

BRIEF REPORT

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# Gastrointestinal complaints in runners are not due to small intestinal bacterial overgrowth

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## Abstract

**Background:** Gastrointestinal complaints are common among long distance runners. We hypothesised that small intestinal bacterial overgrowth (SIBO) is present in long distance runners frequently afflicted with gastrointestinal complaints.

**Findings:** Seven long distance runners (5 female, mean age 29.1 years) with gastrointestinal complaints during and immediately after exercise without known gastrointestinal diseases performed Glucose hydrogen breath tests for detection of SIBO one week after a lactose hydrogen breath test checking for lactose intolerance. The most frequent symptoms were diarrhea (5/7, 71%) and flatulence (6/7, 86%). The study was conducted at a laboratory. In none of the subjects a pathological hydrogen production was observed after the intake of glucose. Only in one athlete a pathological hydrogen production was measured after the intake of lactose suggesting lactose intolerance.

**Conclusions:** Gastrointestinal disorders in the examined long distance runners were not associated with small intestinal bacterial overgrowth.

## Introduction

Gastrointestinal (GI) disturbances during or immediately after exercise are common among runners [1,2]. 20-50% of long distance runners are affected [3]. Both the upper and lower GI tract are involved. Symptoms are vomiting, nausea, bloating, heartburn and flatulence as well as watery and bloody diarrhea and anal incontinence [4]. The causative mechanisms are not completely understood. The mechanical irritation of the GI tract during running can change intestinal motility [5], additionally exercise causes a reduction of the mesenteric blood flow [6] and both may contribute to the symptoms. Both, a GI dysmotility as well as a reduced mesenteric blood flow are well known risk factors for development of small intestinal bacterial overgrowth (SIBO) [7,8]. Clinical manifestations of SIBO involve the upper and lower GI tract and are similar to the complaints of long distance runners. The gold standard in diagnosing SIBO consists in culture of jejunum aspirate for bacterial

counts, but also non-invasive hydrogen breath testing with glucose (GHBT) is well established [9-12]. We hypothesized that due to the high weekly training volume with irritation of GI motility and repeated impairment of the mesenteric perfusion SIBO is present in long distance runners with frequent GI symptoms.

## Methods

Seven long distance runners (5 female, 2 male) were recruited with the help of the headcoach for long distance runners of Baden-Württemberg. Baseline characteristics are given in table 1.

We only included otherwise healthy, non-smoking long distance runners with a training experience of  $\geq 5$  years and a minimum two years lasting, unexplained history of frequent GI complaints (nausea, eructation, heartburn, angina pectoris, vomiting, abdominal cramping, flatulence, diarrhea, or stitch) during or within one hour after running. "Frequent" was defined as at least every other run, and they must have had at least two of the above-mentioned symptoms. By a modified self-assessment questionnaire used in a previous study [13], the following exclusion criteria were assessed: known GI diseases, family history of bowel disease, indication that

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**Table 1 baseline characteristics**

subject	sex	age [years]	body mass index [kg/m <sup>2</sup> ]	body fat [%]	training experience [years]	weekly training mileage [kilometers]	training sessions [/week]	running speed at 4 mmol/l lactate threshold [km/h]
1	female	25	19.5	14.1	6	120	10	16.6
2	male	33	20.6	8.5	9	120	10-12	18.3
3	male	27	22.1	13.3	8	60	11	16.8
4	female	21	20.8	14.1	6	60	4-6	13.9
5	female	33	19.8	15.8	7	100	7	15.6
6	female	38	21.8	15.3	17	60	6	13.2
7	female	27	22.1	20.7	7	60	6	13.7

intake of special food or beverage could explain the GI complaints, intake of antibiotics or proton-pump inhibitors within one month before the study started. Table 2 summarises the GI symptoms reported in the questionnaire. Clinical examination of the abdomen including auscultation and palpation were normal. ECG at rest and during exercise and blood examinations for haemogram, ESR, Aspartate- and Alanine-transaminase,  $\gamma$ -glutamyltransferase, creatinine, urea and ferritin were normal. Body fat composition was determined by 3-point skin fold calipometry [14]. After preexamination, a lactose hydrogen breath test (LHBT) and at least one week later a GHBT on "Wasserstoff-Atemtest" (IFM GmbH, Wetztenberg, Germany) were performed after a 12 hour fasting period. These tests were performed in a laboratory of the division of gastroenterology where this examination is routine practice. After two measurements of baseline values for exhaled hydrogen, either 50 g lactose or 75 g glucose (both dissolved in 200 ml of water) was applied and breath samples were analysed for hydrogen every 10 minutes for 3 hours. SIBO is suspected if a clearly recognisable hydrogen peak is present and exhaled hydrogen exceeds 20 parts per million over baseline values in both tests [15,16]. Late hydrogen peaks in the GHBT can be caused by a faster GI transit time for glucose and thus simulate SIBO [9]. Therefore,

LHBT was performed as a control in the case of a positive GHBT: SIBO must also result in a positive LHBT [17], but a faster transit time for Glucose does not. Written informed consent was obtained from the subjects, and the study has been approved by the Ethics Committee of the Medical Faculty of the University of Heidelberg.

### Results

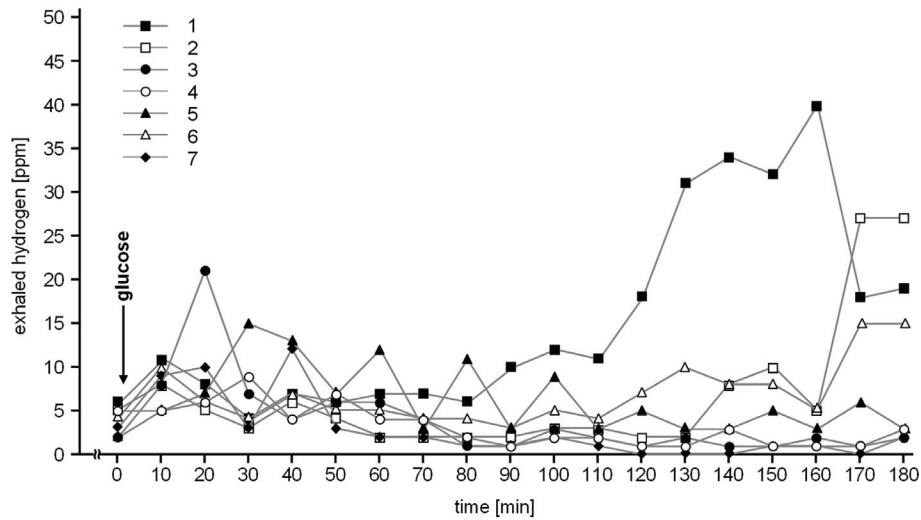
In none of the seven athletes a pathological hydrogen production after application of glucose was observed (Figure 1). In subject 3, a pathological hydrogen production was measured after intake of lactose but not after glucose, suggesting lactose intolerance. Incidentally, this athlete never had any problem after the intake of milk products. In the remaining 6 subjects, LHBT was unremarkable (Figure 2). Subject 4 reported bloody diarrhea after a marathon race two years before. At this time, gastroscopy only revealed some gastric erosions without helicobacter pylori infection whereas colonoscopy was unremarkable.

### Discussion

This study does not provide evidence of SIBO as a common cause accounting for GI problems in long distance runners. All of the investigated runners were frequently afflicted with the usually reported GI symptoms in runners, but none of them showed a pathological GHBT. In the absence of an early peak in this test which could indicate SIBO, the late peak in subjects 1 and 2 in the GHBT is attributable to the passage of the glucose into the colon. This conclusion is supported by the unremarkable LHBT in both runners. The sensitivity and specificity of the GHBT in detecting SIBO was reported to be 62% and 83% [18,19]. With a given prevalence of SIBO in younger adults aged 24 to 59 years of 5-10% [20], the negative predictive value of an unremarkable GHBT is 95-98%. Considering the consistent negative findings in our study we conclude that SIBO is not a common cause for the GI problems of the long distance

**Table 2 distribution of gastrointestinal symptoms**

symptoms	total		during running		after running	
	n	%	n	%	n	%
nausea	0	0	0	0	0	0
eructation	2	29	1	14	1	14
heartburn	2	29	1	14	1	14
angina pectoris	0	0	0	0	0	0
vomiting	1	14	0	0	1	14
abdominal cramping	3	43	3	43	3	43
flatulence	6	86	3	43	3	43
diarrhea	5	71	3	43	5	71
stitch	1	14	0	0	1	14



**Figure 1** results of the glucose hydrogen breath test.

runner. It appears that the daily duration of the reduced mesenteric blood flow and of the mechanical GI tract concussion does not last long enough in these runners to cause SIBO. The positive LHBT in subject 3 either could be false-positive or indicates a real lactose intolerance. It is reported that lactose maldigesters can usually tolerate small amounts of lactose without symptoms [21]. This could explain why this athlete is asymptomatic except when running. The self-assessment questionnaire did not reveal the intake of lactose-containing food or dietary supplements in connection with running

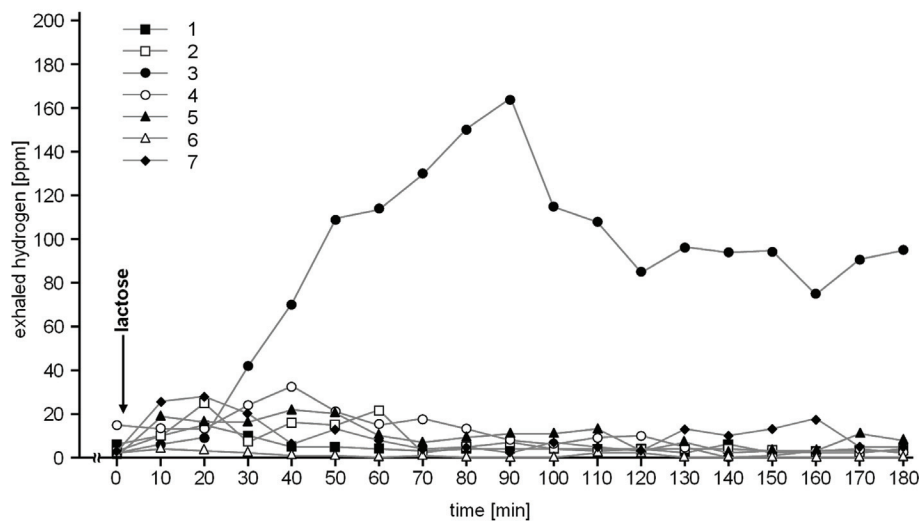
and thus, lactose intolerance is not the reason for the GI symptoms in this athlete.

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**Figure 2** results of the lactose hydrogen breath test.

#### Authors' contributions

KS: conception and design, acquisition, analysis and interpretation of data, drafting the manuscript; DR: acquisition and analysis of data; PB: analysis and interpretation of data, drafting of the manuscript; PS: design, acquisition, analysis and interpretation of data, drafting of the manuscript. All authors read and approved the final manuscript.

#### Competing interests

The authors declare that they have no competing interests.

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