

LETTER

The effect of exercise and diet on gut microbial diversity

We have read with great interest the study by Clarke *et al*¹ who in a very elegant and sophisticated manner documented the increase in gut microbial diversity in association with exercise and dietary extremes in professional rugby players. The observed microbial shifts were accompanied by lower inflammatory and healthier metabolic profiles among athletes. Significantly higher proportions of the genus *Akkermansia muciniphila* in athletes as well as in low Body Mass Index control group were found. As previously shown, the presence of these bacteria in the human GI tract has been associated with improved metabolic profiles, possibly due to enhanced barrier function. However, from the study of Clarke *et al* it is difficult to draw the conclusion and assess the impact of exercise per se from dietary influences in groups studied for their gut microbial diversity. As the alterations of the microbial diversity have already been linked to changes in dietary habits, it is important to address an important issue, which is the reported high prevalence of GI presentations among professional athletes. Endurance training has been associated with reduced GI blood flow, tissue hyperthermia and hypoxia leading to possible alterations of microbiota and GI barrier. As documented in a well-designed and randomised, double-blinded, placebo-controlled trial, probiotic supplementation affected markers of intestinal barrier, oxidation and inflammation in trained men. Lamprecht *et al* have shown that a 14-week period of supplementation with multi-species probiotics in trained men led to normalisation of stool zonulin concentrations (a marker indicating enhanced gut permeability) as compared with the placebo group. The researchers found no effect of exercise on tumour necrosis factor- α serum concentrations.² Other studies with high endurance athletes documented beneficial effects of dietary interventions on improvements in cytokines and immune-marker panels, positive effects on redox biology and lessening of GI symptoms. As implicated in the study by Clarke *et al*, the gut microbial diversity may be viewed as a new biomarker or indicator of

health. However, Wills *et al*³ in their recent prospective study using next-generation sequencing for examining the faecal microbiota composition in patients with IBD during a quiescent disease phase and a subsequent exacerbation could not demonstrate general changes in microbial composition or diversity in both groups studied. Of importance, a large increase in relative abundance of *Bacteroides fragilis* or *Akkermansia muciniphila* during active phase of disease in some of patients was reported.³ Other studies document that prolonged strenuous exercise expands the population of developmentally early stem cells in bone marrow and mobilises them into peripheral blood (personal communication, Dr Ratajczak, University of Louisville, USA).⁴ The precise mechanism of this phenomenon is not known; however, it could play an important role in tissue/organ rejuvenation after strenuous exercise. Our group has documented an increase in mobilisation of stem and progenitor cells into peripheral blood in patients with active IBD.⁵ It is difficult to exclude that these health effects are at least in part mediated by gut derived bacterial lipopolysaccharides (endotoxins), which enter the general circulation due to impaired gut barrier integrity and increased intestinal permeability—factors which could be considered more important health determinants than microbial composition itself. It would be very tempting to address the role of intestinal barrier (eg, by measuring intestinal markers such as intestinal-fatty acid binding protein or zonulin) or to measure the levels of serum endotoxin in future studies investigating the effect of exercise and diet on gut microbiota. Observations that antibiotic treatment abolishes stem/progenitor cell mobilisation into peripheral blood are relevant.⁶ It would be interesting to know to what extent the microbial diversity is affected by exercise itself with regard to diet and to quantify the exercise required for seeing a change in microbial diversity.

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Contributors WM and IL contributed equally to this letter in the form of study concept and design as well as in reviewing the literature and writing the manuscript.

Funding None.

Competing interests None.

Provenance and peer review Not commissioned; internally peer reviewed.

Data sharing statement Personal communication with Dr. Ratajczak and quoting of this statement in the manuscript has been agreed by both parties. The original research of Dr Ratajczak has already been presented in the form of abstract at ASH meeting in Atlanta 2012: Tarnowski M, Piotrowska K, Grymula K, *et al*: Prolonged Strenuous Exercise Expands the Population of Developmentally Early Stem Cells in Bone Marrow (BM) and Mobilizes Them Into Peripheral Blood—Novel Evidence That Strongly Supports a Positive Effect of Physical Activity On Extension of Life Span At the Level of Stem Cells. 56th American Society of Hematology Annual Meeting and Exposition. Atlanta 2012, USA.

To cite Marlicz W, Loniewski I. *Gut* Published Online First: [please include Day Month Year] doi:10.1136/gutjnl-2014-307909

Received 23 June 2014

Accepted 15 July 2014

Gut 2014;0:1. doi:10.1136/gutjnl-2014-307909

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Gut published online August 1, 2014
doi: 10.1136/gutjnl-2014-307909

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