

Supplementary Material

Oxygen-18 stable isotope of exhaled breath CO₂ as a
non-invasive marker of *Helicobacter pylori* infection

Abhijit Maity[†], Suman Som[†], Chiranjit Ghosh[†], Gourab Dutta Banik[†], Sunil B. Daschakraborty[‡], Shibendu Ghosh[§], Sujit Chaudhuri[‡] and Manik Pradhan^{†,*}

[†] *Department of Chemical, Biological and Macromolecular Sciences, S. N. Bose National Centre for Basic Sciences, Salt Lake, JD Block, Sector III, Kolkata-700098, India*

[‡] *Department of Gastroenterology, AMRI Hospital, Salt Lake City, JC-16 & 17, Kolkata-700098, India*

[§] *Department of Medicine, Vivekananda Institute of Medical Sciences, 99 Sarat Bose Road, Kolkata-700027, India*

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Table: 4

*Corresponding Author:

Dr Manik Pradhan
Department of Chemical, biological and Macromolecular Sciences
S.N. Bose National Centre for Basic Sciences
Salt Lake, JD Block, Sector III, Kolkata-700098, India

Email: manik.pradhan@bose.res.in

Phone: + 91 33 2335 5706-8

Fax: +91 33 2335 3477

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Table S1 Detailed information of the subjects' characteristics

<i>Subjects</i>	<i>Sex (M/F)</i>	<i>Age (yr)</i>	<i>Weight (kg)</i>	<i>Height (inch)</i>	<i>Endoscopy & Biopsy (Rapid Urease Tests)</i>	<i>¹³C-Urea Breath Test (¹³C-UBT)</i>		<i>Gastrointestinal Disorders</i>
						<i>δ_{DOB}¹³C (‰) at 30 min</i>	<i>δ_{DOB}¹⁸O (‰) at 30 min</i>	
HP 1	M	18	54	63	Positive	4.41	3.29	Active Deodenal Ulcer
HP 2	F	47	56	54	Positive	6.8	4.29	Active Deodenal Ulcer
HP 3	F	62	55	57	Positive	48.13	5.44	Peptic Ulcer
HP 4	M	58	59	62	Positive	10.62	2.09	Deodenal Ulcer
HP 5	M	17	51	61	Positive	3.32	7.95	Deodenal Scarring
HP 6	M	16	85	71	Positive	2.25	2.42	Deodenal Ulcer
HP 7	M	38	56	63	Positive	2.72	2.29	Antral Gastritis
HP 8	M	45	67	65	Positive	2.38	2.66	Deodenal Ulcer
HP 9	F	60	74	64	Positive	25.68	2.43	Antral Gastritis
HP 10	F	56	75	67	Positive	14.72	2.82	Duodenitis
HP 11	F	47	46	61	Positive	26.04	3.97	Antral Gastritis
HP 12	M	46	66	65	Positive	22.31	3.51	Erosive Gastritis with duodenitis
HP 13	M	39	63	59	Positive	56.4	3.22	Erosive Gastritis
HP 14	M	62	59	62	Positive	49.35	2.55	Antral Gastritis
HP 15	M	66	77	69	Positive	4.09	2.52	Dypepsia
HP 16	F	48	58	64	Positive	8.08	10.37	Erosive Gastritis
HP 17	M	28	67	66	Positive	4.59	3.29	Antral Gastritis
HP 18	F	35	56	59	Positive	2.86	2.7	Antral Gastritis
HP 19	F	40	55	61	Positive	68.76	3.28	Antral Gastritis
HP 20	M	59	49	62	Positive	2.6	3.33	Antral Gastritis
HP 21	M	60	53	63	Positive	19.98	12.83	Erosive Antrum
HP 22	F	27	61	64	Positive	24.62	2.71	Dypepsia
HP 23	M	20	48	66	Positive	18.26	3.68	Antral Gastritis
HP 24	F	51	66	66	Positive	2.25	3.69	Erosive Gastritis
HP 25	M	27	61	64	Positive	20.88	2.98	Dypepsia
HP 26	M	31	71	71	Positive	25.28	4.85	Deodenal Ulcer
HP 27	M	32	45	66	Positive	2.95	2.91	Mild Antral Gastritis
HP 28	F	29	50	66	Positive	2.82	2.47	Antral Gastritis
HP 29	F	47	71	61	Positive	3.14	5.68	Erosive Gastritis
HP 30	F	41	69	63	Positive	4.98	1.92	Active Deodenal Ulcer
HP 31	F	38	84	59	Positive	4.75	3.43	Active Deodenal Ulcer
HP 32	F	32	47	61	Positive	2.98	3.11	Antral Gastritis

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HP 33	M	27	60	65	Positive	13.7	2.7	Deodenal Ulcer
HP 34	M	46	65	66	Positive	58.34	3.57	Active Deodenal ulcer
HP 35	F	30	68	59	Positive	2.94	5.73	Antral Gastritis
HP 36	M	29	52	64	Positive	3.44	2.02	Antral Gastritis
HP 37	M	36	75	71	Positive	51.09	3.1	Antral Gastritis with duodenitis
HP 38	M	72	40	64	Positive	48.02	5.82	Active Deodenal ulcer
HP 39	M	39	56	67	Positive	98.39	3.32	Antral Gastritis
HP 40	M	23	62	68	Positive	31.71	3.76	Antral Gastritis
HP 41	M	56	58	64	Positive	4.74	2.51	Active Deodenal ulcer
HP 42	M	21	75	64	Positive	5.97	3.67	Antral Gastritis
HP 43	F	49	60	65	Positive	41.54	5.61	Active Deodenal ulcer
HP 44	F	61	71	69	Positive	2.51	2.88	Antral Gastritis
HP 45	F	56	68	67	Positive	77.4	3.7	Deodenal Scarring
HP 46	M	32	60	69	Positive	64.57	4.11	Active Deodenal ulcer
HP 47	M	46	66	66	Positive	56.47	2.26	Peptic Ulcer
HP 48	F	32	60	63	Positive	20.89	3.36	Erosive Gastritis with Duodenitis
HP 49	M	37	102	71	Positive	2.31	2.79	Antral Gastritis
HP 50	M	30	67	65	Positive	8.36	8.61	Antral Gastritis
HP 51	M	28	60	66	Positive	3.61	3.29	Dypepsia
HP 52	F	45	68	57	Positive	4.92	3.43	Erosive Gastritis
HP 53	M	38	47	67	Positive	48.97	4.97	Dypepsia
HP 54	M	42	84	68	Positive	8.08	2.41	Active Ulcer
HP 55	M	47	74	67	Positive	2.82	2.47	Antral Gastritis
HP 56	M	34	65	67	Positive	4.98	5.68	Antral Gastritis
HP 57	F	41	78	71	Positive	4.39	2.62	Erosive Gastritis
HP 58	F	42	72	68	Positive	2.83	1.92	Active Ulcer
HP 59	M	35	68	68	Positive	24.73	2.87	Dypepsia
HP 60	F	52	58	58	Positive	3.14	3.43	Antral Gastritis with Duodenitis
HP 61	F	41	59	61	Positive	46.78	6.57	Active Duodenal Ulcer
HP62	M	35	68	68	Positive	24.73	2.87	Dypepsia
HP63	F	41	59	61	Positive	46.78	6.57	Active Duodenal Ulcer
HP64	M	52	67	66	Positive	10.95	2.23	Dypepsia
HP65	M	59	83	71	Positive	108.69	2.07	Peptic Ulcer
HP66	M	66	65	68	Positive	4.75	3.11	Dypepsia
HP67	M	42	70	70	Negative	-0.86	-2.22	X

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HP68	M	52	65	63	Negative	-1.04	-1.23	X
HP69	M	57	70	67	Negative	0.28	0.38	X
HP70	M	48	60	70	Negative	1.19	0.48	X
HP 71	M	38	74	66	Negative	1.17	-0.67	X
HP 72	M	53	55	66	Negative	0.94	0.35	X
HP 73	F	41	55	56	Negative	0.73	0.72	X
HP 74	M	40	68	68	Negative	0.93	0.4	X
HP 75	M	48	70	69	Negative	-0.24	0.82	X
HP 76	F	60	68	56	Negative	-1.57	-1.2	X
HP 77	M	28	66	66	Negative	0.61	-1.3	X
HP 78	M	31	71	71	Negative	1.2	0.28	X
HP 79	M	25	58	70	Negative	1.38	-0.91	X
HP 80	F	39	57	67	Negative	-0.23	0.23	X
HP 81	M	56	68	63	Negative	0.81	-1.23	X
HP 82	M	28	56	58	Negative	0.67	-1.23	X
HP 83	F	31	54	57	Negative	0.55	-1.83	X
HP 84	F	48	58	56	Negative	-2.07	-0.29	X
HP 85	F	35	62	58	Negative	-0.18	-0.81	X
HP 86	F	42	56	52	Negative	-1	-0.96	X
HP 87	M	26	62	60	Negative	-1.12	-1.35	X
HP 88	F	32	54	59	Negative	0.41	-0.44	X
HP 89	F	37	65	62	Negative	-0.04	-2.02	X
HP 90	M	35	62	62	Negative	0.8	-0.57	X
HP 91	F	42	68	56	Negative	-1.37	-1.14	X
HP 92	M	28	61	58	Negative	-0.27	0.47	X
HP 93	F	33	53	62	Negative	0.21	0.28	X
HP 94	F	46	68	63	Negative	-0.46	-0.37	X
HP 95	F	52	70	59	Negative	1.43	-1	X
HP 96	M	30	68	67	Negative	1.09	-1.43	X
HP 97	M	34	70	66	Negative	0.81	-1.23	X
HP 98	M	24	68	67	Negative	0.67	-1.23	X
HP 99	F	45	62	66	Negative	0.55	-1.83	X
HP 100	M	49	68	65	Negative	-2.07	-0.29	X
HP 101	F	55	51	63	Negative	-0.18	-0.81	X
HP 102	F	34	61	62	Negative	-1.02	-0.96	X
HP 103	M	48	93	70	Negative	-1.12	-1.35	X
HP 104	M	42	77	72	Negative	0.41	-0.44	X
HP 105	M	39	69	69	Negative	-0.04	-1.02	X
HP 106	M	27	50	66	Negative	0.8	-0.57	X
HP 107	F	65	69	65	Negative	0.21	0.28	X

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HP 108	F	47	74	61	Negative	-0.46	-0.37	X
HP 109	M	26	71	65	Negative	1.13	-1	X

Table S2 Comparison of the $\delta^{13}\text{C}\%$ values measured by ICOS with that of certified calibration standards. SD corresponds to the 1 standard deviation of three successive measurements

$\delta^{13}\text{C}\%$ of certified calibration standards analyzed by IRMS	$\delta^{13}\text{C}\% \pm \text{SD}$ measured by ICOS
-22.8	-22.7 ± 0.15
-13.22	-13.34 ± 0.15
-7.33	-7.33 ± 0.15

Table S3 Measurements of the $\delta^{18}\text{O}\%$ values by ICOS of five flasks filled from a certified standard NOAA air tank (Serial No.CB10073).

Flask	$\delta^{18}\text{O}\%$ measured by ICOS method
Flask-1	-0.93
Flask-2	-1.28
Flask-3	-0.88
Flask-4	-1.18
Flask-5	-0.82
Avg.	-1.02
Standard Deviation	± 0.20
NOAA	-1.00
Diff.	0.02 ± 0.20

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Table S4 Statistical analysis of ROC Curve for $\delta_{\text{DOB}}^{18}\text{O}\%$ at 30 min: Cut-off value is 1.92%.

(See highlighted portion)

(a)

Positive Cut-Off Value	TP Rate (Sensitivity)	95% Confidence Level	TN Rate (Specificity)	95% Confidence Level
-2.22	1.000	0.946 to 1.000	0.000	0.000 to 0.082
-2.02	1.000	0.946 to 1.000	0.023	0.001 to 0.123
-1.83	1.000	0.946 to 1.000	0.047	0.006 to 0.158
-1.43	1.000	0.946 to 1.000	0.093	0.026 to 0.221
-1.35	1.000	0.946 to 1.000	0.116	0.039 to 0.251
-1.30	1.000	0.946 to 1.000	0.163	0.068 to 0.307
-1.23	1.000	0.946 to 1.000	0.186	0.084 to 0.334
-1.20	1.000	0.946 to 1.000	0.302	0.172 to 0.461
-1.14	1.000	0.946 to 1.000	0.326	0.191 to 0.485
-1.02	1.000	0.946 to 1.000	0.349	0.210 to 0.509
-1.00	1.000	0.946 to 1.000	0.372	0.230 to 0.533
-0.96	1.000	0.946 to 1.000	0.419	0.270 to 0.579
-0.91	1.000	0.946 to 1.000	0.465	0.312 to 0.623
-0.81	1.000	0.946 to 1.000	0.488	0.333 to 0.645
-0.67	1.000	0.946 to 1.000	0.535	0.377 to 0.688
-0.57	1.000	0.946 to 1.000	0.558	0.399 to 0.709
-0.44	1.000	0.946 to 1.000	0.605	0.444 to 0.750
-0.37	1.000	0.946 to 1.000	0.651	0.491 to 0.790
-0.29	1.000	0.946 to 1.000	0.698	0.539 to 0.828
0.23	1.000	0.946 to 1.000	0.744	0.588 to 0.865
0.28	1.000	0.946 to 1.000	0.767	0.614 to 0.882
0.35	1.000	0.946 to 1.000	0.837	0.693 to 0.932
0.38	1.000	0.946 to 1.000	0.860	0.721 to 0.947
0.40	1.000	0.946 to 1.000	0.884	0.749 to 0.961
0.47	1.000	0.946 to 1.000	0.907	0.779 to 0.974
0.48	1.000	0.946 to 1.000	0.930	0.809 to 0.985
0.72	1.000	0.946 to 1.000	0.953	0.842 to 0.994
0.82	1.000	0.946 to 1.000	0.977	0.877 to 0.999
1.92	1.000	0.946 to 1.000	1.000	0.918 to 0.100
2.02	0.970	0.895 to 0.996	1.000	0.918 to 0.100
2.07	0.955	0.873 to 0.991	1.000	0.918 to 0.100
2.09	0.939	0.852 to 0.983	1.000	0.918 to 0.100
2.23	0.924	0.832 to 0.975	1.000	0.918 to 0.100
2.26	0.909	0.813 to 0.966	1.000	0.918 to 0.100
2.29	0.894	0.794 to 0.956	1.000	0.918 to 0.100
2.41	0.879	0.775 to 0.946	1.000	0.918 to 0.100
2.42	0.864	0.757 to 0.936	1.000	0.918 to 0.100
2.43	0.848	0.739 to 0.925	1.000	0.918 to 0.100
2.47	0.833	0.721 to 0.914	1.000	0.918 to 0.100
2.51	0.803	0.687 to 0.891	1.000	0.918 to 0.100

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2.52	0.788	0.670 to 0.879	1.000	0.918 to 0.100
2.55	0.773	0.653 to 0.867	1.000	0.918 to 0.100
2.62	0.758	0.636 to 0.855	1.000	0.918 to 0.100
2.66	0.742	0.620 to 0.842	1.000	0.918 to 0.100
2.70	0.727	0.604 to 0.830	1.000	0.918 to 0.100
2.71	0.697	0.571 to 0.804	1.000	0.918 to 0.100
2.79	0.682	0.556 to 0.791	1.000	0.918 to 0.100
2.82	0.667	0.540 to 0.778	1.000	0.918 to 0.100
2.87	0.652	0.524 to 0.765	1.000	0.918 to 0.100
2.88	0.621	0.493 to 0.738	1.000	0.918 to 0.100
2.91	0.606	0.478 to 0.724	1.000	0.918 to 0.100
2.98	0.591	0.463 to 0.710	1.000	0.918 to 0.100
3.10	0.576	0.448 to 0.697	1.000	0.918 to 0.100
3.11	0.561	0.433 to 0.683	1.000	0.918 to 0.100
3.22	0.530	0.403 to 0.654	1.000	0.918 to 0.100
3.28	0.515	0.389 to 0.640	1.000	0.918 to 0.100
3.29	0.500	0.374 to 0.626	1.000	0.918 to 0.100
3.32	0.455	0.331 to 0.582	1.000	0.918 to 0.100
3.33	0.439	0.317 to 0.567	1.000	0.918 to 0.100
3.36	0.424	0.303 to 0.552	1.000	0.918 to 0.100
3.43	0.409	0.290 to 0.537	1.000	0.918 to 0.100
3.51	0.364	0.249 to 0.491	1.000	0.918 to 0.100
3.57	0.348	0.235 to 0.476	1.000	0.918 to 0.100
3.67	0.333	0.222 to 0.460	1.000	0.918 to 0.100
3.68	0.318	0.209 to 0.444	1.000	0.918 to 0.100
3.69	0.303	0.196 to 0.429	1.000	0.918 to 0.100
3.70	0.288	0.183 to 0.413	1.000	0.918 to 0.100
3.76	0.273	0.170 to 0.396	1.000	0.918 to 0.100
3.97	0.258	0.158 to 0.380	1.000	0.918 to 0.100
4.11	0.242	0.145 to 0.364	1.000	0.918 to 0.100
4.29	0.227	0.133 to 0.347	1.000	0.918 to 0.100
4.85	0.212	0.121 to 0.330	1.000	0.918 to 0.100
4.97	0.197	0.109 to 0.313	1.000	0.918 to 0.100
5.44	0.182	0.098 to 0.296	1.000	0.918 to 0.100
5.61	0.167	0.086 to 0.279	1.000	0.918 to 0.100
5.68	0.152	0.075 to 0.261	1.000	0.918 to 0.100
5.73	0.121	0.054 to 0.225	1.000	0.918 to 0.100
5.82	0.106	0.044 to 0.206	1.000	0.918 to 0.100
6.57	0.091	0.034 to 0.187	1.000	0.918 to 0.100
7.95	0.061	0.017 to 0.148	1.000	0.918 to 0.100
8.61	0.045	0.009 to 0.127	1.000	0.918 to 0.100
10.37	0.030	0.004 to 0.105	1.000	0.918 to 0.100
12.83	0.015	0.000 to 0.082	1.000	0.918 to 0.100

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(b)

True positive	True negative	False positive	False negative
66	0	43	0
66	1	42	0
66	2	41	0
66	4	39	0
66	5	38	0
66	7	36	0
66	8	35	0
66	13	30	0
66	14	29	0
66	15	28	0
66	16	27	0
66	18	25	0
66	20	23	0
66	21	22	0
66	23	20	0
66	24	19	0
66	26	17	0
66	28	15	0
66	30	13	0
66	32	11	0
66	33	10	0
66	36	7	0
66	37	6	0
66	38	5	0
66	39	4	0
66	40	3	0
66	41	2	0
66	42	1	0
66	43	0	0
64	43	0	2
63	43	0	3
62	43	0	4
61	43	0	5
60	43	0	6
59	43	0	7
58	43	0	8
57	43	0	9
56	43	0	10
55	43	0	11
53	43	0	13
52	43	0	14
51	43	0	15
50	43	0	16
49	43	0	17

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48	43	0	18
46	43	0	20
45	43	0	21
44	43	0	22
43	43	0	23
41	43	0	25
40	43	0	26
39	43	0	27
38	43	0	28
37	43	0	29
35	43	0	31
34	43	0	32
33	43	0	33
30	43	0	36
29	43	0	37
28	43	0	38
27	43	0	39
24	43	0	42
23	43	0	43
22	43	0	44
21	43	0	45
20	43	0	46
19	43	0	47
18	43	0	48
17	43	0	49
16	43	0	50
15	43	0	51
14	43	0	52
13	43	0	53
12	43	0	54
11	43	0	55
10	43	0	56
8	43	0	58
7	43	0	59
6	43	0	60
4	43	0	62
3	43	0	63
2	43	0	64
1	43	0	65