A critical review on the impact of slaughterhouses and meat production industries on global warming

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Abstract: The global demand for meat has risen significantly over the past decades, leading to an expansion of these industries. In the same trend, its impact has also become significant. This critical review has been written to examine the substantial and multifaceted impacts of slaughterhouses and meat production industries on climate change and global warming. Due to the increasing demand for beef, forests of up to 11000 square kilometers are being lost every year in Brazil alone. Other than deforestation, it includes huge water usage, air and water pollution, and greenhouse gas emissions. The paper also discusses potential solutions and policy recommendations aimed at mitigating the adverse impacts of slaughterhouse operations on the environment.

Keywords: Global Warming; Climate Change; Slaughterhouse; Meat Production

1. Introduction

Slaughterhouses are integral components of the global meat production industry, providing animal-derived products for human consumption. Slaughterhouses and meat production industries have played a significant role in shaping the contemporary discourse on climate change and global warming [1]. This relationship between slaughterhouses and meat production industries and their impact on climate change and global warming has been a subject of intense debate and research. Hence, the environmental consequences of these facilities have garnered increased attention in the recent years. The processes involved in meat production, from livestock rearing to processing and transportation, contribute significantly to greenhouse gas emissions, deforestation, water usage, and various environmental challenges [2].

If we look at the animal husbandry sector, we will find that a large number of animals are artificially bred for the supply of meat. To produce one kilogram of meat from an animal, it has to feed on an average 10 kilograms of grain. Similarly, 20940 liters of water is used per kg of meat production, whereas only 503 liters of water per kg of wheat production is required [3]. Along with the grains and water, a large space of land is also required for this sector. Consequently, forests are being destroyed, due to which the entire ecosystem is being affected badly. Due to the increasing demand for beef, forests of up to 11000 square kilometers are being lost every year in Brazil alone [4].

The problem of the environmental degradation is not limited to a country alone but the whole world is going through a dreadful situation. Tragic conditions of the current times are out of the 7.8bn population. The United Nations estimates that by the year 2050, the world population can cross 9.8bn, which would emerge out as a serious concern for the future generations. The studies show that in the year 2050, the food demands of world population of 9.8bn men would need to increase gross food production by nearby 70% between 2005 and 2050 [5]. Production in the developing countries would need to be two times of the present needs. Looking at the current trends, the global animal husbandry sector will face the challenges to produce an adequate amount of food supply from animal sources to meet then consumer demands because of the growing competition for energy, land, and water in different communities. The average global earth temperature has been increased by 1.1oC in the last century and is expected to reach the mark of 1.5oC increase by the year 2030, which could be very disastrous [6]. This review critically evaluates these impacts and their potential implications on the broader context of global warming. It is essential to understand these consequences in order to make informed decisions regarding the future of our food systems and environmental sustainability. It has also been

tried to delve into potential mitigation strategies and alternative solutions for a more sustainable food system.

2. Global Production and Consumption

Meat production on a global scale has experienced a substantial growth in the last five decades. As evident from the chart, the total production has multiplied by over fourfold since 1961. The chart illustrates the regional breakdown of worldwide meat production, measured in tons [7].

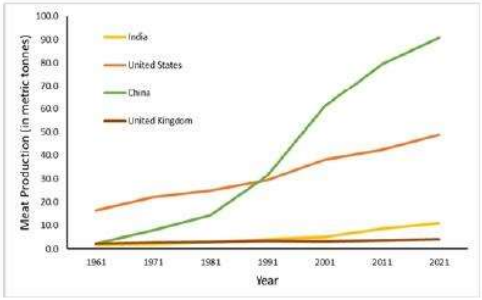

Fig. 1: Increase in the meat production in last 60 years

In terms of regional meat production, Asia stands out as the largest contributor, representing approximately 40-45 percent of the total meat production.

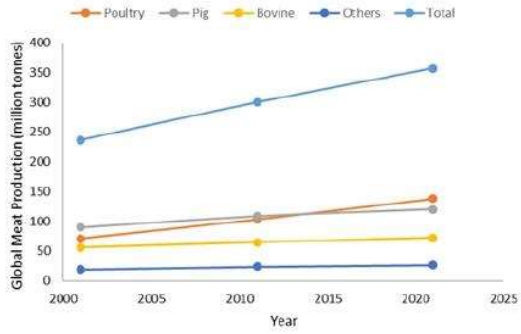

Fig. 2: Global meat production by livestock

This distribution across regions has undergone substantial transformations in recent years. Back in 1961, Europe and North America held the reins as the primary meat producers, with shares of 42 and 25 percent, respectively. Meanwhile, Asia's contribution was a modest 12 percent. However, by 2013, the landscape had shifted, with Europe and North America's shares declining to 19 and 15 percent, respectively. The production of various meat categories has shown absolute growth over the past five decades. The data of last 20 years has been depicted in Figure 2 [5]. However, when examining the relative distribution of global meat types, there have been significant changes. In 1961, poultry meat represented just 12 percent of the total global meat production. By 2013, its share had expanded nearly threefold to approximately 35% [8]. In contrast, the proportion of beef and buffalo meat in the overall meat production has almost halved, now making up around 22 percent. The share of pork has remained relatively stable, hovering at approximately 35-40%. The anticipated growth in worldwide meat protein consumption for the upcoming decade is expected to rise by 14% by the year 2030 when compared to the average from the base period of 2018-2020. This increase is primarily attributed to the combined factors of income and population expansion. [9].

3. Greenhouse Gas Emissions

One of the most significant environmental concerns associated with slaughterhouses and meat production is their substantial contribution to greenhouse gas emissions, particularly methane and carbon dioxide. Livestock farming, including beef, pork, and poultry production, is a major source of these emissions. The methane produced by ruminant animals during digestion and the carbon dioxide released during feed production and transportation have a substantial impact on global warming. Additionally, the energy-intensive processes in the meat industry, such as refrigeration and transportation, contribute to carbon dioxide emissions. The carbon footprint of meat production is substantial, making it a key driver of global warming [10].

In the 2018-2020 base period, greenhouse gas emissions (GHG) originating from meat production accounted for approximately 54% of the total emissions stemming from agriculture, measured in terms of CO2 equivalent. By 2030, it is anticipated that emissions from the meat sector will increase by 5%. Interestingly, this increase is notably less than the overall rise in meat production [11]. This disparity is primarily attributed to the increased significance of poultry production and the expectation of higher meat yields from the existing livestock population. Furthermore, the implementation of innovative technologies, such as methane-reduction feed supplements not widely available at present, has the potential to further decrease emissions per unit of meat produced in the future.

4. Deforestation

To accommodate the growing demand for meat, large areas of forests have been cleared to create space for livestock farming, especially in regions like the Amazon rainforest [12]. Deforestation leads to the release of stored carbon, reduces the planet's capacity to absorb carbon dioxide, and disrupts local ecosystems and affecting the global

ecosystem in large spectrum. The scale of deforestation due to meat production has made it a key driver of habitat loss and biodiversity decline, further exacerbating the environmental consequences [13].

5. Mitigation Strategies

To address the environmental impact of slaughterhouses and meat production, several mitigation strategies have been proposed:

a. Sustainable Livestock Farming: Implementing more sustainable livestock farming practices, such as rotational grazing, can reduce emissions and improve land management [14].

b. Alternative Protein Sources: Encouraging the consumption of alternative protein sources, like plant-based vegetarian and vegan diets. Lab-grown cultured meats are also getting attention in this scenario, where it does not require animal slaughter yet it also utilizes animal tissues. It may help to reduce the environmental footprint of meat production [15].

c. Other uses of the animal wastes should be promoted whether it is in the form of manure or for the development of solid and liquid fuels [16], [17].

d. Regulation and Policy: Government policies that incentivize sustainable practices and penalize excessive emissions can help curb the environmental impact of the meat industry. Implementing and enforcing stronger land-use policies, zoning regulations, and sustainable farming incentives can discourage deforestation. International efforts and trade agreements can also play a vital role in addressing this issue [18].

While some mitigation efforts, such as improved animal diets and waste management are minimizing the greenhouse gases but that effects seems to be insignificant in the view of intensity of problem.

6. Conclusion and Future Directions

The critical review of the impact of slaughterhouses and meat production industries on climate change and global warming highlights their significant contribution to greenhouse gas emissions, deforestation, water usage, and energy consumption. These factors underscore the need for immediate and sustainable changes within the industry to reduce its environmental footprint. Strategies such as adopting more-efficient farming methods, promoting plant-based alternatives, and raising awareness among consumers are all vital steps toward mitigating the adverse effects on the environment. Ultimately, addressing the environmental challenges posed by meat production is not only an ethical imperative but also a critical aspect of global efforts to combat climate change and ensure a sustainable future. The root cause of all the environmental problems lies in the philosophy which considers nature as a commodity. The developed world has exploited the planet earth excessively. We need a complete paradigm shift for the development models. It should be earth-centric rather than consumer-centric. Then only, development could be made sustainable otherwise without sustainable consumption, sustainable development is only daydream.

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