

Eixo Temático: Inovação e Sustentabilidade

**MUDANÇAS CLIMÁTICAS: UMA REVISÃO INTERPRETATIVA DE SUA
RELAÇÃO COM A CONFIGURAÇÃO BASEADA EM ANIMAIS DO SISTEMA
ALIMENTAR**

**CLIMATE CHANGE: AN INTERPRETATIVE REVIEW OF ITS DIRECT
RELATION WITH THE CURRENT MEAT-CENTRIC CONFIGURATION OF THE
FOOD MARKET**

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RESUMO

Através de uma revisão da literatura de estudos recentes de diferentes áreas da ciência focados em mudanças climáticas, torna-se cada vez mais evidente que nosso sistema alimentar atual, em seus padrões baseados produtos de origem animal, é insustentável. O setor de alimentos é um dos principais impulsionadores das mudanças climáticas, considerando as emissões diretas de dióxido de carbono, metano e óxido nitroso, ineficiências inerentes à transformação de proteínas vegetais em proteínas de carne, uso do solo, pressão por desmatamento, pegada hídrica e assim por diante. As mudanças climáticas e suas transformações na atmosfera, nos oceanos e na superfície terrestre já estão afetando a vida de milhares de pessoas, especialmente as mais vulneráveis, como evidenciam estudos das ciências da meteorologia e das ciências ambientais. O sistema alimentar é um sistema socioeconômico humano, por isso é formado e transformado pela agência humana através de decisões econômicas, fluxos de capital, marketing, preferências culturais e regulação (inter)governamental. É essencial considerar este tema na pesquisa interdisciplinar de administração e marketing.

Palavras-chave: Mudança Climática, Consumo Sustentável, Sistema Alimentar, Gases de Efeito Estufa.

ABSTRACT

Through a literature review of recent studies focused in climate change from different areas of science, is getting more and more evident that our current food system, in its animal-based patterns, is unsustainable. The food sector is one of the main drivers of climate change, considering the direct emissions of carbon dioxide, methane and nitrous oxide, the inefficiencies inherent to transform vegetal protein into meat protein, land use, deforestation pressure, water footprint, and so on. Climate change and its transformations in atmosphere, ocean and surface is already affecting the lives of thousands of people, especially the most vulnerable, as studies from meteorology and climatology and environmental and ecology science are evidencing. Food system is a human socioeconomic system, so its formed and transformed by human agency through economics decisions, capital flows, marketing, cultural preferences and governmental and institutional regulation. It is essential to consider this theme in business and marketing interdisciplinary research.

Keywords: Climate Change, Sustainable Consumption, Food System, greenhouse gases emissions.

" Climate change is a global problem with grave implications: environmental, social, economic, political and for the distribution of goods. It represents one of the principal challenges facing humanity in our day. Its worst impact will probably be felt by developing countries in coming decades (...) our industrial system, at the end of its cycle of production and consumption, has not developed the capacity to absorb and reuse waste and by-products. We have not yet managed to adopt a circular model of production capable of preserving resources for present and future generations, while limiting as much as possible the use of non-renewable resources, moderating their consumption, maximizing their efficient use, reusing and recycling them. A serious consideration of this issue would be one way of counteracting the throwaway culture which affects the entire planet, but it must be said that only limited progress has been made in this regard."

(Laudato si': On Care For Our Common Home, an encyclical of Pope Francis, 2015)¹

Climate change² is a systematic change in the long-term state of the atmosphere, constituting an observed pattern (MARENGO, 2017). Today is been causing five critical global environmental changes: warming temperature of the earth's surface and the oceans; changes in the global water cycle (hidrocycle becomes faster, disasters as storms and floods become more intense and frequent); declining glaciers and snowpack; sea level rise; ocean acidification. (MARENGO, 2017) These changes have countless consequences, imposing new risks and affecting human life in various ways: food production, livelihoods, health and/or economics, wildfire, marine ecosystem, coastal erosion, extreme weather and climate events, etc., so its inferred that climate change poses risks to human and natural systems (IPCC, 2014)

Attribution of climate change are the increasing atmospheric concentrations of greenhouse gases; the global changes in land surface, such as deforestation — to timber exploration and to farm animals, or to produce grains in a monoculture system to feed animals —; and the increasing atmospheric concentration of aerosols. The first too attribution are strongly related to the economic sector, or market, focused on this study (MARENGO, 2017; IPCC, 2014).

As natural forces (such as solar and volcanic activity) alone cannot explain the global warming phenomenon, scientists know that recent climate change is caused by human activities by mesuaring fingerprints. With different methods of natural sciences, is possible to affirm that the current level of atmospheric CO₂ concentration is unprecedented (MARENGO, 2017), and that some climate changes in the global environment must be irreversible (CHIESSI, 2017).

These problems are caused for our socioeconomic systems, the forms as we are organized as society to employ capabilities and maximize the use of resources in order to supply our needs. These systems we used to named markets. Our consumptions habits are dependent on particular market configurations. And there are one sector in special that are inflicting climate change: the food sector.

The current configuration of food market has prominent negative consequences for sustainability in all dimensions: environmental, social, economic and ethical. The problems related to this meat-and-dairy-centric meals involves its leading role in greenhouse gases

¹ In this enciclical letter, the Pope Francis alerts and critiques inconsequent consumption levels and irresponsible development, regreting environmental destruction and ongoing climate change and invite christians of the world to take urgent global mitigation action: http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_eniclica-laudato-si.html

² Climate change is a change which is attributed directly or indirectly to human activity that alters the composition of global atmosphere and which is an addition to natural climate variability observed over comparable time periods (IPCC, 2014; MARENGO, 2017)

(GHG) emissions, not just carbon dioxide (CO₂), but methane (CH₄) and nitrous oxide too (N₂O) — the latter two being more aggressive, causing greater damage to the ozone layer and intensification of the greenhouse effect than carbon dioxide itself.

Moreover, there are significant impacts on land use and loss of soil, deforestation pressure — there are indications that around 90% of deforestation in the Amazon, beyond the exploitation of wood, was promoted for animal production, between pasture areas and intensive monoculture of grains for animal feed. Our animal-based food market both impact significantly the use and pollution of water and the loss of biodiversity —, including recent mass extinctions in oceans. In addition, livestock production, in its current configuration to meet global market demand, causes threat to global food security, propitiates the emergence and proliferation of new communicable diseases, impacts consumer health, inflicts on high levels of human mortality and causes infringements upon animal rights and human ethics.

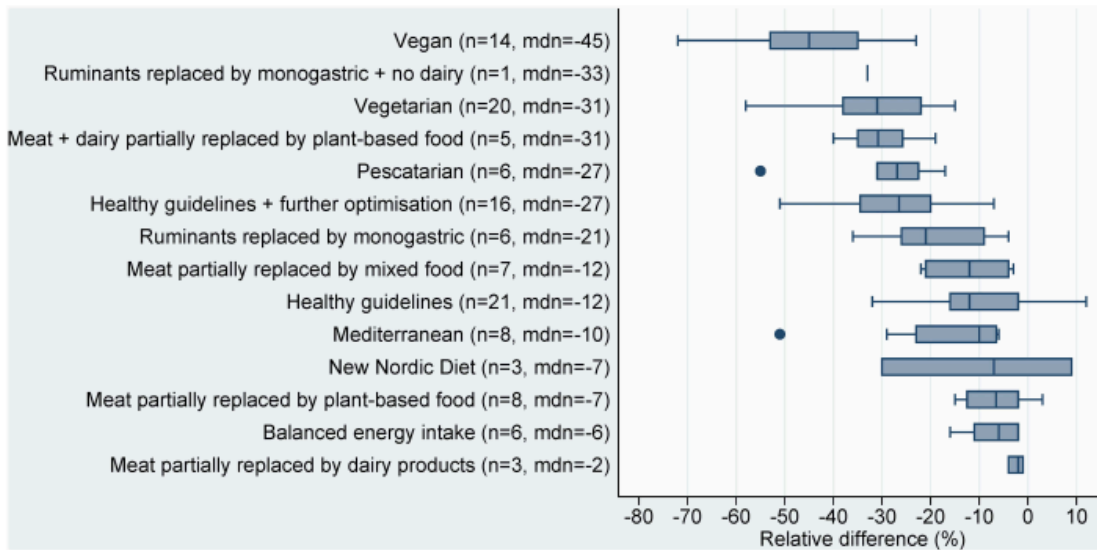
"The food system is responsible for more than a quarter of all GHG emissions, of which up to 80% are associated with livestock production. The aggregate dietary decisions we make thus have a large influence on climate change." (SPRINGMANN, et al. 2016) Because, animals, in food production system, implies in an additional trophic level that emits GHG and intensify land use.

Scarborough et al. (2014) estimates that GHG emissions in kilograms of carbon dioxide equivalent per day are around 7kg for consumers of diets with more than 100 grams of meat per day, 6kg per day for consumers of diets between 50-99 grams of meat, 5kg for consumers of diets with less than 50 grams per day of meat, 3.9kg for consumers of fish diets, 3.8kg for vegetarians (containing milk and egg derivatives in diets) and 2.9 kg for vegans (strictly vegetable diets). By changing diets patterns from meat-centric to vegan, besides healthy benefits and other benefits, a consumer stop emitting more than 1,5 ton of carbon per year.

ONU has warned about the unsustainability of global food production in light of demand forecasts for 2050, a year in which the food sector could become the main polluter, surpassing of the energy sector. For these compelling reasons, some researchers indicate that it is more effective, to stop climate change and to preserve our environment, changing human behaviors that to put faith in some disruptive technological innovation.

Climate change are been driven by 3 main antropogenic reasons (MARENCO, 2017; IPCC, 2014): GHG emissions, changes in land use and aerosols emissions. Two of this reasons are impacted by animal-based food production in significant amounts, like can be observed in the following figures resulted from a systematic review of 63 studies about GHG e land use of dietary patterns.

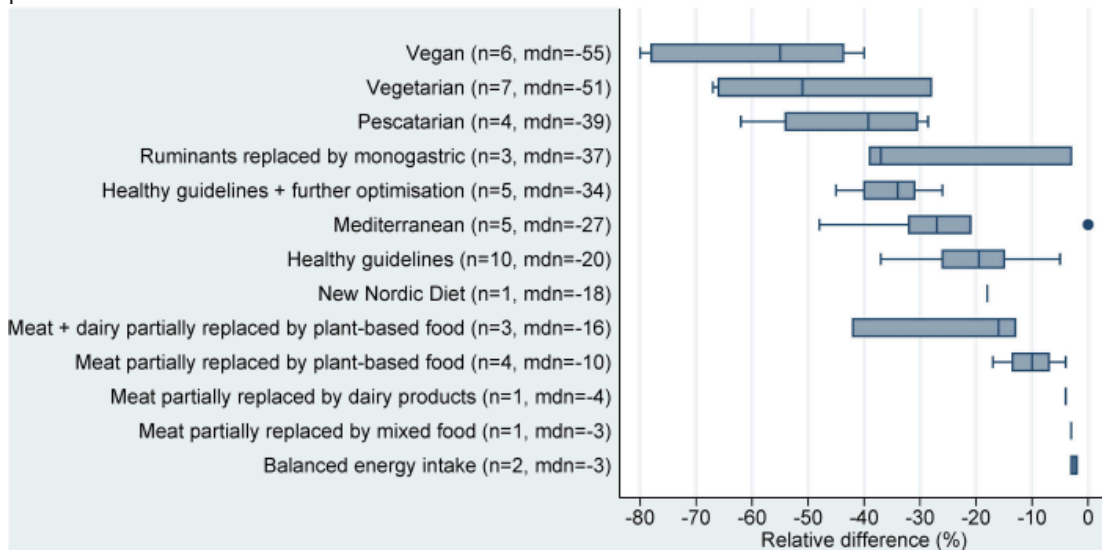
Figure 1: Relative differences in GHG emissions (kg CO₂eq/capita/year) between current average diets and sustainable dietary patterns.



Note: n = number of studies considered in the analysis, mdn = median.
Font: Aleksandrowicz et al., 2016.

The land use implies, among other problems, in deforestation pressure. In Brazil, deforestation is a major factor of CO₂ emissions, and when added to direct emissions from livestock animals, it is the main factor of brazilian CO₂ emissions, responding for 66%.³

Figure 2: Relative differences in land use (m²/capita/year) between current average diets and sustainable dietary patterns.



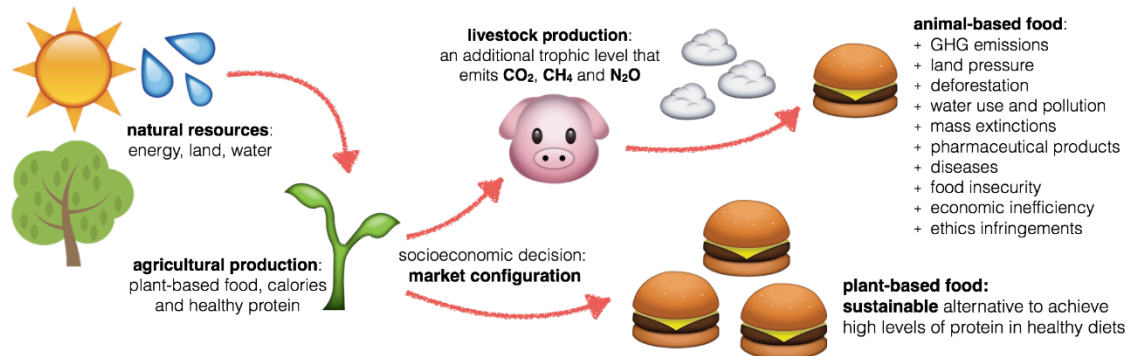
Note: n = number of studies considered in the analysis, mdn = median.
Font: Aleksandrowicz et al., 2016.

Based on a large amount of scientific studies, after a integrated analysis implemented by Aleksandrowicz et al. (2016), considering kg CO₂ eq/capita/year is an adjusted indicator including CO₂, N₂O, and CH₄ to greenhouse gases emissions and land use (m²/capita/year), as can be viewed in previous figures. This review indicates that environmental benefits could be achieve in those diets which most reduced the amount of animal-based foods, highlighted as vegan (total plant-based diet), which is the better diet pattern in terms of benefits for both GHG emissions and land use, followed by the vegetarian pattern (a diet pattern that excludes all types of meat but includes dairy and eggs).

³ Read more in: <http://www1.folha.uol.com.br/ambiente/2016/09/1810765-66-das-emissoes-brasileiras-de-co2-vem-de-atividade-agropecuaria.shtml>

These problems can be visualized in a simple figure that illustrates the inefficiencies and environmental pressures and threats imposed by animal-based food production.

Figure 3: A simplified schemata of trophic levels of food production.



Font: The author, 2017.

Several recent studies states these advantages of plant-based diets, suggesting that: "influencing consumer behaviour, e.g. to eat less animal products (...), offer substantial potential to improve food security for the rising global population in a sustainable manner" (ALEXANDER et al., 2017)

So, although do not the central topic of this paper, it must necessary to indicate that, beyond mitigating food-related greenhouse gas emissions by 29–70% compared with a reference scenario in 2050, a global dietary changes in favor of a hypothetical vegan pattern include advantages in healthy, life expectancy and economics, in a way that macroeconomics as marketing emerge as research areas to explore this topic:

"transitioning toward more plant-based diets that are in line with standard dietary guidelines could reduce global mortality by 6–10% (...) the economic benefits of improving diets is estimated to be 31 trillion US dollars, which is equivalent to 0.4–13% of global gross domestic product (GDP) in 2050. However, significant changes in the global food system would be necessary for regional diets to match the dietary patterns studied" (SPRINGMANN, et al. 2016)

There is a need to studies in social sciences to understand the food market current configuration and to promote its transformation to a more sustainable format. This studies must include consumer behavior and marketing areas (FUENTES, 2017) Experimental studies and investigations should focus on strategies that in fact change consumption practices, not just attitudes, related to reduce meat consumption (HARTMANN, SIEGRIST, 2017). But research must go beyond and involves other disciplines from business, economics and sociology — an interdisciplinary approach must be ideal — in a way to provide understandings and to act together with public policy and society in urgent mitigation of aggravation of climate change (HADDAD, et. al., 2016).

So, the general conclusion of this paper states the significance to understand and act through science in the market and in the supply chain of food sector, analyze governamental business incentives, accessing the distinct players that make it works in its current way, through multimethods approaches and mobilizing diverse sciences, in favor of a sustainable — vegan — reconfiguration to stop climate change, achieve global sustainability and improve human well-being, in consonance with the proposed "global research agenda for food" by Nature (HADDAD, et. al., 2016).

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