LETTER TO THE EDITOR

Publicly stressing the role of mitochondria in NAFLD with(in) a sports event

Nonalcoholic fatty liver disease (NAFLD) is currently the most prevalent cause of chronic liver disease and constitutes a major risk for the development of end-stage liver disease. Led by hypercaloric diets and sedentary lifestyle characteristic of modern societies, NAFLD has a prevalence of 25% amongst the adult population worldwide. Moreover, NAFLD incidence is rising both amongst children and adolescents.1 Alongside basic biomedical research for novel therapeutic tools and the optimization of management strategies, currently based on lifestyle interventions targeting weight loss,2 health promotion initiatives targeting primary prevention through improvement of nutritional quality and physical activity habits are imperative to tackle this and other metabolic diseases.

Offering an interactive environment, informal venues such as music festivals or mass sports events are effective settings to foster community receptiveness for behaviour change towards healthier lifestyles.3-5 Sports captivate the attention of countless fans, providing entertainment and joy to both athletes and spectators, and eliciting a contagious wave of emotional connection that gathers and engages the interest and participation of large audiences. As posited by the social cognitive theory’s (SCT) concept of modelling,6 even if not actively engaged in the practice of sports, passers-by and the spectators of the event can experience a self-reflection upon their own health-oriented values and physical activity habits; in other words, sport events can trigger a behavioural change towards healthier lifestyles.4,7,8 Furthermore, the receptivity and effectiveness of health-oriented messages seem to be further increased when perceived as matching with the nature of the event and supported by a wider media campaign.5,9,10 Thus, sports events provide the ideal setting for promoting exercise as an ally for the prevention and treatment of NAFLD and other sedentary-driven contemporary metabolic disorders.

Based on the evidence supporting strategic cross-sectoral partnerships between sport event organizers and health-related specialists in disseminating health valorization ideas and well-being,4,11 we designed and implemented a science communication multimodal approach at the 2018 edition of the European Universities Games (EUG), the largest university multisport event in Europe. Combining an on-site outreach booth with a wider media campaign targeting the local community at large, we intended to raise awareness on NAFLD and promote lifelong healthy lifestyles, encouraging the practice of physical activity by stressing the role of mitochondria within the context of (energy) homeostasis and the impact of (un)healthy lifestyles on the biological processes that drive health and ageing.

1 | SCIENCE COMMUNICATION MULTIMODAL APPROACH OVERVIEW

The media campaign involved the collaboration of 52 national and international researchers in the development of science communication materials focused on the biomedical underpinnings driving the health-related benefits of exercise practice in metabolism and metabolic diseases, sleep cycles, memory, reproduction and fertility, articular degeneration and arthritis, menopause, cardiovascular health, neurodevelopment and neurodegenerative disorders. The campaign resulted in 14 illustrated chronicles, radio clips, flyers, videos and a comic strip and had a particular focus on NAFLD and the impact of exercise on mitochondria bioenergetics.

NAFLD is led by a disruption of energy homeostasis and the development of systemic insulin resistance and thus shares an underlying aetopathogenesis with other metabolic diseases such as obesity or type 2 diabetes mellitus.12 The metabolic milieu brought about by this chronic positive energy balance leads to hepatic steatosis that compromises mitochondrial function and triggers an inflammatory state known as nonalcoholic steatohepatitis (NASH), which, in turn, can progress to cirrhosis or hepatocellular carcinoma (HCC).13 Known as the powerhouse of the cell, mitochondria mediate the conversion of energy substrates into ATP and thus represent the ultimate link between energy intake and energy expenditure. As such, mitochondria is a crucial element for the conceptual understanding of the cycle of energy homeostasis and the relationship between nutrition and physical activity.14
FIGURE 1  (A) Illustration of the chronicle “A Tale of a (Too Much) Sugar and How to Fight it” about the impact of excess of sugar and sedentary lifestyle/physical activity on the development of cardiometabolic diseases, including nonalcoholic fatty liver disease. (B) Illustration of the chronicle “Sports and Neurodegenerative Diseases” about the role of exercise practice in the regulation of autophagy, involved in the degradation of toxic protein aggregates such as senile plaques in Alzheimer's disease and Lewy bodies in Parkinson's disease. (C) Social media coverage in the online platforms of CNC, EUG 2018 and FOIE GRAS. (D) Comic “Exercise, Mitochondria...& Us” introducing the concept of body adaptation to exercise practice and the fact that endurance training promotes mitochondrial biogenesis, closing with age-dependent physical activity recommendations by the World Health Organization.1
For the illustrations and the comic, the science content was discussed between researchers and an illustrator, to de-construct some scientific jargon and co-create simple and attractive images. Visual imagery is particularly suited to portray and communicate abstract concepts characteristic of macro- and microscopic biological mechanisms or subcellular structures that lie beyond the visual experiential reach of nonexperts, as is the case for mitochondria (Figure 1A,B). Besides the 14 illustrations for the chronicles, the co-creation process also resulted in the production of the comic “Exercise, Mitochondria...& Us” (Figure 1D), which combines the power of visual communication and storytelling to elicit learning and attitude shifts. In this case, the narrative of the comic explored the role of mitochondria as the mediators of the metabolic processes that link energy intake with energy expenditure, food consumption and physical activity, closing with age-dependent physical activity recommendations by the World Health Organization. The use of languages such as comics to explore scientific subjects is a creative way to communicate and to involve different audiences.

In addition to the media campaign, the outreach booth “Paddle/Pedal Bar” was designed to engage visitors from the local community as well as athletes and passers-by in the practice of physical activity with a static bike and rowing paddle machines. The outreach booth aimed at promoting interactions between the public and science communication materials as well as the participation in a questionnaire game enquiring about lifestyle behaviours.

2 OUTCOMES AND FOREFRONT

It is difficult to predict the impact of any science communication and outreach campaign, but we estimate that our multimodal approach reached more than 100 000 people (Figure 1C), via the EUG 2018 newsletter (3612 subscribers), the Portuguese regional press (Diário de Coimbra, with a daily circulation of 10 000 copies), the Portuguese national press (Público online, 6814 page views), the Healthy Living with Exercise flyer (2000 printed copies) and the EUG 2018 (https://www.EUG 2018.com), EUSA, CNC (http://www.cnbc.pt/outreach/outreach00_EUG 2018.asp) and FOIE GRAS online social media platforms, besides the coverage in the Portuguese News Agency Lusa. Researchers also collaborated in 2- to 3-minute-long radio pieces (in Portuguese) and in a special interview, produced by the Radio University of Coimbra (RUC, an academic radio with a huge impact in both academic and nonacademic local communities).

The Pedal Bar outreach booth (Figure 2) received 1021 visitors from 33 different nationalities during the ten days of the event. The audience (43% women and 57% men) was composed of athletes (41%), visitors (37%), young volunteers (13%) and staff members (9%). The majority of participants were young adults (74%), but other age groups, going from children to senior citizens, also engaged in Pedal Bar activities. The Pedal Bar was also devised as a space for the interaction between scientists and a nonscientific audience. The interaction with people during the questionnaire game clearly elicited a mutually beneficial dialogue about lifestyle habits and perceptions on and about the importance of exercise practice, and a moment of self-reflection (Figure 2B-F) about individual lifestyle habits from a new and perhaps renewed perspective. Health and well-being are understood and practised not only in reference to biomedical knowledge, but also shaped by beliefs, perceptions and attitudes that are dependent on cultural, social and environmental factors. The communication of mitochondrial-related concepts rarely occurs outside of the circles of experts, yet its appropriation by nonexpert audiences can provide a biological framework to understand the process of energy homeostasis and its relation with lifestyle-driven behaviours. Rising awareness on these concepts within the environment of a sports event might be particularly useful for health promotion initiatives focusing on NAFLD and other metabolic diseases, in which sedentary behaviours and the lack of physical activity are aetiologically related to the disruption of mitochondrial function and largely to the pathophysiology of the disease. A multimodal approach such as the one undertaken in EUG seems to engage different publics and broadens the impact of the sports event, reaching not just the spectators visiting the venue but the local community at large.

ACKNOWLEDGEMENTS

The FOIE GRAS project, focused on the Bioenergetic Remodeling in the Pathophysiology and Treatment of Non-Alcoholic Fatty Liver Disease (NAFLD), is a European Training Network (ETN) funded by the European Union’s Horizon 2020, under the Research and Innovation Programme, Marie Skłodowska-Curie Grant Agreement No. 722619. The European Universities Games Coimbra (EUG 2018), celebrated “A winner’s heartbeat!” between July 15 and 28, had over 4 000 participants from 291 Europe’s leading sport universities, organized under the umbrella of the European University Sports Association (EUSA), supported by the International University Sports Federation (FISU) and also received funding from the European Erasmus + Programme and 672 volunteers from Portugal and abroad. We would like to thank the organizers of EUG 2018 and the researchers of FOIE GRAS and the Center for Neuroscience and Cell Biology that participated in this initiative, as well as the public and visitors of the Pedal Bar that made this a successful experience.
Regarding the WHO Physical activity recommendations...

- I didn’t know, but my exercise habits are in line with the recommendations
- I did know and my lifestyle habits are in line with the recommendations
- I did know, but I don’t follow these recommendations
- I didn’t know and I want to start exercising more to follow the recommendations
- I didn’t know, but now that I do, I don’t plan on making any changes on my lifestyle

Regarding exercise practice, with which of the following do you agree the most?

- Has healthy effects on aging and metabolism
- Has a positive impact on every organ, including the brain, guts, liver, heart and pancreas
- The practice of exercise is part of the treatment and prevention strategies of many diseases or the gut
- For a healthy lifestyle all of us has to exercise throughout our lifetime
- All of the above

How would you describe your lifestyle habits?

- I am very active and I eat a healthy diet
- I am very active, but my diet could be more healthy
- I could exercise more, but my diet is very healthy
- I don’t exercise enough nor take care of my diet, but I have a healthy lifestyle
- I don’t exercise enough nor take care of my diet and I notice it on my health

Are you aware of the healthy benefits of exercise?

- Yes, I was fully aware of all the beneficial effects of exercise
- Yes, but I thought it only affected the muscles
- Yes, but I didn’t know that it also affected organs like the liver or the gut
- Yes, but I discovered that it has healthy effects I was unaware of
- No, I was not aware of the healthy effects of exercise

I practice exercise mostly because...

- Because I gain satisfaction and joy from practicing sports
- To improve or maintain my appearance and fitness
- To improve or maintain my health (including weight-related aspects)
- To socialize
- Another reason / All of the above

Testimonies

Evidence Of Reach

“We saw the flyers in the university canteens...”; “150 minutes [of exercise] per week? It’s a short time...” Group of Portuguese volunteers (2♂, 3♀): “These drawings are what we are getting in the newsletter. I have already seen this one [metabolism]!” Judo athletes from Catalonia (4♂): “I read your tips on a healthy diet in the newsletter and the food we eat in the canteen is not really balanced; a lot of meat and no vegetables...” Basket athletes from Germany (3♀): “We received the chronicles by e-mail in the newsletter. I read the one about the liver!” Volleyball athlete from the Netherlands (9)

Engagement With Scientific Knowledge

“How cool! How do we know which is the right balance [energy homeostasis]? How should we proceed? What is the right type of exercise?” Portuguese Volunteer (♂): “Very nice. I didn’t know that exercise had beneficial effects on the pancreas, how is that?” Portuguese volunteer (♀): “Are you aware of the benefits of exercise practice? I don’t know what are the recommendations. I didn’t know there were any recommendations!” Visitor 10 years old (♂): “What are these designs? Ah... Brain, Cell... I hadn’t noticed. It is very cool!” Judo athlete, Portugal (♀)

Appreciation

“It’s really a good idea! Not only the questions but also the creativity - shapes- and interactions” Basket athletes from Russia (3♂): “Thank you very much for participating” Paulo Oliveira, CNC researcher “No, thank you for promoting health” Rosa Mota, European (1982, 1986, 1990), World (1987) and Olympic (1988) Female Marathon winner
CONFLICT OF INTEREST
None of the authors have potential conflicts of interest to be disclosed.

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