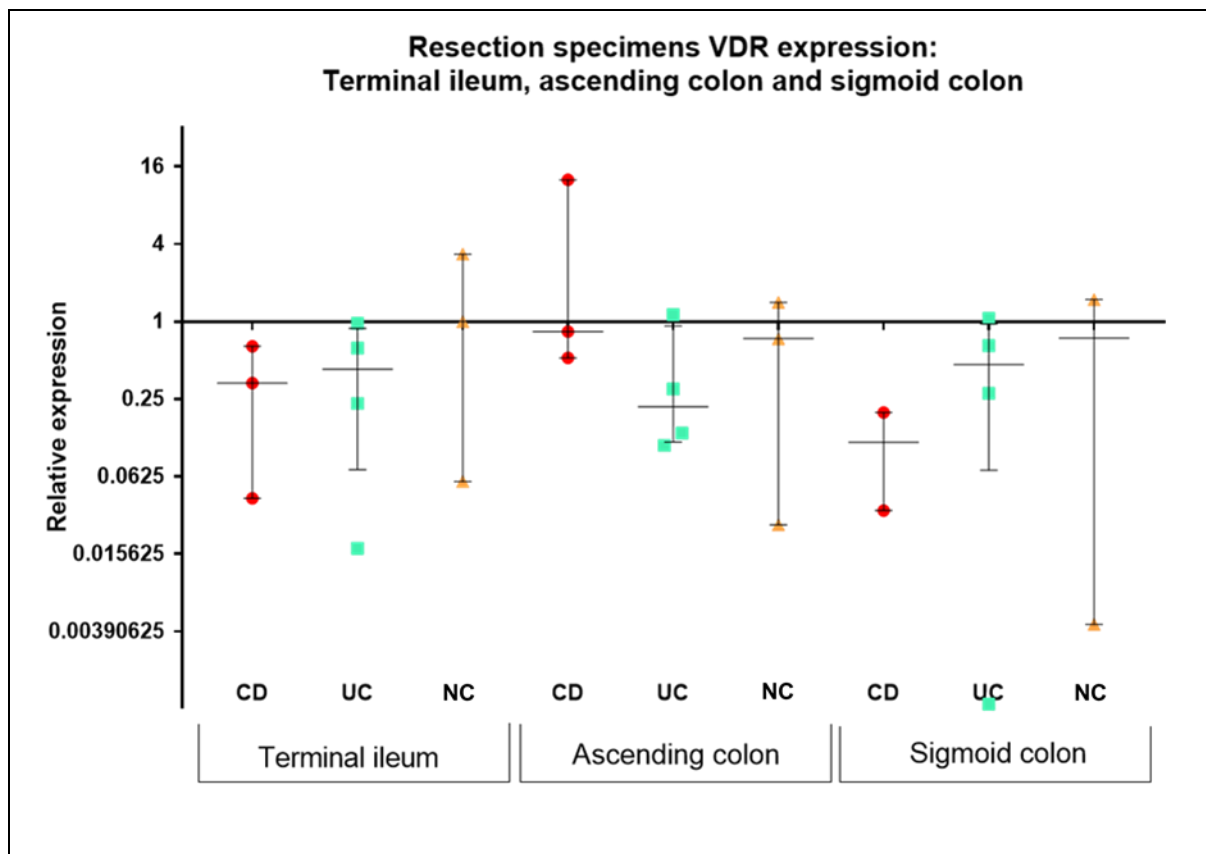
	Crohn's disease (n=5)		Ulcerative colitis (n=5)	
Montreal Classification	Age at diagnosis (y)		Disease extent	
Number of patients, n (%)	< 17	1 (20)	Proctitis	0 (0)
	17-40	3 (60)	Left sided colitis	0 (0)
	> 40	1 (20)	Extensive colitis	5 (100)
	Location		Disease severity	
	Ileal	0 (0)	Clinical remission	0 (0)
	Colonic	1 (20)	Mild	1 (20)
	Ileocolonic	4 (80)	Moderate	0 (0)
	Upper GI	0 (0)	Severe	4 (80)
	Behaviour			
	Non-stricturing, non-penetrating	0 (0)		
	Stricturing	2 (40)		
	Penetrating / fistulising	3 (60)		

	Perianal	3 (60)		
Disease activity	Harvey Bradshaw Index (median, range)	15 (3-18)	Simple Clinical Colitis Activity Index (median, range)	13 (2-16)
	Active disease (faecal calprotectin \geq 100 μg/g and/or C-reactive protein \geq 5 mg/L), Number of patients, n (%)	4 (80)		5 (100)
Medical therapy	Nil	1 (20)		0 (0)
Number of patients, n (%)	5-ASAs only	0 (0)		0 (0)
	Steroids \pm 5-ASAs	0 (0)		1 (20)
	Azathioprine / 6-MP \pm 5-ASAs / steroids	1 (20)		2 (40)
	Methotrexate \pm 5-ASAs / steroids	0 (0)		1 (20)
	IFX / ADA \pm 5-ASAs / steroids	1 (20)		0 (0)
	IFX / ADA \pm immunomodulators	2 (40)		1 (20)
Previous intestinal surgery / surgeries, Number of patients, n (%)	Jejunal resection	0 (0)		

Single ileal resection	0 (0)
Multiple ileal resections	0 (0)
Single ileo-colonic resection	1 (20)
Multiple ileo-colonic resections	2 (40)
Ileal resection(s) + colectomy (total or subtotal)	0 (0)
Colectomy (total or subtotal)	0 (0)

Supplementary Figure 4. Resection specimen gene expression of VDR amongst patients with IBD and non-IBD controls in the terminal ileum, ascending colon and sigmoid colon.

Expression is relative to the median of the non-IBD control terminal ileal expression. Circles represent patients with CD, squares patients with UC and triangles non-IBD controls (NC).



Supplementary Figure 5. Immunohistochemical staining for VDR amongst patients with IBD and non-IBD controls in the terminal ileum, ascending colon and sigmoid colon across the mucosa, submucosa and circular muscle. Staining is expressed as the percentage of DAB+ particle density identified at an arbitrary detection threshold using Image J image processing software. Circles represent patients with CD, squares patients with UC and triangles non-IBD controls (NC).

