Running may be better than cycling for long-term bone health

Exercise that puts greater strain on bones, like running, may improve long-term bone health more effectively than non weight-bearing activities like cycling, conclude the authors of a new study measuring the hormones of mountain ultra-marathon runners. The results of the study are presented today at the European Congress of Endocrinology.

Previous research from the Istituto Ortopedico Galeazzi in Milan found that cyclists racing in ultra-endurance conditions suffered chronic bone resorption – where calcium from bone is released into the blood stream, weakening bones. In this study, the same group set to find out whether a similar group of elite athletes – mountain ultra-marathon runners – had the same response.

The researchers measured two vital bone constituents as well as hormones associated with energy regulation. Osteocalcin and P1NP are two proteins associated with bone formation and their levels in blood are an indicator of bone health. Glucagon, leptin and insulin are hormones involved in regulating metabolism and indicate the body's energy needs. Increasing glucagon levels indicate an energy demand, whilst increasing insulin and leptin levels indicate adequate or excessive energy levels. The researchers measured these three hormones as well as levels of osteocalcin and P1NP in 17 trained runners before and after a 65-km mountain ultramarathon run and compared it to the hormones and bone constituents of twelve adults of the same age who didn't run the race but did low to moderate physical exercise.

Compared to the control group, ultramarathon runners had higher levels of glucagon and lower levels of leptin and insulin when finishing the race. The falling levels of insulin within this group were linked to similarly falling levels of both osteocalcin and P1NP – suggesting that athletes may be diverting energy from bone formation to power the high-energy demands of their metabolism. However, ultramarathon runners had higher P1NP levels at rest compared to controls, suggesting that they may divert energy from bones during racing but have a net gain in bone health in the long-term.

"The every-day man and woman need to exercise moderately to maintain health", said Dr Giovanni Lombardi, lead author of the study. "However, our findings suggest that those at risk of weaker bones might want to take up running rather than swimming or cycling".

One theory that could explain the effect of different exercises on bone formation is the role of osteocalcin, explains Dr Lombardi. "Previous studies have shown that osteocalcin communicates with beta cells in the pancreas, which regulate the body's glucose metabolism", he said. "Because running exerts a higher physical load on bone than swimming or cycling, it could be that these forces stimulate bone tissue to signal to the pancreas to help meet its energy needs in the long-term."

"Our work has shown that bones aren't just lying idle, but are actively communicating with other organs and tissues to drive the body's energy needs," said Dr Lombardi. "We often find that metabolic conditions and fracture risks are linked to the same underlying condition, so the more we learn about the interaction between bones and body metabolism, the better we will understand complex but important diseases such as diabetes and osteoporosis."

--- ENDS ---

European Society of Endocrinology
the European hormone society

ECE2016
28 – 31 May 2016
MUNICH, GERMANY
18th EUROPEAN CONGRESS OF ENDOCRINOLOGY

Abstract

OC10.3

Ultra-trail marathon induces bone response in association with acute and established metabolic changes

Giovanni Lombardi[1], Veronica Sansoni[1], Silvia Perego[1], Gianluca Vernillo[2,3], Federico Schena[3,4], Giampiero Merati[2,5], Andrea Baruti[6,7], Antonio La Torre[2], Giuseppe Banfi[1,8]

[1]I.R.C.C.S. Istituto Ortopedico Galeazzi, Laboratory of Experimentak Biochemistry & Molecular Biology, Milano, Italy, [2]University of Milano, Dept. of Biomedical Sciences for Health, Milano, Italy, [3]University of Verona, Research Center for Sport, Mountain & Health, Rovereto, Italy, [4]University of Verona, Dept. of Neurological & Movement Sciences, Verona, Italy, [5]IRCCS Fondazione Don Carlo Gnocchi, Milano, Italy, [6]University of Milano, Dept. of Biosciences, Milano, Italy, [7]University of Milano, Centro Interuniversitario di Medicina Molecolare e Biofisica Applicata (CIMMBA), Milano, Italy, [8]Vita-Salute San Raffaele University, Milano, Italy

Introduction. Bone and energy metabolisms are deeply related determining a two-way street aimed in regulating the energy utilization [1]. Mountain ultra-marathons are peculiar aerobic performances hardly proving whole body homeostasis [2]. In this study we aimed at investigating and characterizing the metabolic profile (hormones involved in energy metabolism), the metabolic inflammation profile (adipokines), the bone metabolism (bone turnover markers), and their integration (mediated by osteocalcin [3]) both in experienced ultra-marathon runners and control subjects.

Methods. Serum concentrations of bone turnover markers (pro-collagen type I N-terminal propeptide, carboxylated/undercarboxylated osteocalcin), measured by ELISA, and metabolic hormones (C-peptide, insulin, glucagon, glucagon-like peptide, gastric-inhibitory peptide, ghrelin, leptin, resistin, and visfatin), measured by fluorescent-based multiplex assay, were compared before and after a 65-km mountain ultra-marathon in 17 trained runners and in 12 age-matched controls with a low physical activity profile.

Results. After the race, runners experienced a reduction in pro-collagen type I N-terminal propeptide ($p< 0.05$), although it remained higher than in controls ($p< 0.05$), while carboxylated osteocalcin remained unchanged. Among the metabolic hormones, only glucagon and leptin were different between runners at rest and controls. C-peptide and leptin decreased after the race in runners, while glucagon, glucagon-like peptide 1, resistin, and visfatin were increased ($p< 0.01$). Undercarboxylated osteocalcin was decreased (50 %, $p< 0.05$) and highly correlated with insulin and C-peptide ($r= 0.65$, $p< 0.01$).

Conclusions. In order to keep homeostasis, the energy use is strikingly regulated at expenses of bone metabolism. Undercarboxylated osteocalcin changes clearly mark the global energy needs of the body.

European Society of Endocrinology
the European hormone society

ECE 2016
28 – 31 May 2016
MUNICH, GERMANY
18th EUROPEAN CONGRESS OF ENDOCRINOLOGY

Notes for Editors

1. For further information about the study please contact:

Dr Giovanni Lombardi
Researcher
Istituto Ortopedico Galeazzi
Milan, Italy
[redacted]

2. The study "Ultra-trail marathon induces bone response in association with acute and established metabolic changes" will be presented at the European Congress of Endocrinology at 12:09PM on Tuesday 31 May 2016 at the ICM in Munich, Germany.

3. For other press enquiries please contact the ECE 2016 press office:

Omar Jamshed
Communications Executive
European Society of Endocrinology
Tel: (+44) (0)1454 642206
Mob: (+44) (0)7876824027
Email: omar.jamshed@bioscientifica.com

4. The European Congress of Endocrinology is held at the Internationales Congress Center München between 28-31 May 2016.

5. The European Society of Endocrinology was created to promote research, education and clinical practice in endocrinology by the organisation of conferences, training courses and publications, by raising public awareness, liaison with national and international legislators, and by any other appropriate means.