

Med Diet 4.0: the **Mediterranean diet** with four sustainable benefits

Ornella I. Selmin, PhD

The University of Arizona, Tucson AZ



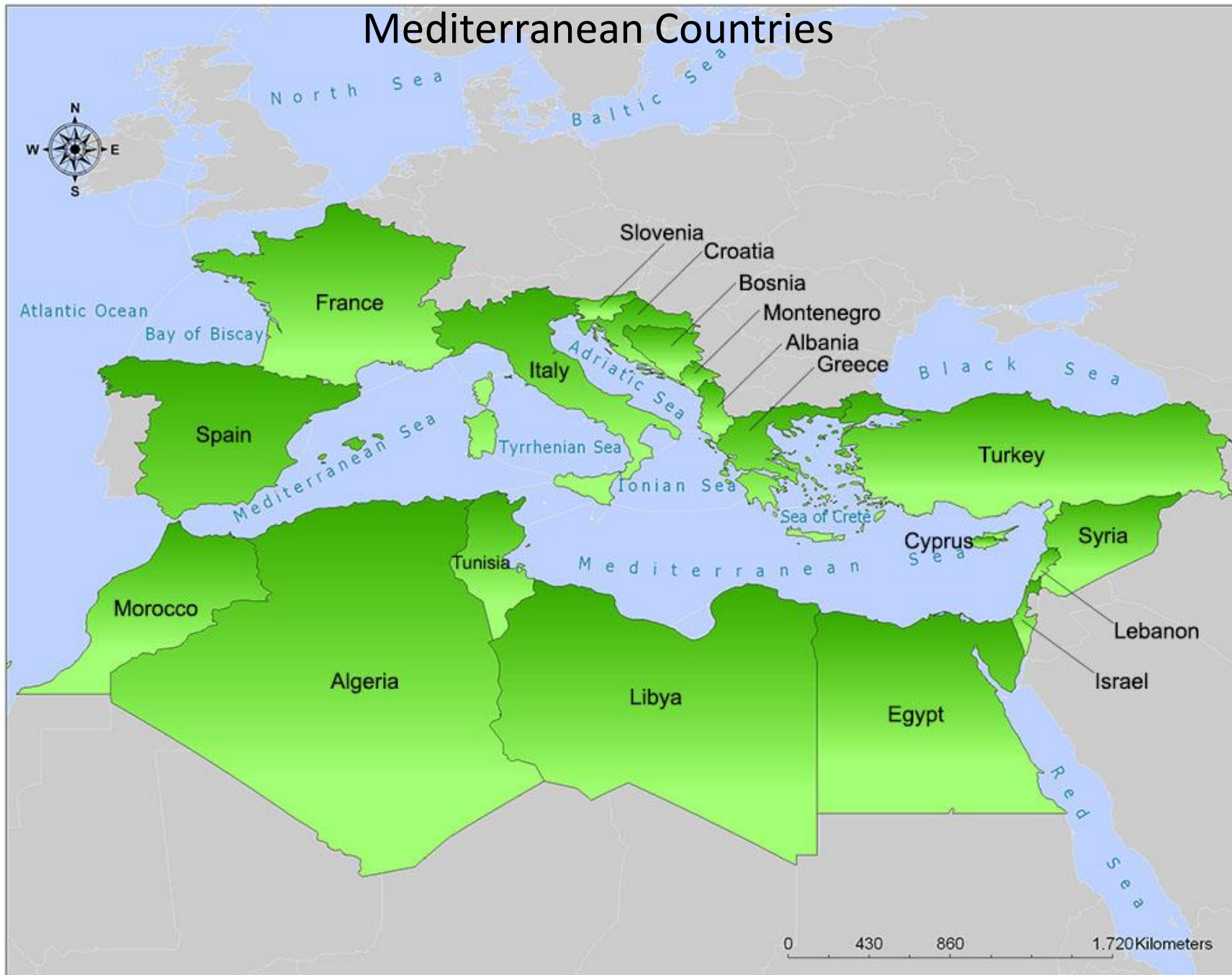
OBJECTIVES

1. Major health and nutrition benefits
2. Low environmental impacts and richness in biodiversity
3. High socio-cultural food values
4. Positive local economic returns

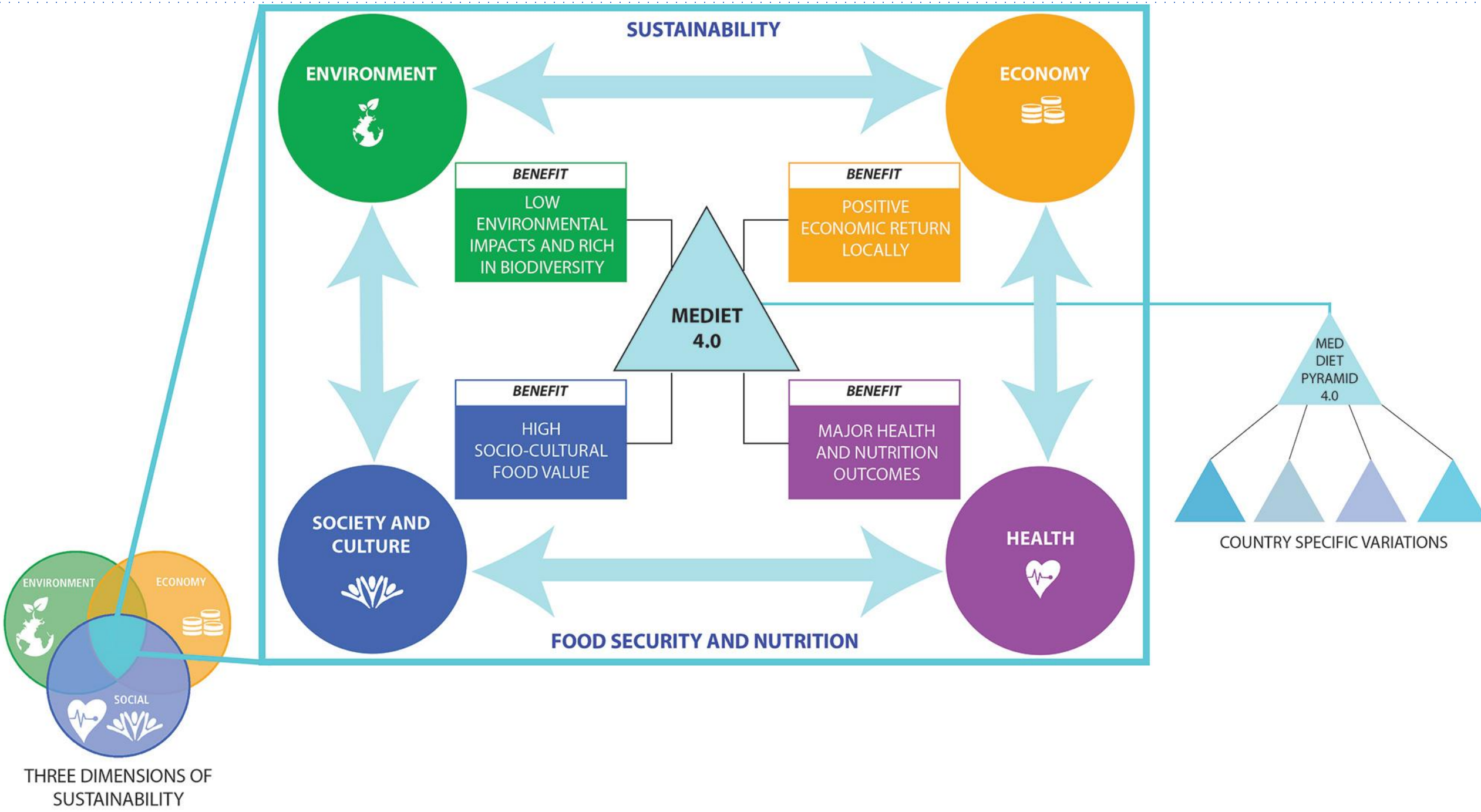
KEY POINTS RELATED TO DIETARY CHANGES

- The notion of the **Mediterranean diet** has undergone a progressive evolution over the past 50 years, from that of a **healthy dietary pattern for the heart** to the model of a **sustainable diet**.
- Despite the fact that the Mediterranean diet is well documented and acknowledged as a healthy diet, paradoxically, it is being abandoned, mainly by the **young generations** in most Mediterranean countries.
- Southern and Eastern Mediterranean countries are passing through a '**nutritional transition**' in which problems of **undernutrition** coexist with **overweight, obesity and diet-related chronic diseases**.

Mediterranean Countries



- ❖ In 2010, at an international scientific symposium on 'Biodiversity and Sustainable Diets: United against Hunger', held at the Food and Agriculture Organization in Rome, an agreement was reached on the following definition of 'sustainable diets':
- ❖ *Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations.*
- ❖ *Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources.'*



THREE DIMENSIONS OF SUSTAINABILITY

At the end of 2010, the MD was recognized as an Intangible Cultural Heritage of Humanity by the United Nations Educational, Scientific and Cultural Organization (UNESCO)



The proposed *new graphical representation* of the MDP responds to the need for a common framework among Mediterranean countries in the form of food-based dietary guidelines which are in line with the 2010 definition of sustainable diets elaborated by FAO (Food and Agriculture Organization).



p=portion Serving or portion size based on frugality and local habits

- Regular physical activity
- Adequate rest
- Conviviality
- Wine (and other alcoholic fermented beverages) in moderation and respecting social beliefs



Biodiversity and seasonality
 Traditional, local and eco-friendly products
 Culinary activities

Extra virgin olive oil

Olive production (for use as oil or as olives) represents a significant utilization of land in the southern regions of the EU:

Spain (2.4 million hectare),

Italy (1.4 million ha),

Greece (1 million ha)

Portugal (0.5 million ha).

According to the International Olive Council (IOC), the production of table olives in the EU during 2019–2020 was 808.4 (x1000) tons

500 were in Spain,

207 in Greece,

74.1 in Italy

22.5 in Portugal.

Among the other countries of the IOC, the tons of table olives produced were:

Egypt 690,

Turkey 414,

Algeria 300

Morocco 130 (x1000)

- ❖ *In the olive sector, the **negative environmental** effects of **intensification** could be reduced considerably by means of sustainable farming practices. Moreover, with appropriate support, **traditional low-input plantations** could continue to maintain important natural and social values in marginal areas.*
- ❖ *On the other hand, several studies have shown that olive oil production is associated with adverse effects on the environment during the **fruit growth** and olive oil **production** phases.*
- ❖ *For this reason, it is crucial to identify those phases with greater environmental impacts in order to minimize their effects.*

- On a positive note, olive trees are a **barrier to desertification** and **erosion** and olive orchards are a **CO₂ sink**, removing CO₂ from the atmosphere and fixing it in the soil.
- In the production of 1 L of olive oil, olive trees remove **10 kg of CO₂** from the atmosphere.



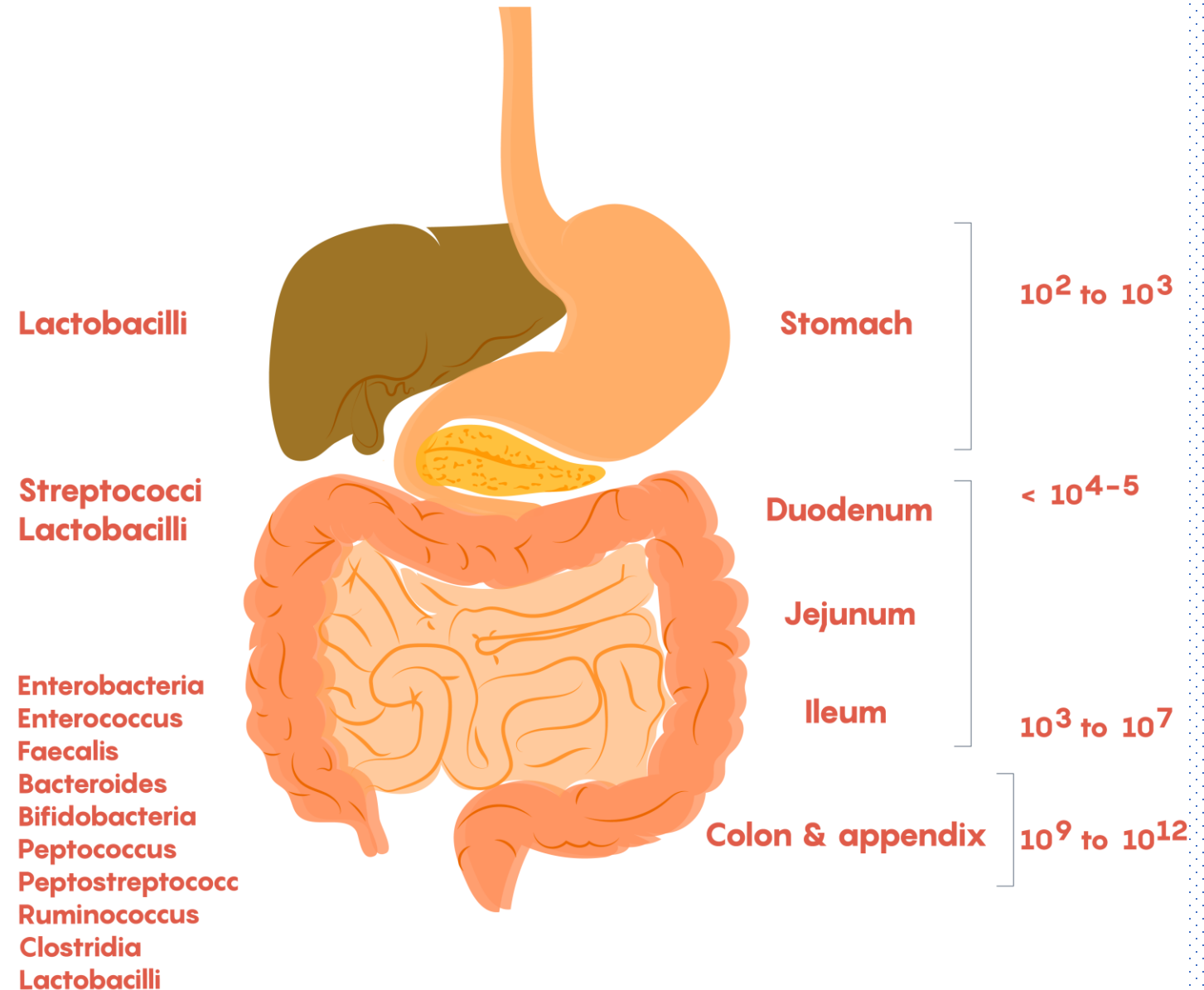
- ❖ *It is relevant here to discuss **palm oil**, an industrial alternative to olive oil in the Mediterranean countries. Due to its properties, it is used in many commercial products (e.g., processed foods, cosmetics, biofuels).*
- ❖ *Globally, palm oil cultivation has increased in the past years, resulting in **deforestation** (particularly in Indonesia and Malaysia), **biodiversity loss**, and **net GHG (Greenhouse gas) emission**.*
- ❖ *However, Europe remains the leading market for sustainably sourced palm oil, although progress on the number of voluntary initiatives and commitments by industry has been slow.*



- ❖ Milk and dairy products should be consumed on a **daily basis in a moderate amount** (maximum of two servings per day).
- ❖ Traditionally, in the Mediterranean region, the most consumed dairy products were in the form of **yogurt and cheese** (particularly from sheep's milk) and these should continue to be consumed in moderation.
- ❖ Dairy products like milk, cheese and yogurt have numerous benefits for **bone and muscle health**, as they are a source of proteins, calcium and micronutrients.
- ❖ Moreover, due to their probiotic content, they boost digestive tract health and positively affect the **microbiome**.

Intestinal Microflora

10^{14} microorganisms, >500 species



- *However, dairy products together with meat represent a major concern because of their **environmental impact**. Dairy farming in the EU is becoming more **intensive** and more **specialized**, with imported grains and soybeans used as feed.*
- *There is a move towards **fewer and larger farms**, except where national authorities actively intervene to help maintain small producers or promote organic production.*
- *These trends lead to problems regarding atmospheric, land and water **pollution** (e.g., from transportation and animal waste) and put pressure on marginal habitats and landscape features, biodiversity and soil integrity.*
- *Eating a variety of dairy products and, as much as possible, milk and dairy products from **small producers and local farmers** should be preferred, as well as consuming **organic products**.*
- *This will help to **reduce** the **environmental impact** of these products (i.e., harm to soil quality, or impacts from packaging and transport), **sustain the local economy**, and **yield better quality** products, as grazing leads to better lipid profiles in milk.*

Eco-Friendly Products

- *Consuming eco-friendly products will help the preservation of Mediterranean landscapes and sea.*
- *Eco-friendly production methods, such as agro-ecology or **organic agriculture**, result in biodiversity promotion and reduction or elimination of harmful chemical use.*
- *Health for consumers as well as nature (land, rivers, sea, etc.) will be promoted. Indeed, recent large epidemiological studies have shown that consumers whose diet comprises a high share of organic foods adopt a healthier plant-based dietary pattern with **lower pesticide exposure, lower body mass, lower impact on natural resources and lower GHG emissions.***

Combining the MD with regular organic food consumption appears to be the optimal option.

Affordability

Adherence to a MD does not necessarily increase the expense of one's diet significantly.

- Basing meals on legumes, cereals and local and seasonal vegetables, fruit and fish can help to offset the cost of other potentially more expensive foods such as meat or less healthy processed foods.*
- Following the guidance of the updated MDP can assist those who are financially insecure in consuming a healthier diet.*



Assessing the sustainability and especially the environmental impact of the MD has been perceived as a complex task, but one which is urgently required

With this objective, during 2012–2016 an informal international working group from different institutions collaborated to identify nutritional indicators for assessing the sustainability of a healthy diet.

The group identified thirteen indicators belonging to five areas:

- *biochemical characteristics,*
- *food quality,*
- *environmental,*
- *lifestyle*
- *clinical aspects.*

The *role of agriculture* has been crucial in historically shaping the biodiversity of EU countries, but over the last decades this synergistic relationship has been undermined

Intensification and specialization of agricultural production has been established increasing production potential, but also causing the *marginalization and abandonment* of many areas of land and consequently *losses of species and habitats associated with farmland*.

For these reasons, the sustainable management of natural resources is part of the objectives of the EU's Common Agricultural Policy agenda.

Moreover, *changes in food consumption and production* could have important implications for *land use and GHG emissions*

The nature of this *land-food relationship* depends on the *type of food* consumed and on other factors,

- *population growth,*
- *agricultural productivity,*
- *land ownership and investment patterns,*
- *land use efficiency.*

- With the identification of the **food production chain** as one of the main contributors towards a negative environmental impact in the last decades, the study of such effects has often involved using the **Life Cycle Assessment (LCA)** method.



- This method comprises a tool for appraising the
 - *environmental impacts and resources used throughout a product's life cycle.*
- For example, in the case of food production, the LCA investigates the *environmental impact of each phase*, from agricultural production to final consumption, examining
 - industrial processing,
 - packaging,
 - distribution and retail,
 - cooking
 - waste management .



Muñoz et al.'s 2010 study analyzed the average Spanish

diet consisting of :

- *water 75%,*
- *protein 3.6%,*
- *fat 5.8%,*
- *carbohydrate 13%*
- *fiber 0.78%*

of ingested food weight, using the LCA method.

Results showed that the net Global Warming Potential (GWP) related to feeding a Spanish citizen for one year amounted to 2.1 tons of CO2 equivalent.

Considering the whole food production chain from production to wastewater treatment, this figure was dominated by the production stage.

Moreover, the contribution of meat and dairy production represented around 54% of total GWP for food production.

Similarly, eutrophication potential and primary energy use were dominated by the food production stage.



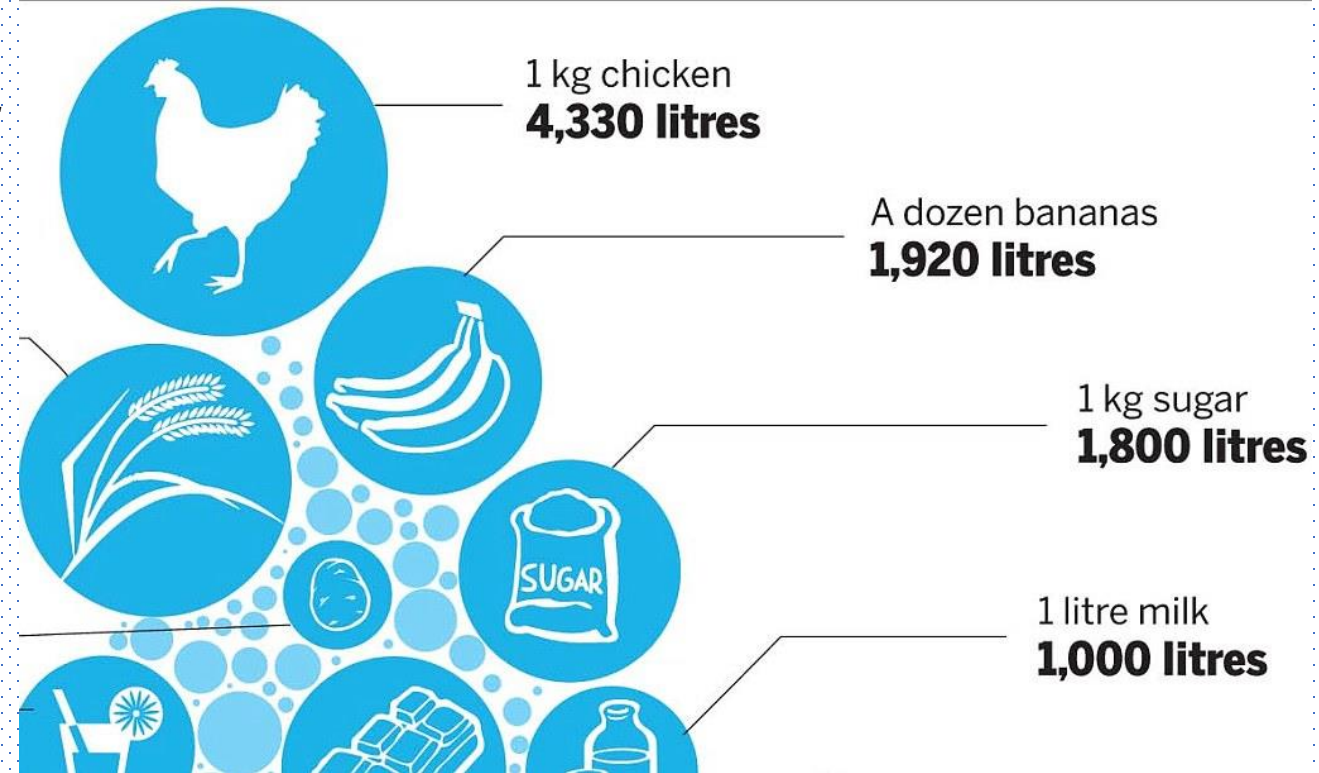
The *sustainability* of the updated *MD* versus present-day *Spanish* and *Western* dietary patterns in the context of the Spanish population was analyzed in 2012–2013 comparing the reference pattern of the MD pyramid with an estimation of the current Spanish and Western dietary patterns derived from FAO data.

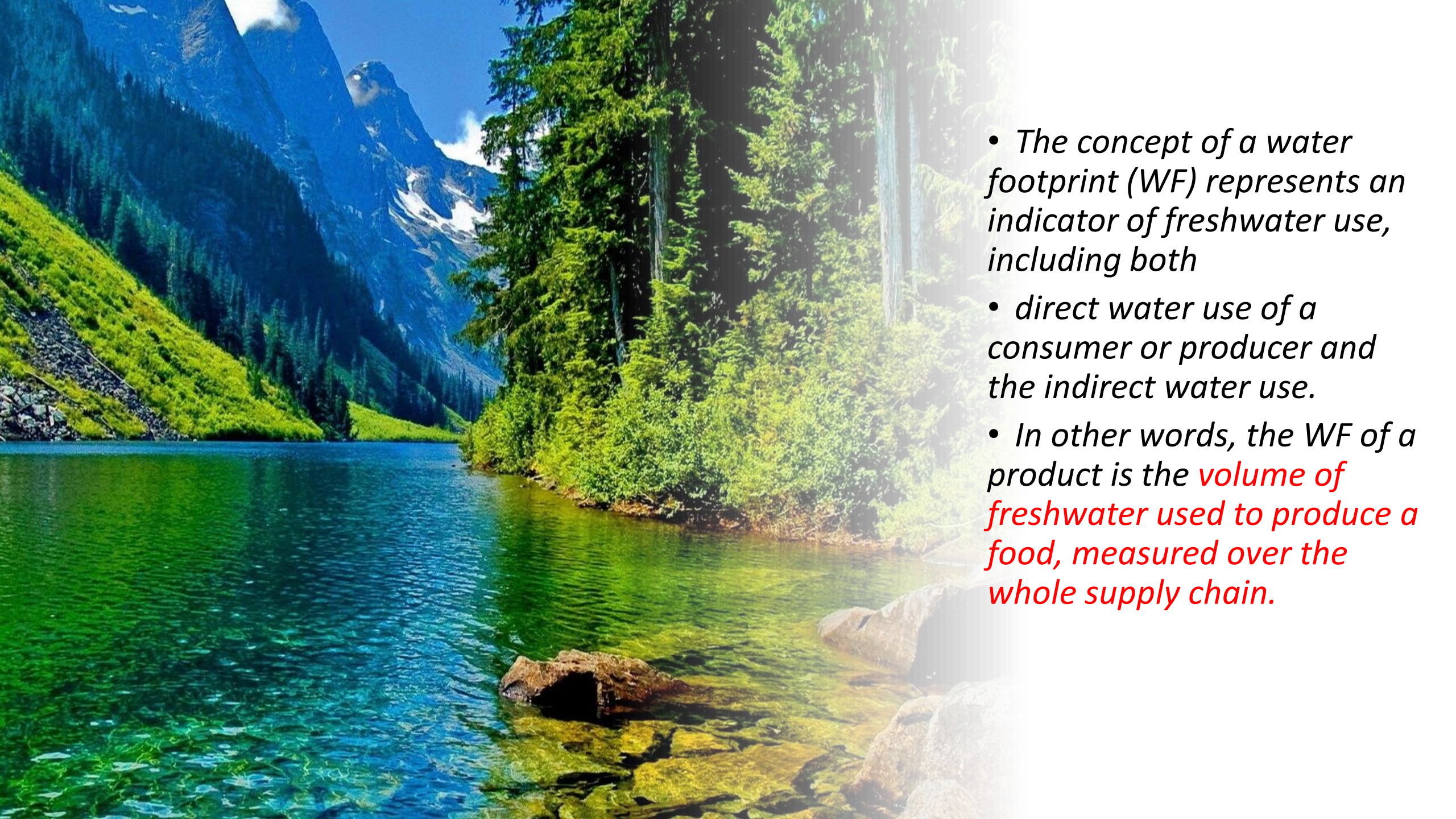
<u>Environmental impact.</u>	<u>Agricultural land use</u>	<u>Energy consumption</u>	<u>Water consumption</u>	<u>GHG emissions</u>
<i>MD</i>	.25	.39	.6	.16
<i>Spanish.</i>	.37	.46	.6	.33
<i>Western</i>	1 (ha/year)	1 (TJ/year)	1(Km3/year)	1 (Gg CO2eq/year)

The *MD* emerged as having the *lowest environmental impact* .

- *The environmental burden of the MD applied in the Italian context was also analyzed. The authors recognize that the LCA method inevitably suffers from omissions (which are required to make the method applicable) that could lead to underestimation of the total impact when applied to household consumption.*
- *For this reason, they chose to assess the environmental footprint of the MD using a hybrid method. This method addresses stages of food production and consumption through the LCA and other methodologies (in this case input-output analysis).*
- *The national average diet led to 402.91 kg CO₂ eq/month of GHG emissions, while the MD presented a 6.81% lower CO₂ eq/month*

- ❖ It is important to note (as briefly mentioned earlier) that the environmental impact of food production also involves water use. Water availability is an important issue in some countries of the Mediterranean basin (e.g., in Spain and Malta), linked to the increasing water demand for **agriculture** plus the **desertification** process.
- ❖ For these reasons, the concept of a **water footprint** is gaining importance when analyzing the link between water resources and the food production chain.
- ❖ In the last decades, methodologies such as the **Water Footprint Assessment (WFA)** and the LCA have been implemented to study such relationships.





- *The concept of a water footprint (WF) represents an indicator of freshwater use, including both*
- *direct water use of a consumer or producer and the indirect water use.*
- *In other words, the WF of a product is the **volume of freshwater used to produce a food, measured over the whole supply chain.***

A study conducted in 2019 investigated the nutritional and water usage implications of the current **Spanish diet (SD) compared with the **MD****

SD: 2554 L/capita per day

MD: 1835 L/capita per day.

This difference was mainly due to the higher consumption of red and processed meat, sugars, pastries, beverages and dairy products



Nevertheless, the evidence supporting the environmental sustainability of the MD has some limitations that should be considered

1. **Limited information** about each step of the food production chain, and assumptions are sometimes made in environmental impact analyses.
 2. **Complexity of the food production system**: **transport, distribution and retail** are extremely globalized and diverse. The evaluation of the sustainability of a certain dietary pattern should be **context-specific** and involve different professionals from the health, medical, sociological and educational fields, as well as from systems engineering, and from agronomic, veterinary and environmental sciences.
 3. Evidence shows that to stay within the guidelines that foster sustainable food systems, a **combination of dietary changes and production and management-related** measures are required.
- **Important aspect**: **reducing food waste and loss**

In summary, according to the United Nations Sustainable Development Goals (SDGs), the MD complies with at least 11 out of 17 goals:

SDG2 Zero Hunger: End hunger, achieve food security and improved nutrition and promote sustainable agriculture;

SDG3 Good Health and Well-Being: Ensure healthy lives and promote well-being for all at all ages;

SDG4 Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all;

SDG5 Gender Equality: Achieve gender equality and empower all women and girls;

SDG6 Clean Water and Sanitation: Ensure availability and sustainable management of water and sanitation for all;

SDG7 Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable and modern energy for all;

SDG8 Decent Work and Economic Growth: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;

SDG11 Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient and sustainable;

SDG12 Responsible Consumption and Production: Ensure sustainable consumption and production patterns;

SDG13 Climate Action: Take urgent action to combat climate change and its impacts;

SDG14 Life Below Water: Conserve and sustainably use the oceans, seas and marine resources for sustainable development;

SDG15 Life on Land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.



- **Transferability of the Mediterranean Diet to Non-Mediterranean Countries.**
- **What Is and What Is Not the Mediterranean Diet**

Limitations:

- Access to fresh vegetables and fruits (food desert)
- Cost of foods like fish and organic produce
- Cultural and social customs (eating to satisfy hunger, no conviviality, binge drinking...)

References:

- **Berry EM.** Sustainable Food Systems and the Mediterranean Diet. *Nutrients*. 2019 Sep 16;11(9):2229. doi: 10.3390/nu11092229. PMID: 31527411; PMCID: PMC6769950.
- **Dahl WJ,** Rivero Mendoza D, Lambert JM. Diet, nutrients and the microbiome. *Prog Mol Biol Transl Sci*. 2020;171:237-263. doi: 10.1016/bs.pmbts.2020.04.006. Epub 2020 Apr 25. PMID: 32475524.
- **Dernini S,** Berry EM, Serra-Majem L, La Vecchia C, Capone R, Medina FX, Aranceta-Bartrina J, Belahsen R, Burlingame B, Calabrese G, Corella D, Donini LM, Lairon D, Meybeck A, Pekcan AG, Piscopo S, Yngve A, Trichopoulou A. Med Diet 4.0: the Mediterranean diet with four sustainable benefits. *Public Health Nutr*. 2017 May;20(7):1322-1330. doi: 10.1017/S1368980016003177. Epub 2016 Dec 22. PMID: 28003037.
- **Martínez-González MÁ,** Hershey MS, Zazpe I, Trichopoulou A. Transferability of the Mediterranean Diet to Non-Mediterranean Countries. What Is and What Is Not the Mediterranean Diet. *Nutrients*. 2017 Nov 8;9(11):1226. doi: 10.3390/nu9111226. Erratum in: *Nutrients*. 2018 Jun 26;10(7): PMID: 29117146; PMCID: PMC5707698.
- **Serra-Majem L,** Tomaino L, Dernini S, Berry EM, Lairon D, Ngo de la Cruz J, Bach-Faig A, Donini LM, Medina FX, Belahsen R, Piscopo S, Capone R, Aranceta-Bartrina J, La Vecchia C, Trichopoulou A. Updating the Mediterranean Diet Pyramid towards Sustainability: Focus on Environmental Concerns. *Int J Environ Res Public Health*. 2020 Nov 25;17(23):8758. doi: 10.3390/ijerph17238758. PMID: 33255721; PMCID: PMC7728084.