BMJ Open

'Gut health' and the microbiome in the popular press: a content analysis

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To cite: Marcon AR, Turvey S, Caulfield T. 'Gut health' and the microbiome in the popular press: a content analysis. *BMJ Open* 2021;**11**:e052446. doi:10.1136/bmjopen-2021-052446

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2021-052446).

Received 15 April 2021
Accepted 14 July 2021

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ABSTRACT

Objective Extensive research and important discoveries on the microbiome have led to a growth in media coverage. This study explores how the microbiome has been portrayed in press sources popular among American and Canadian audiences.

Design Content analysis.

Methods Using the FACTIVA Database, we compiled a finalised data set of (N=830) articles from press sources popular among American and Canadian audiences which were published between 1 January 2018 and 11 October 2019 and which contained at least one of the following search terms: 'microbiome', 'microbiota', 'gut health', 'healthy gut', 'unhealthy gut', 'gut bacteria', 'probiotic' or 'probiotics.' We performed content analysis on the articles to determine how often ideas of the microbiome were presented as beneficial, in which health contexts, and whether actions could be taken to reap stated benefits. We compared this portrayal of benefits with critical portrayals of the microbiome.

Results Almost all of the articles (94%) described health benefits associated with the microbiome with many (79%) describing actions which could be taken to reap stated benefits. Articles most often described health benefits in more broad, general context (34%) and most commonly outlined actions related to food/drug (45%) as well as probiotic (27%) intake. Only some articles (19%) provided microbiome-related critiques or limitations. Some of the articles (22%) were focused on highlighting specific research developments, and in these articles, critiques or limitations were more common.

Conclusions Articles discussing the microbiome published for American and Canadian audiences typically hype the microbiome's impact and popularise gut health trends while only offering a little in the way of communicating microbiome science. Lifestyle choices including nutrition, taking probiotics, stress management and exercise are often promoted as means of reaping the microbiome-related health benefits. The trend of actionable 'gut health' is foregrounded over more evidence-based descriptions of microbiome science.

Strengths and limitations of this study

- The study included a large data set of microbiome-related articles from media sources popular among Canadian and American audiences.
- Analysis was able to provide a detailed examination of how ideas around the microbiome are being portrayed for audiences.
- The data set represented only one kind of media output (articles in the popular press).
- The data set represented only English-language media.

INTRODUCTION

The term microbiome (derived from the Greek for 'small life') encompasses the microbial community that lives in and on our bodies, as well as the genes these microorganisms express and their metabolic activity. Over the past decade, technological advances in genetic sequencing have greatly accelerated our understanding of the human microbiome in health and disease. Fuelled by extensive research, important discoveries about the microbiome have steadily increased resulting in a growth in coverage by the popular media.[1–6] Researchers have been examining the roles that diverse microorganisms play in shaping our environments and impacting our health.[7 8] This includes exploration of how the microbiome may influence, for example, risk of obesity,[9] cancer[10] mental health outcomes,[11 12] and cardiometabolic and chronic disorders.[13] Other research has been investigating the microbiome's role in childhood asthma[14–16] as well as the how the use of antibiotics alters gut microbiota.[16–18] Currently, however, there are only a few microbiome-related interventions in use,[19 20] and critiques have been made around the hyping[21] of gut microbiome's potential impact in various contexts.[1 4 22–27] In particular, while research has indicated benefits for the use of probiotics in the context of paediatric antibiotic-associated diarrhoea,[28] critiques have also been raised about the exaggerated benefits attributed to probiotics.[29–31]

Concerns have also been raised around the popularisation and commercialisation of microbiome-related research, particularly with regard to its portrayal in the popular press and on social media.[3 4 6 12 22 32] Searches on Google, for example, yield an extensive assortment of microbiome-related discourse detailing products, therapies and research

developments, including gut makeovers, gut health diets, cleanses, microbiome reboots, probiotic products, skin regimens, cures for disease, and treatments such as colonic hydrotherapy or colonic reflorastation. It was also observed during the COVID-19 pandemic that ideas of gut health circulated often when immune-boosting was discussed.[33] In the case of faecal transplants, for example, while clinical research is progressing and showing signs of promise,[34] there has already been a case of a Canadian naturopath using the procedure to treat children with autism.[35] Research has shown that in the context of microbiota–gut–brain axis, articles in popular press simplify research and potential health impacts by highlighting 'dietary change (including probiotics) as a 'natural' means of changing the microbiome, and thus host health status.'[4] Further media research has indicated that microbiome coverage tends to focus on observational studies with less coverage given to clinical trials and systematic reviews.[32] Indeed, as noted by Reid *et al*[30] 'on a consistent basis scientists, media and industry misrepresent probiotics or make generalised statements that illustrate a misunderstanding of their utility and limitations.'

This project analysed portrayals of the microbiome in popular English-language news sources for American and Canadian audiences. We mapped out how often, and for which health topics and conditions, microbiome ideas were portrayed as beneficial. We then determined how often, and which actions were presented in order to obtain stated benefits. Lastly, we examined how often ideas of the microbiome were presented critically—that is, whether microbiome benefits or actions were presented as unproven, uncertain, ineffective or exaggerated.

METHODS

To examine how the microbiome was portrayed in the popular press, we performed directed content analysis[36] on articles published in newspaper sources popular among English-speaking American and Canadian audiences.[37] We used the FACTIVA Database to search for and download all articles published on a popular source list between 1 January 2018 and 11 October 2019 (the day of data collection), which contained at least one of the following search terms: 'microbiome', 'microbiota', 'gut health', 'healthy gut', 'unhealthy gut', 'gut bacteria', 'probiotic' or 'probiotics.' The search terms were chosen to capture microbiome-related media content created for general audiences without excluding the presence of more specific, research-focused content. The terms were finalised after various reviews of sample searches were performed. The time frame was selected as it was observed through FACTIVA searches and analysis on Google trends that the topics of 'microbiome' and 'gut health' had been steadily and increasingly receiving media attention from 2010 onwards with no apparent deviations. See online supplemental material 1 for search summary and list of sources including article counts.

After the removal of duplicates by FACTIVA, our initial dataset totalled 1395 articles, which were downloaded into and made accessible for analysis through the creation of customised platform. We then developed a coding frame using the inductive and deductive methods established by our team from previous studies,[38 39] which involved creating an initial coding frame, applying it to a large sample of the data, and modifying it as necessary to accurately capture the reality of the content. The coding frame had three primary objectives: (1) to determine if claims of health benefits were made in relation to the microbiome (including ideas captured with associated rhetoric, 'gut health', 'gut bacteria', 'probiotics', 'microbiota', etc), and if so, which health topics these benefits were described in relation to (ie, allergies, cancer, skin health, general health ('wellness'), etc); (2) to determine if the article described actions that could be taken to reap the claimed benefits, and if so, what these actions were (ie, eat certain foods, take probiotics, perform faecal transplants, etc); and (3) to determine if any benefits or research related to the microbiome might be portrayed as unproven, uncertain, ineffective or exaggerated. Through the sample analysis, specific categories to classify health benefits and related actions were developed, and three further coding categories were established: (1) whether the article's principal focus was on scientific research, either pertaining to a particular project or summarising a body of work; (2) whether the article discussed babies or children in relation to the microbiome; and (3) whether an article portrayed taking probiotics as beneficial without describing or connecting that probiotic intake to health benefits associated with the microbiome. See online supplemental material 1 for complete coding frame.

During coding, articles that were coded as irrelevant were removed, and the finalised total data set resulted in (N=830) articles. Articles were deemed irrelevant if they were duplicates, incomplete (eg, a 'gut health' headline embedded in an unrelated article), television show transcripts, or focused exclusively on animal biology or business developments. All articles were coded by two coders who met periodically to discuss any irregularities and reach consensus on disagreements. This process, as outlined and enacted in other research projects,[36 40 41] entailed coders being instructed to flag any articles which posed coding ambiguities, and on each meeting collaboratively coding these uncertainties through discussion and consensus. Once all articles had been coded, each coder performed an audit on a sample of articles coded by the other coder to ensure no significant issues were present.

Patient and public involvement

This research was done without patient or public involvement. Patients or members of the public were not invited to comment on the study design and were not consulted to interpret the results. Patients or members of the public were not invited to contribute to the writing or editing of

Figure 1: Microbiome benefits, critiques, research focus and baby/child focus in press articles popular among Canadian and American audiences (N=830)

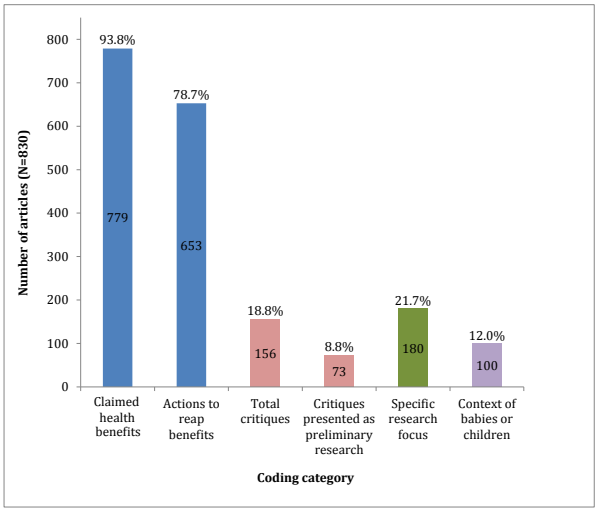

Figure 1 Microbiome benefits, critiques, research focus and baby/child focus in press articles popular among Canadian and American audiences (N=830).

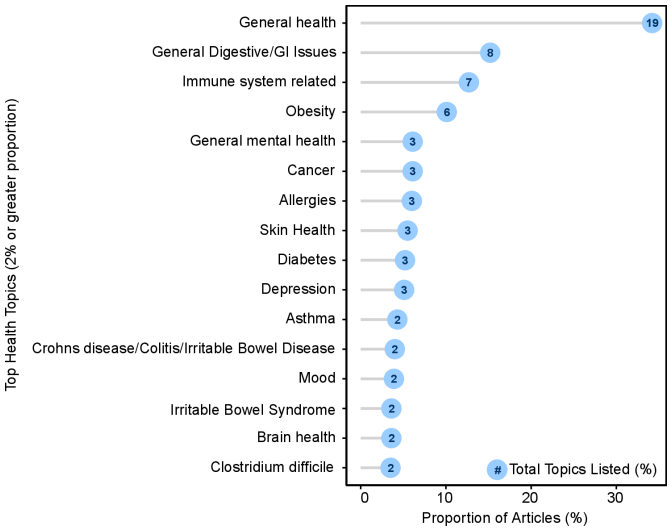

Figure 2 Health topics associated with the portrayal of the microbiome. GI, gastrointestinal.

this document for readability or accuracy. Funders had no input on the decision to publish nor the content.

RESULTS

The 830 articles were published in a total of 41 sources of which 143 (17.2%) came from 18 Canadian sources, 244 (29.4%) came from 18 American sources, and 443 (53.4%) came from the 5 sources based in the UK. Of the 830 articles, 439 (52.9%) were published in 2018, and 391 (47.1%) were published in 2019 (before 11 October). In describing the findings, we will use the term 'microbiome' as an all-encompassing term for all associated rhetoric.

It was considerably more common for articles to discuss the microbiome in a non-research-specific context (n=650, 78.3%) than to focus on specific research (n=180, 21.7%) (figure 1). In total, 779 articles (93.8%) discussed health benefits in relation to the microbiome. The vast majority (n=732, 88.2%) did so including (detailed) descriptions of gut health, the microbiome, gut bacteria, etc, while some articles (n=47, 5.7%) did so simply portraying probiotics as beneficial without mentioning 'gut health' or the 'microbiome.' Articles of this nature, for example, described probiotic-based health regimes of athletes, bars and restaurants offering probiotic health drinks, spas providing probiotic shots and raw water products containing beneficial probiotics.

Actions one could take to reap the health benefits associated with the microbiome appeared in n=653, 78.7% of all articles, and 89.2% of all articles that discussed microbiome benefits (figure 1). Some articles discussed the microbiome in the context of babies or children (n=100, 12%), with approximately half of these 100 articles (n=46) focused on specific research developments. Articles discussing the microbiome in the context of babies or children made up a quarter (25.6%) of all research-focused articles. A total of 156 articles (18.8%) provided critiques, suggesting that either generally or in specific contexts, the health benefits and/or current research of the microbiome might be unproven, uncertain, ineffective or exaggerated (figure 1).

In total, there were more than 135 different health topics for which the microbiome was portrayed as beneficial (see online supplemental material 1 for complete list). The health topics most commonly associated with the microbiome are presented in figure 2 and table 1. Some topics appearing in fewer than 4.0% of articles included anxiety (n=24, 3.3%), Alzheimer's disease (n=15, 2.0%), Parkinson's disease (n=14, 1.9%), autism (n=12, 1.6%), dementia (n=8, 1.1%) and menopause (n=8, 1.1%). The majority of the articles discussed the microbiome in relation to one health topic (n=455, 62.2%), while 86 (11.8%) connected the microbiome with four or more health topics in the same article. Some singular articles, for example, discussed the microbiome in relation to a wide range of health topics such as allergies, diabetes, obesity, Parkinson's disease, asthma, autism, Alzheimer's disease, etc.

The health topic of 'general health' was categorised in cases where an article would state, for example, that certain foods were 'more beneficial for our gut health than other sources,' that certain foods 'maintain a health balance of gut bacteria,' that a particular vitamin product 'boosts gut health,' or that helpful health plans could be 'built on a person's gut microbiome.' In cases such as these, there was typically no further reference to what, or how, the microbiome assists, with the articles instead simply stating that 'gut health' or the 'microbiome' was something valuable and beneficial to one's health and should therefore be 'maintained,' 'balanced,' 'strengthened,' etc.

Of articles describing these microbiome-related health benefits (n=732), the vast majority described actions which

Table 1 Health topics where microbiome benefits were portrayed (min 4.0% of articles with health benefits)

Health topics	# of articles	% of total health topics listed (n=1502)	% of total articles (n=830)
General health	284	18.9	34.2
General digestive/GI issues	126	8.4	15.2
Immune system related	105	7.0	12.7
Obesity	84	5.6	10.1
Cancer	51	3.4	6.1
General mental health	51	3.4	6.1
Allergies	50	3.3	6.0
Skin health	46	3.1	5.5
Diabetes	43	2.9	5.2
Depression	42	2.8	5.1
Asthma	36	2.4	4.3
Crohn's/colitis/ inflammatory bowel disease	33	2.2	4.0
Mood	32	2.1	3.9
Brain health	30	2.0	3.6
Irritable bowel syndrome	30	2.0	3.6
Clostridium difficile	29	1.9	3.5

GI, gastrointestinal.

could be taken to reap said benefits (n=653, 89.2%). In total, there were more than 85 unique actions listed in the articles (see online supplemental material 1 for complete list). The five most common actions included food/drink intake (n=373, 44.9%), taking probiotics (n=174, 21.0%), avoiding certain foods/drink (n=85, 10.2%) and avoiding antibiotics (n=55, 6.6%). The most common actions are presented in figure 3 and table 2. Incorporating the additional articles which detailed the beneficial qualities of probiotics without making an explicit link to gut health or the microbiome resulted in a total of 221 (26.6%) articles portraying probiotics intake as beneficial (figure 3). It was not the goal to identify all of the specific foods and drinks listed to improve gut health, but some commonly listed foods included fermented foods such as kombucha, yoghurt, kefir, kimchi, etc as well as lentils, fresh fruits and vegetables.

The actions of 'avoidance' were illustrated both implicitly and explicitly, with implicit cases typically detailing the potentially harmful effects of certain actions. For example, with food avoidance, links were made between artificial sweeteners and unhealthy gut bacteria and their

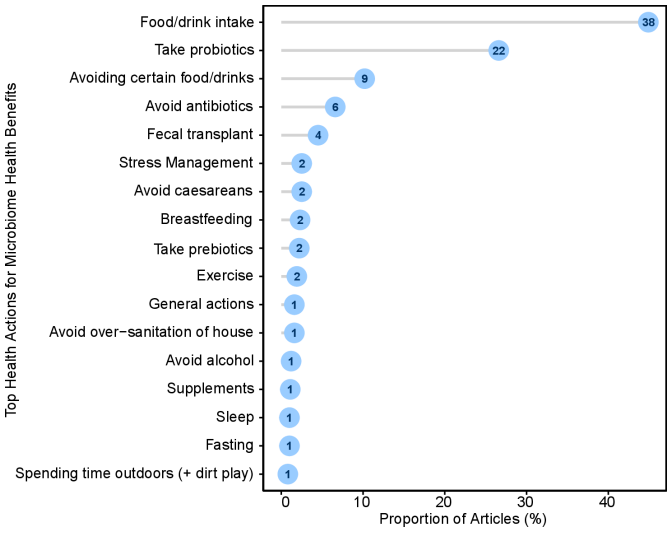

Figure 3 Health actions one can take to reap microbiome benefits.

associations with obesity and other diseases. Similarly, negative emotions were linked to being triggered by gut health issues stemming from too much sugar or caffeine. Having caesareans, and thus not having babies exposed to the healthy bacteria of vaginal birth, were portrayed as

Table 2 Most commonly mentioned actions that could be taken to reap microbiome health benefits (n=653)

Actions	# of articles	% of total actions listed (n=983)	# of total articles (n=830)
Food/drink intake	373	37.9	44.9
Take probiotics*	174	17.7	21.0
Avoid certain food/drinks	85	8.6	10.2
Avoid antibiotics	55	5.6	6.6
Faecal transplant	37	3.8	4.5
Avoid caesareans	21	2.1	2.5
Stress management	21	2.1	2.5
Breast feeding	19	1.9	2.3
Take prebiotics	18	1.8	2.2
Exercise	16	1.6	1.9
Avoid oversanitation of house	13	1.3	1.6
General actions	13	1.3	1.6
Avoid alcohol	10	1.0	1.2
Supplements	9	0.9	1.1
Fasting	8	0.8	1.0
Sleep	8	0.8	1.0
Spending time outdoors (incl. dirt play)	7	0.7	0.8

*Excluding additional 47 articles where probiotics were portrayed as beneficial without mentioning gut health ideas.

negatively influencing a baby's gut microbiome, exposing them to an increased risk of, for example, obesity, asthma, allergies and diabetes. Regarding antibiotics, it was claimed that they could cause, for example, 'irreversible damage to crucial gut bacteria,' or that increasing rates of colorectal cancer were potentially a result of altering the gut microbiome with antibiotics.

There was a considerably smaller percentage of articles which stated the health benefits or current research related to the microbiome might be unproven, uncertain, ineffective or exaggerated (n=156, 18.8%). Of these 156 articles, nearly half (n=73, 46.8%) critiqued microbiome developments on the grounds of developments or findings being preliminary research, thereby noting that research was still developing and, in some cases, that more evidence would be needed to translate findings into practice. The remaining 83 (53.2% of the critical articles, and 10.0% of the total articles) critiqued ideas around the microbiome more broadly, illustrating a lack of scientific evidence and countering perceived hype around the concepts. There were articles, for example, which referenced studies showing how 'adjusting the composition of the microbiome is a complex matter,' articles stating that 'probiotics are useless,' articles doubting that autism could be treated with 'microbes or pills,' or articles casting doubt on the ability of probiotic-rich yoghurt to alter vaginal flora.

There were a few notable distinctions between the articles primarily focused on specific research (n=180, 21.7%) and the remaining articles which did not (n=650, 78.3%). First, as previously mentioned, articles discussing the microbiome in the context of babies/children constituted 25.6% of articles focused on research, but were present in only 8.3% of other articles not specifically focused on research. Both research-focused articles and more general articles described health benefits in relation to the microbiome with similar frequency (90.6% and 87.5%, respectively), and non-research-specific articles detailed microbiome-related actions (80.9%) only slightly more often than research-focused articles (70.6%). Research-specific articles, however, discussed critical perspectives of the microbiome (30.0%) approximately twice as often as general articles (15.7%).

DISCUSSION

The findings from this research demonstrate the presence of microbiome hype[3 25 30] in the popular press of American and Canadian audiences. The overwhelming majority of articles (93.8%) either describe health benefits associated with the microbiome or list health benefits associated with taking probiotics. When detailing health benefits, the vast majority of these articles (89.2%) list actions that can be taken to obtain these claimed benefits. As there is demonstrable public interest in the relationship of the microbiome to one's health, and with considerable interesting research underway, it is unsurprising that numerous health benefits are detailed in articles. Still, a weakness in the way this science is being communicated is the fact that less than 19% of the articles suggest that current microbiome science or applications are unproven, ineffective, exaggerated or requiring more research. This occurs with even less frequency in general articles where the central focus is not detailing specific research. And, as noted in the introduction, despite the abundance of promising research, there are still few microbiome-related clinical applications ready for use.

This research finds the popular press portraying the microbiome as influential in over 135 health conditions/diseases including digestive issues, obesity, cancer, allergies, skin health, diabetes, asthma, irritable bowel syndrome, and a range of mental health topics including depression, mood, 'brain health', as well as behaviour and attention deficit hyperactivity disorder in children. It was linked to discussions of colds, headaches, health during pregnancy, tooth decay, blood circulation, jet lag, eating disorders, sleep, menopause, dementia and athletic performance. *Clostridium difficile*, one of the few ailments for which microbiome treatments are in practice (specifically faecal microbiota transplant) and supported by evidence,[42] is also discussed, but only in a small number of articles (3.5%).

Most often, the benefits of a 'healthy gut' are simply presented as a given. Certain foods (eg, yoghurt, kombucha) and particular practices (eg, taking probiotics) are presented as being beneficial to 'gut health,' though typically no details are provided (eg, research showing benefit in some contexts[28]) about why this is so or what the particular health benefits might be. In this regard, the ideas around the microbiome, particularly when expressed as 'gut health,' appear oversimplified and function like rhetorical products, signalling and bolstering the microbiome trend, generating attention, attracting readers and promoting products. This phenomenon, sometimes referred to as a 'health halo,'[43] has been similarly observed in other topics like 'immune boosting'[31] and in other research on portrayals of the microbiome in the media.[4]

Actions most commonly described to reap the health benefits associated with the microbiome typically focused on lifestyle topics, including nutrition, stress management, general actions ('maintaining', 'strengthening', 'balancing', 'boosting', etc), exercise and sleep. Additionally, health benefits associated with probiotic intake had a large presence in the data set, in 27% of all articles. It was common in these contexts, as well as when promoting faecal transplants and breast feeding or when problematising the impact of antibiotic use on the microbiome, to highlight research or take quotes from healthcare professionals. Research of this precise nature is being conducted in numerous institutions, whereby faecal transplants are showing signs of effectiveness in particular circumstances,[32] and antibiotic intake can negatively influence the microbiome.[44–47] Further, some lifestyle activities, such as nutrition, can play a role in altering the microbiome even though accurately determining

the impact remains a challenge.[48 49] In sum, however, while the articles often mention research projects and quote scientists and healthcare practitioners, the overall portrayal of the microbiome science appears to be either oversimplified or greatly exaggerated, serving instead as a means to promote and validate the lifestyle ideas and products contained in the articles. Indeed, less than 19% of all articles provided any critique of the microbiome, with general articles doing so even less frequently (15.7%) than articles focused on specific research developments (30.0%).

Further, in cases where a critique was evident, nearly half (46.8%) portrayed limitations to the microbiome as being simply a case of preliminary research, which may or may not influence how the diverse readership of the popular press interprets the realistic state of the scientific developments.[50–54] Specifically, it may give a false impression of a potential application's readiness, for example, in cases of the microbiome's influence on autism or mental health.[4] The hyping of science, however, typically involves numerous participants[21 48] and it is therefore misguided to isolate singular actors as the propagators of information distortion such as the authors of the articles in the popular press. Indeed, extensive research has shown how information dissemination through social media creates an abundance of information accuracy challenges.[55–58]

Limitations

This study was limited in its ability to capture and analyse all of the microbiome discourses relevant to audiences. Covering the popular press's portrayal of the microbiome during a period when the topic was popular has provided insights into how microbiome science is being communicated. Future research could replicate this study in other regions to see whether the same trend persists or whether some press sources, in some contexts, portray the microbiome in significantly different manners. Additionally, other research projects could explore whether these portrayals are similar or different on popular social media platforms such as Instagram, Twitter or TikTok.

CONCLUSION

Microbiome articles published for North American audiences typically popularise gut health trends while only offering a little in the way of communicating the science. It is promising to see cases where some complexities of the research were presented alongside ongoing applications, but the overall number of articles which did this were few. The ongoing communication of accurate science will require a more concerted effort from all of those involved in the process.

Acknowledgements The authors thank Mark Bieber, Carly Giles, Allison Jandura, Charisse Petersen and Robyn Hyde-Lay for their assistance in the project.

Contributors ARM and TC designed the study with input from ST. ARM collected the data and performed the analysis. ARM and TC interpreted the data. ARM, TC and ST were involved in drafting and revising the manuscript. All authors approved the final version to be published and agreed to be accountable for all aspects of the work.

Funding The authors would like to thank Genome Canada, Genome Alberta, and the Canadian Institutes for Health Research for their generous support of Childhood asthma and the microbiome–precision health for life: The Canadian Healthy Infant Longitudinal Development (CHILD) Study (#274CHI).

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. The data set is available: https://figshare.com/articles/dataset/Gut_health_pop_press_data_html_Summary_PDF_/14410310

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