Methanogenesis in the GI Tract – Implications for UK Breath Testing

J Haworth[1], C Pitcher[1], J Haynes[1], S Treadway[1,2] and A Hobson[1,2]

[1]Functional Gut Diagnostics, [2]The Functional Gut Clinic

INTRODUCTION

- Methane production in the gastrointestinal tract has been implicated in chronic constipation and diverticulitis.[1,2]
- Methanogenesis is almost exclusive to archaea species and takes place chiefly in the left colon whereas bacterial production of hydrogen takes place mostly in the right colon.[3]
- A positive breath methane test is associated with delayed left colon and total colonic transit time.[4]
- Methane production is not routinely measured during breath testing in the UK but the recent North American Consensus (NAC) on hydrogen and methane-based breath testing (HMBT) has recommended this as standard.[5]
- Manipulation of the microbiome and reducing the number of methanogenic species in the large intestine represents an attractive and alternate therapeutic target to treating constipation associated disorders.
- To evaluate the prevalence of excessive methane production in patients presenting with symptoms of bloating we performed a retrospective analysis of our breath test database from the preceding 6-months.

METHODS

- In total 736 subjects were analysed from our breath test database between June and December, 2017.
- Breath tests for carbohydrate malabsorption and Small Intestinal Bacterial Overgrowth (SIBO) were included, with the substrates being 25g of lactose or fructose and 10g of lactulose or 75g of glucose, respectively.
- If the subject had more than one HMBT within the 6 month period only the first was included in the data analysis.
- Subjects followed a strict 12h low fibre diet and successive 12h fast prior to carrying out a HMBT.
- The presence of methane levels ≥10 ppm was considered methane-positive.[5]
- A positive test for SIBO was determined by a rise in hydrogen ≥10 ppm above baseline within 60 minutes after ingestion of substrate.
- Baseline and intra-study bloating was scored on a visual analogue scale (VAS) of 0-10 with 0 being absent and 10 being extreme.
- Data was analysed statistically using descriptive frequencies and means were compared using independent t-tests.

RESULTS

- 136 subjects (18.5%) had a positive result for excessive methane, 91 were female (66.9%) mean age 41.4 years.
- Within the methane-positive group, 7 subjects had a HMBT for carbohydrate malabsorption and 129 subjects had a HMBT for SIBO with 81 subjects (64.3%) having a negative result for SIBO.
- The remaining 48 subjects (35.7%) were positive for both SIBO and excessive methane production.
- There was an overall increase in intra-study bloating symptoms for methane-positive compared to methane-negative patients (p=0.035). Intra-study bloating symptoms between methane-positive and SIBO-positive were not significant (p=>0.05). Although the highest mean increase in bloating was seen in patients with coexisting SIBO and excessive methane production (figure 3).

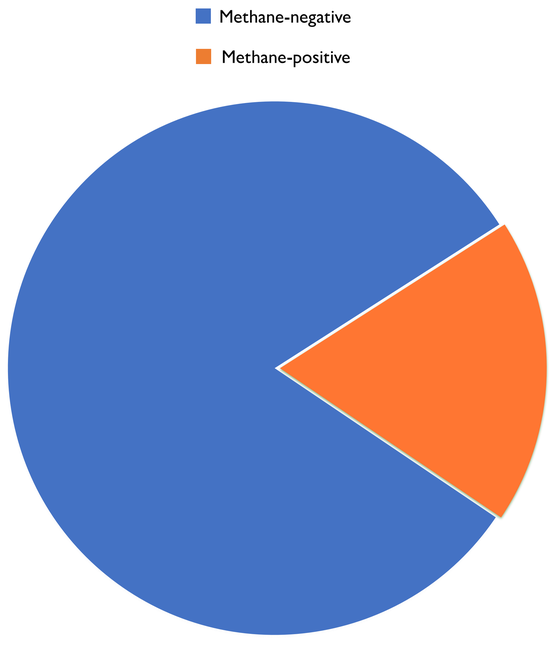

Figure 1. Percentage of subjects with a methane-positive breath test

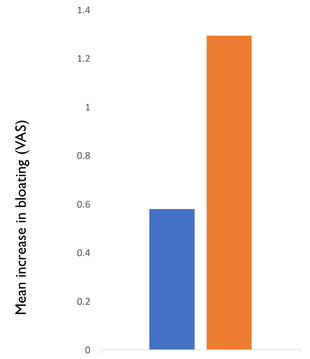

Figure 2. Intra-study bloating in methane-negative and methane-positive subjects (p=0.035)

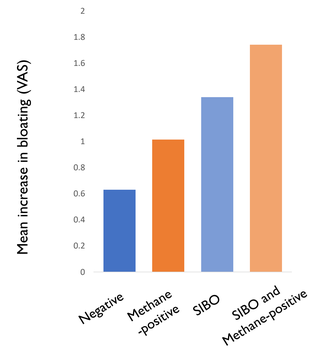

Figure 3. Intra-study bloating mean statistic for HMBT results

CONCLUSION

- Changes in the microbiome to a methane predominant environment occurs in around 20% of patients presenting with bloating symptoms.
- These findings support the NAC statement that methane should be measured routinely during breath testing to avoid false negative results.
- Around 10% of glucose and lactulose HMBTs in patients presenting with bloating demonstrated coexisting SIBO and excessive methane production. Treating hydrogen-producing bacteria with antibiotics may risk changing the microbiome to an even more methanogenic environment.
- Manipulation of the microbiome to a more hydrogen predominant profile represents an attractive alternative therapeutic target to conventional laxative therapy for chronic constipation. Although, further research into this relationship is required.

TAKE-HOME MESSAGE

Breath methane should be routinely measured along with hydrogen in UK breath testing in the assessment of clinical constipation and slowing of GI tract. In patients with a negative hydrogen only breath test, methane testing should be performed especially if presenting with lower GI symptoms of bloating and constipation.

REFERENCES

1. Pimentel M, Mayer AG, Park S et al. Methane production during lactulose breath test is associated with gastrointestinal disease presentation. Dig Dis Sci 2003;48:86–92.
2. Weaver GA, Krause JA, Miller TL et al. Incidence of methanogenic bacteria in a sigmoidoscopy population: an association of methanogenic bacteria and diverticulosis. Gut 1986;27:698–704
3. Flourié B, Etanchaud F, Florent C, Pellier P, Bouhnik Y, Rambaud JC. Comparative study of hydrogen and methane production in the human colon using caecal and faecal homogenates. Gut 1990;31:684-685.
4. Lee KM, Paik CN, Chung WC, Yang JM, Choi MG. Breath methane positivity is more common and higher in patients with objectively proven delayed transit constipation. European journal of gastroenterology & hepatology. 2013 Jun 1;25(6):726-32.
5. Rezaie A, Buresi M, Lembo A, Lin H, McCallum R, Rao S, Schmulson M, Valdovinos M, Zakko S, Pimentel M. Hydrogen and methane-based breath testing in gastrointestinal disorders: the North American consensus. The American journal of gastroenterology. 2017 May;112(5):775.

Functional Gut Diagnostics

The Functional Gut Clinic