



**Universiteit
Leiden**
The Netherlands

Role of gut-liver axis in circadian exercise and dietary interventions to improve metabolic health

Kovynev, A.S.

Citation

Kovynev, A. S. (2025, November 6). *Role of gut-liver axis in circadian exercise and dietary interventions to improve metabolic health*. Retrieved from <https://hdl.handle.net/1887/4282356>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/4282356>

Note: To cite this publication please use the final published version (if applicable).

**Role of gut-liver axis in circadian exercise
and dietary interventions to improve metabolic health**

Artemiy Stanislavovich Kovynev

Role of gut-liver axis in circadian exercise and dietary interventions to improve metabolic health

© 2025, Artemiy Stanislavovich Kovynev

The work described in this thesis was performed at the department of Medicine, division of Endocrinology, Leiden University Medical Center, Leiden, The Netherlands, and at the Eindhoven Laboratory for Experimental Vascular Medicine, Leiden, The Netherlands. This work was supported by an LUMC Prevention & Lifestyle theme grant.

Financial support by the Netherlands Association for the Study of Obesity (NASO) for the publication of this thesis is gratefully acknowledged.

I would like to thank Anne Zijl and Jasmijn van Heijst for fulfilling my vision and designing and creating the thesis cover.

All rights are reserved. No part of this thesis may be reproduced, stored or transmitted in any form or by any means without permission in writing from the author.

Role of gut-liver axis in circadian exercise and dietary interventions to improve metabolic health

Proefschrift

ter verkrijging van

de graad van doctor aan de Universiteit Leiden,
op gezag van rector magnificus prof.dr.ir. H. Bijl,
volgens besluit van het college voor promoties
te verdedigen op donderdag 6 november 2025

klokke 11:30 uur

door

Artemiy Stanislavovich Kovynev

geboren te Moskou, Rusland

in 1998

Promotor Prof. dr. P.C.N. Rensen

Copromotoren Dr. M. Schönke

Dr. Q.R. Ducarmon

Leden promotiecommissie Prof. dr. K. Willems van Dijk

Prof. dr. M. Nieuwdorp (Amsterdam UMC)

Prof. dr. S.W.C. van Mil (UMC Utrecht)

Dr. T.M.H. Eijsvogels (Radboud UMC)

Table of contents

Chapter 1:	General Introduction and outline	7
Chapter 2:	The influence of time-dependent exercise on the immune system in health and disease	33
Chapter 3:	Early but not late exercise training in mice exacerbates hepatic inflammation in developing nonalcoholic fatty liver disease	59
Chapter 4:	Timing Matters: late, but not early, exercise training ameliorates MASLD in part by modulating the gut-liver axis in mice	75
Chapter 5:	Exercise training at different intensities induces heat stress, disrupts barrier function and alters microbiota in the gut of mice	127
Chapter 6:	Combination of dietary fiber and exercise training improves fat loss in mice but does not ameliorate MASLD more than exercise alone	173
Chapter 7:	A fast(ing) way to cardiometabolic health: investigating the effects of a year-long cyclic fasting-mimicking diet on gut microbiome in patients with type 2 diabetes	209
Chapter 8:	General discussion	241
Chapter 9:	Summary, Samenvatting, List of publications, Curriculum Vitae and Acknowledgements	267

