

Balanced diet and active lifestyle : a winning duo



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David mainly works on the metabolic, energetic and nutritional adaptations to daily activities and exercise-versus dietary-induced energy deficits, particularly in pediatric obesity.

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Never before have we been so encouraged to follow recommendations for a healthy, active and balanced lifestyle to ensure better physical, moral and social health, now and in the future. However, at the same time, never before has our society, due to its changes, led us to such a sedentary lifestyle, such a low level of physical activity, or a diet that is too often unbalanced.

Our daily activity habits and our diet, which are often considered in scientific literature and public health recommendations as two independent levers for managing our energy balance, seem to interact and influence each other.

In his article, Professor Lecerf considers the results of a study conducted on more than 5,000 students to illustrate how regular physical activity and a healthy diet positively influence weight regulation and jointly reduce the risks of excess weight.

Dr Aucouturier presents the results of a systematic and meta-analytical review highlighting the essential role of a diet rich in fruit and vegetables in minimising the physiological consequences, and in particular muscle damage, inflammation or other oxidative stress, following certain intensive physical activities.

Finally, Dr Julian highlights the still underestimated effects of our daily activities on our dietary control, pointing out that an active lifestyle and a low level of sedentary behaviour promote a healthier and more balanced diet from an early age.

This issue thus clearly and appropriately highlights not only the need to follow public health recommendations, but also shows the synergy between an active lifestyle and a balanced diet.

Diet and physical activity of Brazilian students

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Unhealthy lifestyles combining a lack of physical activity and poor dietary habits are considered to be the main risk factor for chronic diseases and premature death. Exposure to these risk factors related to overweight emerges strongly as of the second and third decades of life. This is the age when independence begins, including addictive experiences, peer influence, new eating habits, exposure to screens and sedentary lifestyles, and even the cessation of sport due to studies or work.

The aim of this study was to identify both sports practices and fruit and vegetable consumption among students at the Federal Technological University of Paraná in southern Brazil, which has more than 30,000 students.

Characteristics of the study population and their sports practices

5,310 students (boys 61.8% - girls 38.2%) were surveyed:

- 29.1% were 20 years old or younger,
- 39.1% were 21 - 25 years old, and
- 31.8% were 26 years old and over.

In terms of their health status, 28.9% were overweight (boys 35.5%, girls 18.2%) and 10.2% were obese (boys 12.1%, girls 7%), i.e., a total of 39.1% were overweight or obese, which is very high for these age groups.

With regard to sports activities, 19.6% reported that they did not practise any aerobic sports, while 29.9% practised aerobic sports one or two days a week. Furthermore, 26.4% practised aerobic physical activity 3 to 4 days a week and 24.1% at least 5 days a week. The percentage of students not doing any sport was 56.2% among those with obesity. As regards strength sports (exercising against resistance), 48.4% had never practised them, with this percentage reaching 76.9% in obese students.

Consumption of fruit and vegetables well below dietary recommendations

A total of 14.5% never consumed fruit and vegetables (19.6% of boys and 6.2% of girls), 51.8% had a low consumption, 20.7% a moderate consumption and only 13.0% an adequate consumption, i.e., more than 5 servings per day. A total of 7.9% of boys and

21.2% of girls had a high consumption of fruit and vegetables.

It is interesting to note that the lack of consumption decreases sharply according to the three age groups (23.5%, 16.9% and 4.7%), according to marital status (16.6% single - 7.1% in a couple) and increases with the course year (from 10.4% to 16.4%) and sharply with increasing weight (10.7%, 18.1% and 29.7%).

Conversely, the percentage of students with adequate or high consumption decreases with increasing weight (17.9%, 6.9%, 5.8%), as does the percentage with moderate consumption (27.3%, 11.1% and 9.2%).

Lower fruit and vegetable consumption strongly associated with obesity risk

The authors were able to calculate an Odds Ratio (OR) of the risk of obesity and overweight by gender for types of physical activity and for fruit and vegetable consumption. In girls the OR was 1.00 for at least 5 fruit and vegetables/day, 1.43 for 3 - 4 servings/day, 1.97 for 1 - 2 servings/day and 2.92 for 0 servings. For boys the figures were 1.26, 1.54 and 1.98 respectively with in both cases a $p < 0.001$ after adjustment for age, marital status and year of study.

Fruit & vegetable consumption	Women	Men
	OR of the risk of overweight and obesity	
≥ 5 servings/d	1.00 (reference)	1.00 (reference)
3 - 4 servings/day	1.43 (0.94– 2.18)	1.26 (0.91– 2.11)
1 - 2 servings /day	1.97 (1.31– 2.90)	1.54 (1.07– 2.43)
0 serving/day	2.91 (2.07– 4.12)	1.98 (1.41– 3.02)
	$p < 0.001$	$p = 0.001$

Table : Fruit and vegetable consumption and Odds Ratio of the risk of overweight and obesity

Thus, fruit and vegetable consumption among students is modulated by socio-demographic factors. Lower consumption is strongly linked with the risk of obesity.

KEY MESSAGES

- Students are often exposed to a flawed lifestyle (diet, physical activity).
- Physical activity is very insufficient for one student out of five, but more than half are obese.
- Only 13 % of them have an adequate fruit and vegetables consumption.
- A low consumption of fruit and vegetables multiplies by two (boys) or three (girls) the obesity risk.
- Actions must be taken to improve their life habits;

METHODOLOGY

- The survey covered 5,310 university students in Brazil
- An online questionnaire was used to collect the frequency of sports practice and fruit/vegetable consumption.
- Fruit and vegetable consumption was assessed as follows:
 - low intake (1 to 2 times a day)
 - moderate intake (3 to 4 times a day)
 - adequate or high intake (≥ 5 times a day).



Based on: Guedes DP, Silva ALDS. Exercise and fruit/vegetable intake, and their associations with body weight status in university students. Nutr Hosp. 2021 Jun 10;38(3):545-554.

Anthocyanins can help improve muscle recovery in athletes

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Muscle damage can occur both in highly trained athletes and in occasional athletes when they make unusual efforts in terms of duration or intensity. This muscle damage can cause temporary soreness (up to 48 hours), which includes both a perception of pain and a decrease in joint mobility and the ability of the muscle to contract effectively.

In this article, data from a recent review and meta-analysis on the effects of anthocyanins in fruit on muscle recovery after exercise are summarised.

Muscle damage occurs mainly during unusual exertion

Muscle damage is related to longer than usual or more intense sports activities, in terms of both cardio-respiratory activity and the forces produced. This damage is not serious in terms of health and can even be considered a normal stage in the process of muscle adaptation to exercise (MacIntyre, 1995).

This muscle damage results in the loss of cell membrane integrity, which leads to the passage of intra-cellular proteins into blood circulation, and an alteration in the structure of the muscle cells, thus limiting their ability to contract effectively. While some of this damage is the direct result of mechanical stress on the muscle, some of it is linked to the increase in oxidative stress during exercise, and then to the inflammation that follows it (Pyne, 1994).

This has prompted research into whether the polyphenols, and particularly the anthocyanins (mauve or red pigments), contained in the fruit can have antioxidant and anti-inflammatory effects that limit muscle damage.

Recently, researchers from Northumbria and Newcastle Universities in the UK undertook a systematic review and meta-analysis of these studies (Kimble, 2021).

Anthocyanins improve muscle recovery at biochemical, functional and perceptual levels

Analysis of the data compiled from these studies indicates the following main results:

- Anthocyanin consumption results in significant decreases in

markers of muscle damage such as creatine kinase (CK) and markers of inflammation such as C-reactive protein (CRP), while total antioxidant capacity is significantly increased.

- From a functional point of view, the consumption of foods rich in anthocyanins results in less loss of muscle strength after exercise. Moreover, this significant effect, immediately after the end of the exercise, persists for at least 48 hours.

- On a perceptual level, muscle pain related to soreness is significantly reduced 24 hours after exercise.

One of the advantages of the action of anthocyanins is that they act on multiple signalling pathways. This includes, for example, anti-inflammatory effects by inhibiting enzymes such as cyclooxygenase, which is responsible for the production of prostaglandins, or antioxidant effects which limit damage to muscle cell membranes (Bloedon, 2019). Ultimately, the lesser damage to the integrity of the muscle allows its function to be preserved (Kimble, 2021).

The recommendation would be to consume fruit and vegetables that are rich in anthocyanins for a faster recovery after exercising

A limitation of current studies on anthocyanins in fruit is that they often concern processed products, whether juices, powders or concentrates. It follows that anthocyanin intakes can vary greatly from one study to another, although it is not possible to conclude that there is a clear link between anthocyanin dose and the extent of muscle damage limitation. Thus the median anthocyanin intake of the 39 included studies is 80 mg/d, with extreme values ranging from 8 to 3600 mg/d (examples of anthocyanin contents in certain fruit: blackcurrant: 592 mg/100g; black grape: 35 mg/100g; raspberries: 31 mg/100g; strawberries: 24 mg/100g - www.aprifel.com).

Despite this limitation, the existing data justify recommending the consumption of anthocyanin-rich fruit and vegetables for those who wish to recover more quickly from unusual exercise (McLeay, 2012 ; Vitale, 2017). These aspects are interesting both for competitive athletes who want to limit the impact of muscle damage on their performance and for more occasional exercisers who want to limit the discomfort of muscle soreness.

KEY MESSAGES

- The anthocyanins in fruit have anti-inflammatory and antioxidant effects that limit damage to muscle cell membranes
- The existing data justify the recommendation to consume fruit and vegetables that are rich in anthocyanins, after muscular effort and to limit the discomfort linked to muscle soreness.

METHODOLOGY

- This systematic review included 39 papers (PubMed, The Cochrane Library, MEDLINE, SPORTDiscus and CINAHL) for a total of 767 subjects with a median age of 24 years.
- In these studies, anthocyanins were most often found in tart cherries, followed by blackcurrants, grapes, and blueberries.



Based on: Kimble R, et al. The effect of dietary anthocyanins on biochemical, physiological, and subjective exercise recovery: a systematic review and meta-analysis. Crit Rev Food Sci Nutr. 2021 Aug 17:1-15.

References:

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Are movement behaviors associated with eating habits and appetite control in children and adolescents?

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Physical activity (PA), particularly moderate to vigorous intensity PA (MVPA), improves overall health, including body mass index, fat mass, cardiometabolic risks, fitness but also mental and cognitive development in youths.

On the contrary, sedentary behaviors (SB) are associated with cardiovascular and psychosocial adverse health outcome. Although public health guidelines have been regularly updated (Chaput 2020), the current epidemiologic situation remains alarming, with only 44%, 39% and 16% of children meeting recommendations for MVPA, SB, and both MVPA and SB times, respectively. Interestingly, although less discussed so far, such movement behaviors might also be associated with eating habits.

This brief article tends to sum up the available evidence regarding the association between movement behaviors and eating habits and appetite control in children and adolescents.

High physical activity and low sedentary behavior levels are associated with increased food intake and poor diet quality

While the impact of movements on energy expenditure had been largely studied in the past decades, recent works have investigated the two sides of the energy balance, uncovering interactions between movements behaviors and energy intake. Both low PA and high SB levels are associated with increased food intake and poor diet quality. In 9,842 youths, higher PA level has been associated with higher healthy (i.e., fruit and vegetables) and lower unhealthy (i.e., soft drinks, savoury snacks) food intakes (Manz, 2019), which is in line with previous results from the IDEFICS (Identification and prevention of Dietary and lifestyle induced health Effects In Children and infantS) study (Santaliestra-Pasias, 2018). Among SB, screen time seems to be particularly detrimental for eating habits (Lowry, 2015, Tambalis, 2019). The ISCOLE (International Study of Childhood Obesity, Lifestyle and the Environment) study, conducted in 5,873 children, showed that

meeting screen time recommendations was strongly associated with healthy eating habits (Thivel, 2019).

Exercise as a potential “corrector” of an impaired appetite control

From a physiological point of view, for low PA/high SB patterns, hedonic processes would prevail over homeostatic regulating factors, leading to over or unhealthy food consumption. Recent studies found that an acute intense exercise (above 65-70% of maximal aerobic capacity) induced an anorexigenic effect on subsequent food intake in youths (Thivel, 2019). Beyond duration, modality, or induced-expenditure, intensity would be the primary exercise characteristic involved in the modulation of energy intake. Another important parameter to consider is the timing of exercise, including placement during the day (morning vs afternoon), the order/position (pre vs post-meal), and the delay between exercise and meals. Although the literature remains limited in pediatric populations, exercising proximal to a meal would help to achieve homeostatic intake at the subsequent meal.

Improving appetite control and eating habits through exercise in youths is highly likely to have beneficial effects life-long

Comprehensive approaches addressing interactions between all key behaviors show that unfavorable PA/SB patterns are associated with poor eating habits. Intense exercising proximal to a meal might help youths to avoid overconsumption, offering a promising weight management approach. Importantly, children PA and SB tracks into adolescence and adulthood, and both childhood PA and SB have an impact on child health but also influences PA and SB later in life. Improving appetite control and eating habits through exercise in youths is highly likely to have beneficial effects life-long.

KEY MESSAGES

- Low physical activity and high sedentary behaviors patterns are associated with unfavorable eating habits.
- Intense exercising proximal to a meal would improve appetite control.
- Identification of movement patterns and behavioral interventions are required since the younger age.



Based on: Julian V, Haschke F, Fearnbach N, Gomahr J, Pixner T, Furthner D, Weghuber D, Thivel D.. Effects of movement behaviors on overall health and appetite control: current evidence and perspectives in children and adolescents. *Curr Obes Rep.* 2022 Jan 12.

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- Lowry R., et al *J Obes.* 2015;2015:876524
- Tambalis KD. Et al. *J Res Health Sci.* 2019;19:e00439
- Thivel D., et al. *Preventive Medicine.* 2019;118:159–65
- Thivel D. et al. *Obes Rev.* 2019;20:316–24

Higher intakes of fruits, vegetables, and multiple individual nutrients is associated with a lower risk of metabolic syndrome among adults with comorbidities



A Korean study (more than 67,000 adults followed for 10 years) analysed the role of some micronutrients and fruit and vegetables consumption on the metabolic syndrome. According to this work, a high consumption of vegetables (white and red) is associated with a lower risk of metabolic syndrome. For fruits, a lower risk is observed only in men. Finally, among adults with co-morbidities (type 2 diabetes, hypertension, cancers, cardiovascular diseases...), a lower risk of metabolic syndrome is observed with an increase of the daily intake of vitamin B2 and retinol, and with a high consumption of fruit and vegetables (white and red).

Nguyen HD, et al. *Nutr Res.* 2021;99:1-12.

Estimating impact of food choices on life expectancy: A modeling study



A team from the Bergen University (Norway) recently modelled the increase in life expectancy that could allow the improvement of our food consumption (Many data were used – meta-analyses, Global Burden Disease, mortality tables etc.). According to this work, the transition from a typical occidental diet to a nutritionally optimised diet, i.e. an increased consumption of legumes, whole grains, fruit and vegetables and nuts, and less red and processed meat, could increase life expectancy by more than 10 years among 20 year-olds. Benefits are more important in men (13 years) than women (10.7 years). For older people, benefits could be smaller but substantial. The calculator « Food4HealthyLife », the used tool, could be useful to clinicians, decision-makers and the general public to understand the impact of food choices on health.

Fadnes LT, et al. *PLoS Med.* 2022;19(2):e1003889.

Organic vs conventional plant-based foods: a review



A recent review of literature examined the available knowledge on the influence of organic agriculture on the environment, producers, consumers and society. Physico-chemical, nutritional and phytochemical qualities of conventional and organic plant foods were also compared. Authors of this work highlight that, despite the existence of debates on the subject, current scientific knowledge does not show a significant difference between conventional and organic food in terms of environmental impact, nutritional quality, safety and health effects. They identify 5 key findings: 1. organic farming uses natural pesticides and low-dose synthetic pesticides; 2. difficult control of aflatoxins and bacterial contamination is common in organic farming; 3. reduced plant yields are typical of the organic system; 4. The sensory and nutritional quality of organic food is not superior to conventional food. 5. The risk of food loss and price increase for organic products is higher than for conventional products.

Giampieri F, et al. *Food Chemistry*, 2022 FEB,132352,ISSN 0308-8146.

Culinary Nutrition Education Improves Home Food Availability and Psychosocial Factors Related to Healthy Meal Preparation Among Children



A Malaysian team evaluated the effectiveness of a school-based intervention with 10-11 year-olds (83 children) and their parents. Over a 12-week period, participants attended five practical modules including cooking workshops and a nutrition education module (every 2 weeks). The availability of healthy foods at home and psychosocial factors associated with healthy meal preparation (knowledge, attitude, practice and self-efficacy) were assessed in the participants and a control group. In the participant group, the mean score of the four factors assessed and the quality of the meals were higher. Similarly, an increased availability of fruit, vegetables and healthy foods was also noted in the intervention group.

Ng CM, et al. *J Nutr Educ Behav.* 2022;54(2):100-108.

Interaction Between Diet and Microbiota in the Pathophysiology of Alzheimer's Disease: Focus on Polyphenols and Dietary Fibers.



An increasing number of animal studies are looking at the gut-brain axis and showing a potential involvement of microbiota composition in the pathophysiology and progression of Alzheimer's disease. Few studies of this type have been carried out in humans and none have considered diet as a determinant of the composition of the gut microbiota. A recent review of the literature examined the available knowledge. This work highlights that epidemiological studies show that a high consumption of fruit and vegetables could slow down the progression of Alzheimer's disease. This effect would be linked to the presence of certain components such as fibres or polyphenols. The latter have antioxidant, anti-inflammatory and anti-apoptotic activities that could counterbalance the pathophysiological mechanisms of dementia. More broadly, the authors stress the need for further knowledge.

Ticinesi A, et al. *J Alzheimers Dis.* 2022 Feb 9.Education. *Nutrients.* 2021 Nov 21;13(11):4170.