# Combining exercise and diet to prevent and treat non-communicable chronic diseases

# La combinación de ejercicio y nutrición en la prevención y tratamiento de enfermedades crónicas no transmisibles

**Marcela González-Gross**

*Catedrática de Nutrición Deportiva y Fisiología del Ejercicio de la Universidad Politécnica de Madrid. Responsable del grupo de investigación ImFINE. Vicepresidenta de la Sociedad Española de Nutrición. Tesorera de la red EXERNET. Manager científico de Exercise is Medicine Spain.*

An increase in life expectancy and non-communicable chronic diseases (obesity, type-2 diabetes, heart disease, cancer, dementia, depression) has heightened the prominence of both Sport Sciences and Nutritional Sciences in terms of research and Public Health. Yet the lack of connection and collaboration between these two fields has meant that the majority of scientific studies carried out analyse aspects separately. The current state of scientific knowledge appears to indicate that the correct path to follow is to address these issues together, though, clearly, new questions would arise by combining them both. Exploring all of them would divert from the objective and there is not enough space available in this editorial to do so, but we will cover some brief points that can be transposed to the rest.

When it comes to preventing obesity, most studies performed on all age groups conclude that regular physical exercise leads to lower fat mass and greater lean fat percentages, regardless of quality of diet. If we analyse the relationship between intake and expenditure, more active individuals tend to have a lower body fat percentage and ingest more Kcal than inactive individuals, as we demonstrated in the group of adolescents in the HELENA study (Cuenca-Garcia *et al.* 2014), and in the group of adults in the PHYSMED study (Aparicio-Ugarriza *et al.* 2018), data that has been supported by others. Regrettably, very few nutritional studies include information about physical activity and energy expenditure, as we have seen in a review we are carrying out (González-Gross *et al.* unpublished data). Among the studies that do include physical activity (PA) measurements, the majority do not include this data when making conclusions. Similarly, a study carried out in Finland concluded that the adults that followed a traditional Scandinavian diet more closely displayed a lower abdominal fat percentage, though the fact that this group was also more physically active was not taken into account (Kanerva *et al.* 2012). Therefore, it makes no sense to allege that a certain food or even a type of diet "leads to weight gain" without considering the energy expenditure and the type of exercise carried out by an individual or a group of subjects. Likewise, a reduction in energy intake generally leads to a reduction of PA, both EAT and NEAT, and therefore the output, reducing the possible effect on the energy balance.

With regards to treating obesity, particularly in the early stages, physical exercise should not be recommended/prescribed unless the response that this exercise is going to have on the subject's hunger and appetite is known. Many studies indicate that in its acute state, exercise inhibits appetite-stimulating hormones such as ghrelin, and stimulates appetite inhibitors such as PYY or GLP-1 (Schubert *et al.* 2014), delaying post-exertion meals but not affecting the energy intake. However, there are studies that reveal contrary findings. In the long term, it is suggested that the relationship between PA and appetite is J-shaped, though the data is not conclusive. Proposals by authors such as Blundell are particularly interesting, suggesting that the responders and non-responders should be differentiated, both in terms of diet and exercise. In some studies, some subjects even gain weight. Here once again we must emphasise the improvement of scientific methodology, as many studies use the BMI as an indicator even though it has been proven that the fat % should be used, as a loss of fat mass and lean fat gain is usually accompanied by weight gain, rendering the BMI figure invalid. Here is it also worth mentioning the loss of lean fat associated with weight loss. In a recent systematic review, it is even questioned whether physical exercise can be used as a way of increasing appetite among older demographics, but the authors conclude that there is

**Correspondence:** Marcela González-Gross
E-mail: marcela.gonzalez.gross@upm.es

not enough data to back up this hypothesis (Clegg and Godfrey, 2018). The hunger-appetite-exercise relationship undoubtedly requires more research, though a quick look on MedLine indicates that work is being carried out on both high performance demographics and the general public. The inclusion of information differentiating age, sex and level of training is an essential requisite.

Today, it is estimated that after 5 years, 90% of patients that have followed a weight-loss diet, even with exercise, recover the weight lost. Research on the type and intensity of the exertion, along with an optimum dietary combination, is a challenge that will no doubt help improve statistics in the post-weight-loss maintenance phase. A recent publication from the DIOGenes study indicates that the amount and type of protein consumed may be relevant in managing cardio-metabolic and obesity risk factors during this maintenance phase. A lack of data about PA is preventing advances from being made in the interaction in question.

The physiological processes associated with ageing are also driving lines of research in to how to halt, slow down or even prevent these processes from occurring. Sarcopenia is defined by the European Work Group on Sarcopenia in Older People (EWGSOP) as decreased muscle mass associated with less exertion and performance. It is a stimulus for research in both nutrition and the physiology of exercise. In the field of nutrition, studies are being carried out on the quality and quantity of protein that should be ingested to avoid or to revert sarcopenia, as well as how this intake should be distributed throughout the day, and even how it should be combined with other foods and drinks. Likewise, supplementary research is being conducted that could contribute to maintaining muscle mass better throughout the ageing process. In Sports Sciences, research is being carried out on exercise protocols that best preserve muscle mass and strength, as well as on the metabolic mediators and biochemical processes that occur when exercise is performed, or when a sedentary life-style is followed. A 2014 review by the EWGSOP group outlined the need for diet and/or exercise intervention studies, from which we have highlighted the need for combined studies. Sarcopenic obesity, weight gain during the menopause, vitamin D deficiency and osteoporosis, among others, are additional factors to take into account.

In a Doctoral Thesis defended recently in our ImFINE research group, with which we aimed to further investigate the relationship between PA, physical condition and nutrition, adults aged 55 with better physical condition revealed an intake of macro and micro nutrients that adhered more closely to recommended levels compared to those in worse physical condition (Aparicio-Ugarriza *et al.* 2018). We also observed a better hydration pattern among those that carried out regular physical exercise and that were not sedentary.

Current Public Health nutritional guidelines, such as cutting down salt, sugar, kilocalories and fats, principally target sedentary demographics, which in turn are receiving guidelines to reduce sedentary behaviour and to increase physical activity. We are concerned about the impact that these guidelines will have on the physically active population. In this respect, authors such as Koenders *et al.* (2006) conclude that general recommendations regarding salt reductions cannot be appropriate for athletes, particularly for those in hot climates. In that particular study performed on runners, a sodium-poor diet led to worse sodium-plasma concentrations, a higher heart rate and body temperature compared to higher intakes. It is also concerning how the salt-reduction recommendation will affect the nutritional state of iodine, as iodised salt has been key to reducing this endemic deficiency (EUFIC, 2011). The myopathy associated with hypothyroidism, among other things, causes intolerance to exercise and muscle cramps, possibly even resulting in closing the circle mentioned above. The consumption of red meat is related to a higher risk of colon cancer and regularly performing physical exercise seems to be a protective factor against this kind of cancer. Therefore, the interaction between diet and exercise remains to be discovered, as well as if the positive effect of exercise counteracts the possible negative effect of the food type. Epidemiological data indicates that exercise may act as a mitigating factor. Furthermore, the recommendation to reduce the intake of red meat affects iron contributions, a mineral that is usually deficient in athletes and in the general public, as well as others, such as zinc, selenium and proteins with high biological value, fundamentally, among other aspects, for muscle quality and functionality. Any other recommendation to reduce or limit the intake of foods entails a possible risk of malnutrition in a kind of domino effect, and guidelines must include alternative foods that are good sources of these same nutrients so as to avoid falling into the deficiency, and among other effects, reducing the physical and mental performance of the population. Moreover, combined research topics emerge such as nutrigenetics, nutrigenomics, epigenetics, microbiota, allergies and food intolerances, in which the intermediation of exercise *per se* is not known, not referring to types, intensities and frequencies.

We can conclude that we need to perform more research in the relationship between exercise and nutrition. Currently, for most chronic illnesses, we do not know if the effects are synergic, antagonic or attenuating. Men and women of the 21st century live in different environmental, social and working conditions, with different access to food and drink, and with a different response to stimuli. An optimum combination of both, adapted to the physiological and pathophysiological aspects of ageing and chronic illnesses, is a challenge that we are passionate about, and one for which a scientific response should be given.

## Bibliography


1. Aparicio-Ugarriza R, Luzardo-Socorro R, Palacios G, Bibiloni MM, Argelich E, Tur JA, González-Gross M. What is the relationship between physical fitness level and macro- and micronutrient intake in Spanish older adults? *Eur J Nutr.* 2018 May 2. doi: 10.1007/s00394-018-1696-z. [Epub ahead of print]
2. Beaulieu K, Hopkins M, Blundell J, Finlayson G. Does Habitual Physical Activity Increase the Sensitivity of the Appetite Control System? A Systematic Review. *Sports Med.* 2016; 46(12): 1897–1919.
3. Bloise FF, Oliveira TS, Cordeiro A, Ortiga-Carvalho TM. Thyroid Hormones Play Role in Sarcopenia and Myopathies. *Front Physiol*. 2018; 9: 560. Published online 2018 May 23. doi: 10.3389/fphys.2018.00560
4. Clegg ME, Godfrey A.The relationship between physical activity, appetite and energy intake in older adults: A systematic review. *Appetite*. 2018 Jun 7;128:145-51. doi: 10.1016/j.appet.2018.05.139. [Epub ahead of print]
5. Cruz-Jentoft AJ, Landi F, Schneider SM, Zúñiga C, Arai H, Boirie Y, Chen LK, Fielding RA, *et al.* Prevalence of and interventions for sarcopenia in ageing adults: a systematic review. Report of the International Sarcopenia Initiative (EWGSOP and IWGS). *Age Ageing.* 2014 Nov; 43(6): 748–59.
6. Cuenca-García M, Ortega FB, Ruiz JR, Labayen I, Moreno LA, Patterson E, Vicente-Rodríguez G, González-Gross M, *et al;* HELENA Study Group. More physically active and leaner adolescents have higher energy intake. *J Pediatr*. 2014 Jan;164(1):159-166.e2.

7. EUFIC (2011). Iodine deficiency in Europe: A hidden public health concern. https://www.eufic.org/en/whats-in-food/article/iodine-deficiency-in-europe-a-hidden-public-health-concern. Visitado 25 de junio de 2018.

8. Kanerva N, Kaartinen NE, Schwab U, Lahti-Koski M, Männistö S. Adherence to the Baltic Sea diet consumed in the Nordic countries is associated with lower abdominal obesity. *Br J Nutr.* 2013 Feb 14;109(3):520-8.

9. Oostindjer M, Alexander J, Amdam GV, Andersen G, Bryan NS, Chen D, Corpet DE, De Smet S, *et al.* The role of red and processed meat in colorectal cancer development: a perspective. *Meat Sci.* 2014 Aug;97(4):583-96. doi: 10.1016/j.meatsci.2014.02.011. Epub 2014 Feb 24.

10. Schubert MM, Sabapathy S, Leveritt M, Desbrow B. Acute exercise and hormones related to appetite regulation: a meta-analysis. *Sports Med.* 2014 Mar;44(3):387-403.

11. van Baak MA, Larsen TM, Jebb SA, Martinez A, Saris WHM, Handjieva-Darlenska T, Kafatos A, Pfeiffer AFH, Kunešová M, Astrup A. Dietary Intake of Protein from Different Sources and Weight Regain, Changes in Body Composition and Cardiometabolic Risk Factors after Weight Loss: The DIOGenes Study. *Nutrients.* 2017 Dec 6;9(12). pii: E1326. doi: 10.3390/nu9121326.

12. Williams PT. Walking attenuates the relationships of high-meat, low-fruit dietary intake to total and regional adiposity in men and women. *Obesity (Silver Spring)*. 2012 Sep;20(9):1929-35. doi: 10.1038/oby.2011.313. Epub 2011 Oct 27.