American University in Cairo
AUC Knowledge Fountain

Papers, Posters, and Presentations

2023

The most environmentally sustainable diet for adolescents in terms of land use, food waste, and greenhouse gas emissions.

lina tarek linatarek25@aucegypt.edu

Follow this and additional works at: https://fount.aucegypt.edu/studenttxt

 Part of the Agricultural Economics Commons, Environmental Studies Commons, Food Studies Commons, Other Food Science Commons, and the Other Nutrition Commons

Recommended Citation

tarek, lina, "The most environmentally sustainable diet for adolescents in terms of land use, food waste, and greenhouse gas emissions." (2023). *Papers, Posters, and Presentations*. 110.
https://fount.aucegypt.edu/studenttxt/110

This Article is brought to you for free and open access by AUC Knowledge Fountain. It has been accepted for inclusion in Papers, Posters, and Presentations by an authorized administrator of AUC Knowledge Fountain. For more information, please contact fountadmin@aucegypt.edu.

The most environmentally sustainable diet for adolescents in terms of land use, food waste, and greenhouse gas emissions.

Lina Tarek Elsehelly

The American University in Cairo

RHET-1020-49

Professor Young

14 May, 2022

Introduction

In the last few decades, there have been growing concerns about the environment and how to preserve it. This is due to the alarming signs that nature sent to humans. After looking more closely at the reasons behind the environmental deterioration of planet earth, scientists realized that human activities are a major cause of this damage, of which food production and consumption are significant contributing factors. The most prominent examples of this deterioration are the severe climatic change caused by greenhouse gas emissions (GHGE) and land scarcity due to land loss. The dietary patterns of humans have a direct impact on the supply of food products, and the dietary pattern of adolescents is considered a significant segment of the demand for food. During adolescence, eating habits change because the food options available for adolescents are not limited to what the parents or the school offer; the young adults gain more freedom to either eat at home, cook for themselves, or eat in a restaurant. Globally, the current diet of adolescents is close to the Western diet (Naja et al., 2020). This diet is not only known to be disadvantageous for human health but also contributes to negative environmental impacts like high levels of GHGE and extensive land usage. Besides, the problem of food waste at the consumer level dominates the whole globe, requiring an expeditious solution. It is the current generation’s responsibility to save the planet for future generations' growing population. That is why propelling a change in the current behaviors of future adults is crucial because substantial changes happen to their personality, attitudes, and beliefs during the adolescence phase, (Jarrett, 2018), so it should be oriented in a planet-healthy manner. In this paper, I will investigate the dietary patterns that adolescents can follow in order to minimize the extensive land use, food waste, and GHGE to attain environmental sustainability with consideration of other economical, social, and health factors.

Background

Like the ice age, climatic changes have been detected over geological time with considerable fluctuations in temperature, but the rate of temperature change has never been faster than the current one ("Climate Change," 2021). This step alteration in climate is due to modern human activities that produce GHGE such as fossil fuel burning as well as food production and consumption, a reason that is more subtle yet significantly powerful. According to some statistical measurements conducted in 2018, more than a quarter of GHGE comes from food production (Poore & Nemecek, 2018, p.1), contributing to the increase in total GHGE which is 800000 times more than ever before ("Climate Change," 2021). These gasses cause climate change by trapping the heat that comes from sun rays, causing an increase in the temperature of the earth's surface (Jain, 1993, p.6). The changes are alarming because the rate of increase is faster than the rate that living organisms can adapt to ("Climate Change," 2021). What specifically intensifies the problem of food production on the environment is the bidirectional relationship between food and climate change. On one hand, this temperature change causes some species, both animals and plants, to die due to the unsuitable climate limiting available food choices, and disrupting the ecosystem's food web, leading to either the potential death or the exponential and uncontrolled growth of other species. Consequently, this loss in biodiversity, which is the variability between plants, animals, and microorganisms in a certain habitat, limits not only the food options, but also the number of nutrients that are available for human consumption. As mentioned on the World Health Organization website, the micronutrient profile of different food varieties and breeds varies considerably (World Health Organization, n.d.); hence, it is crucial to maintain a high level of biodiversity. In addition to that, the food supply system becomes affected as the productivity of the livestock decreases and the crop yield

deteriorates as a result of higher temperatures (Fanzo, 2018, p.1). This can cause limitations in ensuring food and nutrient security (Tuomisto, 2018), especially in countries where there is limited use of advanced technologies and resources in agriculture and animal husbandry to withstand these changes. On the other hand, the food production system can influence climate change. Livestock, for instance, produce GHGE from feed fermentation in its gut, in addition to the GHGE from intensive energy use and transportation in the processing phase in factories (Fanzo, 2018, p.3). Similarly, agriculture of crops produces GHGE through fossil fuel burning for energy use in industrial farming (Schnieder, 2000, p.8). Agriculture also produces these emissions in other ways such as deforestation–which releases carbon dioxide that the plants had absorbed from the air; in addition, paddy fields like the ones used in rice production produce methane gas (p.8), a greenhouse gas. By this, it can be concluded that humans not only create environmental changes, but are also directly negatively affected by them.

To address the problem of land use and the current diet, the reason behind the land shortage should be understood. The land shortage is due to the population growth, which might reach almost ten billion by 2050 (Lonnie & Johnstone, 2020, p.281), and the increased demand for food and animal products as more people come out of poverty, which results in an increased demand for more expensive food categories (Lambin & Meyfroidt, 2011, p.3466). These shifts in demand need larger land areas to produce as luxurious food items tend to be animal products, which consume larger spaces of land. Furthermore, food production leads to the amplification of the land shortage that faces humans as about half of the habitable land is used in agriculture, of which eighty-seven percent is used for food cultivation (Poore & Nemecek, 2018, p.1). The most dominant diet nowadays is the Western diet, which is high in sugar, fat, salt, and overall calories and contains low amounts of fruits and vegetables (Rakhra, 2020). It is not only linked with an

increased risk of diet-related diseases like diabetes but also with excessive land use (Rizvi et. al, 2018) as this diet contains a large proportion of animal products and sugar that use and cause damage to large areas of land. Additionally, although modern agricultural practices alleviated potential global famines, they resulted in the loss of soil fertility, soil erosion, and land abandonment contributing to lower crop yield (Sarkar, 2010), which adversely affects food availability. After analyzing two research papers, Zabel et al. (2014) calculated that 19-23 hectares of suitable land are lost per minute because of land desertification and soil erosion, which makes agriculture increasingly challenging. The scarcity of land amplifies the significant load of global food production on the environment, which in turn further depletes the present land.

The current diet of adolescents must be subjected to serious investigations because of health and environmental concerns. The current dietary patterns of adolescents and adults are similar; thus, studies on the effect of the current dominant diet, which is done on populations of all ages, can be applied. It needs to be said that teenagers need higher amounts of calories and certain nutrients, specifically protein, than other age groups (Das et al., 2017) because they are in a phase of physical growth and biological maturation. As a result, approaches to minimize the environmental impact of the diet through reducing the food or caloric intake generally as suggested by some research (Wood et al., 2019) are not ideal, so other ways like food choice and quantities of specific food and how to shop for sustainably produced products have to be considered. Despite the significance of having a balanced diet during this critical phase, some studies have shown that teenagers purchase more meat and sugar than adults (Attwood et al., 2021). On average, teenagers consume sugar-sweetened beverages that exceed the daily intake of free sugar recommended by the World Health Organization by 62% to 124% (Ooi et al., 2022),

and this high consumption level correlates to multiple non-communicable diseases (Lundeen,2018). Sugar can not be ignored as being a significant contributor to land loss because the removal of soil at the harvest of sugarcane and beetroot leads to soil erosion (Chessman et al., 2004). Additionally, meat's environmental degradation impact has been investigated in literature from various perspectives and it was concluded that it causes high levels of GHGE and land degradation (Pais, 2020). In conclusion, the contemporary diet for adolescents is environmentally unsustainable and directly associated with health risks.

Also, food waste is a prominent aspect of the food and environment dilemma that is worth addressing. Food waste is the disposal of food that was intended to be for human consumption but was discarded because of spoilage or for aesthetic purposes (Thyberg, 2015). By solving this problem, there will be no need for extra expansion of the food production system as what is already produced is enough to eradicate global hunger and undernourishment (Lindgren et al., 2018). This problem is especially conspicuous in Third World countries where it negatively impacts young adults' health due to undernourishment (Lassi et al., 2017). By systematically reviewing multiple research papers on food waste, Karin Schanes (2018) and her colleagues concluded that the key factor that contributes to food waste is the final household consumer. This is due to overbuying at the supermarket ("The problem of food waste", 2022, para. 1) perhaps because food looked appealing by fancy packaging. In a survey, 46% of questioned teenagers reported that they bought food for their families (Bissonnette & Contento, 2001), which means that they are a fundamental part of the households' food purchases. Besides, inefficient meal planning and fear that food is spoiled because of early expiration dates on the labels are also contributing to domestic food waste ("The problem of food waste", 2022, para. 1). Food waste is contributing to the GHGE as it produces methane gas–which has a twenty-five

times higher global warming potential than carbon dioxide–when it decomposes in landfills, further worsening the global climatic change status (Thyberg, 2015). According to some measures, the average North American consumer wastes one pound of food per day, which equates to 7.7% of all harvested cropland in the United States (Conorad, 2018). Equally shocking statistics were calculated for fertilizers and water losses. That is why teenagers must be more concerned with food waste.

Raising awareness in adolescents

It is increasingly important that teenagers are getting more aware of the current problem of food production systems' effects on the environment. This is because, first, their habits and beliefs were constructed in a negative way concerning the environment (Kildal & Syse, 2017), and these habits continue into adulthood (Wrobleski, 2010). Second, according to a conducted survey in the USA, young adults have a significant consumer power that can shift the supply system because the majority of them shop for themselves and participate in family food shopping (Bissonnette & Contento, 2001). This makes them a significant contributor to the food intake on the individual and family level. In addition, young adults might ignore environmentally sustainable food shopping because of the high prices of sustainable food. However, in a recent study in Finland, although high prices were the most relevant hindrance to climate-friendly diets for a sample of surveyed young adults, price was not the main driver for their food choices (Mäkiniemi & Vainio, 2014). As a result, it can be inferred that other factors like habits and beliefs have greater effects on food choices (Mäkiniemi & Vainio, 2014), which means some actions can be done to affect their food choices. For example, after surveying a sample of high school seniors, Bissonnette and Contento (2001) found that the teenagers did not have strong beliefs or attitudes about the influence of their food choices on the bigger picture, the

environment. So, sustainable eating and shopping are not part of most teenagers' habits. Third, targeting adolescents as a means to drive a significant alteration in dietary practices is advantageous for multiple reasons. This is because a social paradigm shift has occurred in the perception of teenage behaviors (Bissonnette & Contento, 2001). They are no longer hasty and careless risk-takers, but potential problem-solvers who can engage in constructive solutions. That is why raising awareness in adolescents about environmentally sustainable food options can mold their conduct for the rest of their lives.

Choosing sustainably produced food

A pathway to a more sustainable diet is the scrutiny of the food sources and production process. As an example, animal husbandry practices are key when choosing sustainable meat products. A successful method to decrease the environmental impact of livestock is to effectively integrate animal production with crop production (Hu et al., 2017). By choosing the crops that are grown near the farms (Hu et al., 2017) and feeding ruminants such as cattle human-inedible crop residue, like rice straws, instead of grains (Eisler et al., 2014), a reduction in the environmental transportation costs and the impact of feed crops will be attained. To elaborate, no extra land or resources, like water and fertilizers, will be needed to produce animal feed and these can be directed instead to human food or industrial crops. Another method was investigated in a recent study that found that incorporating fruit and vegetable waste as an alternative feed resource for sheep reduced the amount of methane and nitrous oxide, which are greenhouse gasses, in two ways (Sahoo et al., 2021). This strategy eliminated the environmental pollution from biodegradation of fruits and vegetable wastes in landfills and also reduced the gastronomic GHGE from the livestock's digestive system (Sahoo et al., 2021). Consequently, this not only can help in mitigating the food waste problem by reducing the amount that reaches the landfill

sites, but also help in ensuring a higher level of food security as resources dedicated to feeding production can be redirected to human food. Furthermore, when choosing plant-based food, agricultural conventions play an important role in environmental sustainability; that is why choosing sustainable farm produce is vital. Choosing farms that use renewable and clean energy forms like solar or wind energy to run their machinery instead of using diesel-derived machines reduces GHGE ("Renewable energy", 2008). Also, food waste can be used to produce biofuels to be used in agriculture ("Renewable energy", 2008). Also, some traditional farming practices like agroforestry and intercropping can be readopted into modern systems. Agroforestry refers to a method of cultivation that plants trees beside crops, which has been known to be efficient in carbon sequestration and maintaining soil quality while increasing crop productivity (Hamadani et al., 2021). Intercropping is planting multiple crops in one field, which also fights soil erosion and is more land efficient (Hamadani et al., 2021). These implementations are more sustainable in terms of GHGE, land efficiency, and food waste management and ensure food security by higher productivity. Nonetheless, these approaches put all the responsibility on the consumers to check for the level of sustainability of their purchases. As a consequence, governmental systems should issue legislations related to this issue to help alleviate the burden on the consumer and should ensure the producers' transparency by uncompromising monitoring.

Wise consumption of plant-based food

Plant-based food consumption must be critically reviewed in order to maximize the potential benefits of its consumption and mitigate any potential adverse impact of them. In a systematic review study, Aleksandrowicz et al. (2016) concluded that consumption of more plant-based food partially in place of animal products can have an influence on minimizing GHGE and land loss in most of the analyzed scenarios when shifting to sustainably

recommended diets. According to Wood et al. (2019), a shift to a Mediterranean diet–plant-based with moderate consumption of meat, dairy, and fish–or a vegetarian diet reduced land use by two to four times, and reduced GHGE. However, plants might be worse in other environmental indicators like water use (Wood et al., 2019). That is why a consideration of a few environmental factors is not sufficient to reach sustainability in all its aspects. Moreover, consumer attitudes govern the efficiency of such diets in reducing the environmental impact. For instance, while fruits and vegetables are recommended as a part of a healthy diet according to the Healthy Eating Index, forty percent of food wasted by consumers is fruits and vegetables, which are highly resource-intensive in terms of water and fertilizer use (Conorad, 2018). This emphasizes that efforts in pursuing dietary recommendations must be simultaneous with efforts in following sustainable diet choices because sometimes there can be a conflict between the two. Advised healthy diets usually contain a higher proportion of fruits and vegetables. When these diets are followed, more food waste is produced because healthy food items are more perishable than highly processed and unrecommended food items. Policymakers and health institutions must re-examine the nutritional legislations and guidance to sustain planetary health as well as people's health by focusing on the consumer behaviors that might lead to food wastage. Guidelines can be formulated with suggestions on how to prepare and store fruits and vegetables to avoid their spoilage because they are perishable (Conrad et al., 2018). This can help reduce food waste coming from the consumer level.

Wise meat consumption

Meat consumption must be re-examined when thinking about a sustainable diet for limiting GHGE and land loss. Although it might be believed that buying local produce is enough to reach an environmentally sustainable diet because later stages of food production like

transportation and packaging are the major reasons for environmental unsustainability, this is not sufficient. In fact, a wise reduction in meat eating can be more effective in terms of environmental sustainability (Aleksandrowicz et al., 2016). In general, reduced meat consumption with red and processed meat substituted with monogastric animals is environmentally more sustainable. In a recent study, it was suggested that shifting from red and processed meat to monogastric meat, like chicken and turkey, can reduce the environmental impact and be more culturally acceptable (Aleksandrowicz et al., 2016). Thus, the changes can be smoothly implemented without potential conflicts with what people want. These findings are supported by other research that examined the health and environmental sustainability of vegan and the Mediterranean diet. Castañéa and Antónb (2017) found that a mix of Mediterranean and vegan diets is optimal for the environment and health as these diets have lower GHGE and land needs. Nonetheless, the complete removal of meat is neither feasible nor beneficial because of ecological, economic, social, and health reasons. Ruminants, for instance, have a vital role in the ecosystem by supplying manure, making use of non-arable land (Aleksandrowicz et al., 2016), and consuming human-indigestible food. This is especially relevant as about eighty-six percent of the livestock feed can not be consumed by humans (Mottet et al., 2017). They participate in the global protein supply and produce a highly nutritious protein that is essential for muscle growth in adolescents (Wrobleski, 2010). Another key significance of animal protein generally is its bioavailability. Plant-based protein has anti-nutritional compounds that cause hindrance in the digestion of protein (Lonnie & Johnstone, 2020, p.281). This makes the plant proteins need specific preparation procedures, which might be difficult for adolescents because it is a time when their responsibilities exponentially increase, so they may prefer time-saving food options. So, animal protein in moderation can be a highly efficient protein source. However, limiting

meat consumption must be coupled with economic and social considerations. As an example, people who rely on raising livestock will be inevitably harmed when meat is reduced (Lindgren et al., 2018). Further research is needed to quantify the correct amounts of various food categories like ruminant and monogastric meats and other food for different sub-population of age groups and genders with attention to the other surrounding factors like social acceptability and economic viability. Collectively, a lower meat consumption than the current one and the substitution of red and processed meat with monogastric meat are more environmentally sustainable choices.

Curbing ultra-processed food

Teenagers have been found to be major consumers of ultra-processed food. By using the National Health and Nutrition Examination survey from 2007 to 2016, Zhang et al. (2020) calculated that almost two-thirds of the average American adolescent diet is ultra-processed, with teenagers spending over four billion dollars on highly processed snacks each year (Bissonnette & Contento, 2001). It is well documented that these foods are related to a diverse range of diseases in young adults including type-two diabetes, cardiovascular disease, and obesity (Monteles et al., 2019), but their environmental impact is as significant. In Australia for example, these types of food contribute to 33% of the total GHGE produced and 35% of the ecological footprint (Hadjikakou, 2017), as well as to other environmental indicators like the use of water and energy. To assess the difference between ready-made processed meals and home cooking, Schmidt et al. (2014) compared the environmental impact of a typical dinner of the same ingredients. They found that home cooking is lower on many environmental indicators such as global warming potential, eutrophication, photochemical smog, and ozone layer depletion because the refrigeration and manufacturing environmental costs are excluded (Schmidt et al., 2014), but

land use, food wastage, and GHGE were not specifically calculated. Moreover, ultra-processed food is linked to intensive farming and agricultural routines that have a significant environmental impact, beside having many ethical concerns related to animal rights (Fardet & Rock, 2020). Another key point about the negative consequences of processed food is the packaging itself. Most of the processed food comes ready packaged in plastic, which persists in landfills for centuries (Ncube et al., 2020) consuming a considerable area of land. In addition, plastic production is a major greenhouse gas emitter (Alberts, 2021). Apart from the packaging, the ultra-processed food ingredients are contributing to its environmental burden. Ultra-processed food usually contains soy oil, palm oil, and other preservatives that have a potential detrimental environmental impact (Seferidi, 2020). However, a paramount element that drives ultra-processed food consumption is time scarcity (Djupegot et al., 2017). Teenagers might be consuming more of this food because of its convenience and almost no preparation time. As a result, sustainable food producers should take into account the convenience of their products in order to attract more adolescents to purchase them. Further, due to its addictive nature and association with a sense of pleasure (Lustig, 2020), ultra-processed food prompts overeating (Seferidi, 2020), which makes curbing it harder. Therefore, relying on the young adult's attitude change towards ultra-processed food is not sufficient to fight the problems of this food as the problem must be tackled from multiple perspectives due to its health and environmental costs.

How to convince teenagers to change their diets

Multiple strategies can be used to impose or convince adolescents with more sustainably oriented eating habits. First, parental guidance is crucial due to the influence of the teenagers' environment in which they live. For example, in a study based on a survey conducted in 2014 on parent-adolescent pairs in the case of sugar-sweetened beverages, parental intake of these drinks

increased the probability of similar intake in teenagers (Elizabeth, 2018). This means that children of parents who did not drink these beverages consumed less of them, while knowledge alone of health risks linked to these drinks was not sufficient to minimize their intake (Elizabeth, 2018). Consequently, this shows that parental influence is decisive when it comes to teenagers' behavior. This is because the parents' actions act as a model for adolescents and inspire them more than what they can hear from the media or the parents themselves. Second, since 20% of the average American adolescent spending is on food (Tighe, 2020), it is predicted that adolescents will be price sensitive. That is why tax imposition on environmentally unsustainable diets can be effective. To analyze the taxation effectiveness of nutrition, Harding & Lovenheim (2017) used data from multiple databases on American household food spending. They found that nutrient-specific taxes were effective in reducing the targeted nutrient categories' consumption (Harding & Lovenheim, 2017). The same can be applied to the food items that have the highest environmental impact, though no research has yet investigated this aspect. Moreover, to make sustainable food economically viable for adolescents, one effective and environmentally sustainable way to do so is by minimizing food waste. This can be done through food waste management guidelines; nonetheless, there might be a need for rigorous ways to reduce it by taxation. This would induce more agile changes in behavior. Beside taxation, environmentally friendly food options should be financially incentivized to attract low income or budget cautious young adults by governmental subsidies (Pais et al., 2019). Third, just like the energy efficiency tag that is added to electric appliances, food labeling can be successful to facilitate sustainable shopping for the consumer. For example, a third party can do an environmental assessment for a food product in double-blind circumstances to avoid any possible biases. Afterward, on a scale from one to ten, the food product will be labeled by its position on the scale, with ten being the

most environmentally sustainable option and one as the least. Certainly, this idea needs a strong standardized set of assessments to be reflective of the real impact that is inclusive of all possible environmental costs, in addition to powerful authoritative regulations. This idea is adopted from the BBC Sounds radio food program (The Food Program, 2022). Last, there is a need for cultural and social paradigm shifts to put pressure on food producers to become more environmentally conscious and to make sustainable shopping more embraced. Moreover, since meat consumption has social and cultural values (Wood et al., 2019), calls for reduction of meat consumption have to come more from the health side as well as the environmental side to make its consumption more susceptible to change. Although it is not simple to integrate these solutions as it needs collaboration between different stakeholders, multiple strategies like good parental influence, price controls and taxation, sustainability tags, and cultural shifts can be used to convince adolescents to adopt sustainable diets.

Conclusion

The relationship between the environment and human nutrition is complex and needs multidisciplinary efforts to achieve optimization for both factors while taking into consideration the various aspects surrounding them like cultural acceptance, affordability, and personal preferences. The rationale behind why the topic is vital is that the damages that can occur because of unsustainable dietary patterns are detrimental and sometimes irreversible like loss of some species. For instance, this can make a culturally preferred strain of fruit or a rare plant used in medicines no longer available. In addition, a major adverse effect of climatic change caused by unsustainable diets is making the current food systems vulnerable to disturbance. This creates a bigger problem for fragile or underdeveloped communities where importing food is either very hard or very expensive. Besides, it can disrupt the wildlife by causing wildfires that destroy

whole ecosystems. This research suggests that some proposed changes to achieve environmental sustainability include maintaining the correct balance between food items, limiting processed food and household food waste, and following the production process of food to ensure its sustainability. Through exploring these strategies the best diet for adolescents in terms of land use and GHGE can be formulated without ignoring social, ethical, or economical components associated with food. To urge people to reduce domestic food waste, it is recommended that further research focus on the effectiveness and feasibility of food waste reduction methods and the monetary advantages of this reduction on the household food budget (Conrad et al., 2018). In addition, further research must assess the environmental sustainability of the diets that people actually consume instead of hypothetical dietary patterns and assess it from most environmental perspectives in order to approach a holistic view of the influence of the diets. Concurrent with raising environmental awareness, sustainable food has to be tasty, convenient, and cost-friendly due to the importance of these factors to a great sector of consumers (Hadjikakou, 2017). Also, governments must not overlook their role in solving the problem, and instead of waiting for voluntary changes by consumers, robust laws should be implemented regarding food's environmental impacts from all aspects. At present, consumers must be more careful and mindful about their choices and try to follow steps towards a more environmentally sustainable diet. This is essential for teenagers as their habits during this period lay the foundation for their future behaviors. The pathway to a sustainable society through eating habits needs the collaboration between governmental efforts and individuals. Like most environmental issues, collective efforts must be united to reach the ultimate goal of reversing man-made damages to the environment.

References

Alberts, E. C. (2021, October 26). *Plastics set to overtake coal plants on U.S. carbon emissions, new study shows*. Mongabay Environmental News. Retrieved April 17, 2022, from https://news.mongabay.com/2021/10/plastics-set-to-overtake-coal-plants-on-ghg-emissions-new-study-shows/

Aleksandrowicz, L., Green, R., Joy, M., Smith, P., Haines, A. (2016) The Impacts of Dietary Change on Greenhouse Gas Emissions, Land Use, Water Use, and Health: A Systematic Review. *PLoS ONE 11*(11): e0165797. doi:10.1371/journal. pone.0165797

Attwood, S., Blondin, S., & Vennard, D. (2021, April 20). Youth say they want climate-friendly diets. Let's help them step up. *World Resources Institute*. https://www.wri.org/insights/youth-climate-friendly-diets-environmental-values

Bissonnette, M. M., & Contento, I. R. (2001). Adolescents' perspectives and food choice behaviors in terms of the environmental impacts of food production practices: Application of a psychosocial model. *Journal of Nutrition Education, 33*(2), 72–82. https://doi.org/10.1016/s1499-4046(06)60170-x

Castañéa, S., & Antónb, A. (2017). Assessment of the nutritional quality and environmental impact of two food diets: A mediterranean and a vegan diet. *Journal of Cleaner Production, 167*, 929-937. https://doi.org/10.1016/j.jclepro.2017.04.121

Cheesman, O. D. (2004, August). *Environmental impacts of sugar production: the cultivation and processing of sugarcane and Sugar Beet*. SKUAST Jammu Digital Repository. Retrieved April 11, 2022, from http://sherekashmir.informaticspublishing.com/603/

Climate change. Amnesty International. (2021, October 28). Retrieved April 6, 2022, from https://www.amnesty.org/en/what-we-do/climate-change/#:~:text=This%20rapid%20rise%20is%20a,a%20range%20of%20other%20impacts.

Conrad, Z., Niles, M., Nehe, D., Roy, E., Tichenor, E., & Johans, L. (2018) Relationship between food waste, diet quality, and environmental sustainability. *PLOS ONE, 13*(4): e0195405. https://doi.org/10.1371/journal.pone.0195405

Das, J.K., Salam, R.A., Thornburg, K.L., Prentice, A.M., Campisi, S., Lassi, Z.S., Koletzko, B. & Bhutta, Z.A. (2017), Nutrition in adolescents: physiology, metabolism, and nutritional needs. *The Newyork Academy of Science*, *1393: 21*-33. https://doi.org/10.1111/nyas.13330

Djupegot, I.L., Nenseth, C.B., & Bere, E. (2017). The association between time scarcity, sociodemographic correlates and consumption of ultra-processed foods among parents in Norway: a cross-sectional study. *BMC Public Health, 17*, 447. https://doi.org/10.1186/s12889-017-4408-3

Eisler, M., Lee, M., Tarlton, J., (2014). Agriculture: Steps to sustainable livestock. *Nature 507*, 32–34. https://doi.org/10.1038/507032a

Fanzo, J., Davis, C., McLaren, R., & Choufani, J. (2018). The effect of climate change across food systems: implications for nutrition outcomes. *Global Food Security, 18*, 12–19. https://doi.org/10.1016/j.gfs.2018.06.001

Fardet, A., & Rock, E. (2020). Ultra-processed foods and food system sustainability: What are the links? *Sustainability, 12*(15), 6280. doi:http://dx.doi.org/10.3390/su12156280

Hadjikakou, M. (2017). Trimming the excess: Environmental impacts of discretionary food consumption in Australia. *Ecological Economics, 131*, 119–128. https://doi.org/10.1016/j.ecolecon.2016.08.006

Hamadani, H., Rashid, S. M., Parrah, J. D., Khan, A. A., Dar, K. A., Ganie, A. A., Gazal, A., Dar, R. A., & Ali, A. (2021). Traditional farming practices and its consequences. *Microbiota and Biofertilizers, Vol 2*, 2, 119–128. https://doi.org/10.1007/978-3-030-61010-4_6

Harding, M., & Lovenheim, M. (2017). The effect of prices on nutrition: Comparing the impact of product- and nutrient-specific taxes. *Journal of Health Economics, 53*, 53-71. https://doi.org/10.1016/j.jhealeco.2017.02.003

Hu, Y., Cheng, H., & Tao, S. (2017). Environmental and human health challenges of industrial livestock and poultry farming in China and their mitigation. *Environment International, 107*, 111–130. https://doi.org/10.1016/j.envint.2017.07.003

Jarrett, C. (2018, June 11). *How our teenage years shape our personalities*. BBC Future. Retrieved April 9, 2022, from https://www.bbc.com/future/article/20180608-how-our-teenage-years-shape-our-personalities

Kildal, C. L., & Syse, K. L. (2017). Meat and masculinity in the Norwegian Armed Forces. *Appetite, 112*, 69–77. https://doi.org/10.1016/j.appet.2016.12.032

Lambin, E., & Meyfroidt, P. (2011). Global land use change, economic globalization, and the looming land scarcity. *Proceedings of the National Academy of Sciences, 108*(9), 3465–3472. https://doi.org/10.1073/pnas.1100480108

Lassi, Z., Moin, A., & Bhutta, Z. (2017, November 20). Nutrition in middle childhood and adolescence. In: Bundy, D.A.P., Silva, N.d., Horton, S., editors. *Child and Adolescent Health and Development* (3rd edition). Washington (DC): The International Bank for Reconstruction and Development / The World Bank. Retrieved April 3, 2022, from https://www.ncbi.nlm.nih.gov/books/NBK525242/

Lindgren, E., Harris, F., & Dangour, A. (2018). Sustainable food systems—a health perspective. *Sustain Sci 13*, 1505–1517. https://doi.org/10.1007/s11625-018-0586-x

Lonnie, M., & Johnstone, A. M. (2020). The public health rationale for promoting plant protein as an important part of a sustainable and healthy diet. *Nutrition Bulletin, 45*(3), 281-293. https://doi.org/10.1111/nbu.12453

Lundeen, E. A., Park, S., Onufrak, S., Cunningham, S., & Blanck, H. M. (2018). Adolescent Sugar-Sweetened Beverage Intake is Associated With Parent Intake, Not Knowledge of Health Risks. *American Journal of Health Promotion, 32*(8), 1661–1670. https://doi.org/10.1177/0890117118763008

Lustig R. H. (2020). Ultraprocessed food: Addictive, toxic, and ready for regulation. *Nutrients, 12*(11), 3401. https://doi.org/10.3390/nu12113401

Mäkiniemi, J.-P., & Vainio, A. (2014). Barriers to climate-friendly food choices among young adults in Finland. *Appetite, 74,* 12–19. https://doi.org/10.1016/j.appet.2013.11.016

Mottet, A., de Haan, C., Falcucci, A., Tempio, G., Opio, C., & Gerber, P. (2017). Livestock: On our plates or eating at our table? A new analysis of the feed/food debate. Global Food Security, 14, 1-8. https://doi.org/10.1016/j.gfs.2017.01.001

Monteles N, L., Santos O, K. dos, Gomes, K. R., Pacheco R, M. T., & Gonçalves F, K. de. (2019). The impact of consumption of ultra-processed foods on the nutritional status of

adolescents. *Revista Chilena De Nutrición, 46*(4), 429–435. https://doi.org/10.4067/s0717-75182019000400429

Naja, F., Hwalla, N., Zouhbi, A. E., Abbas, N., Chamieh, M. C., Nasreddine, L., & Jomaa, L. (2020). Changes in environmental footprints associated with dietary intake of Lebanese adolescents between the years 1997 and 2009. *Sustainability, 12*(11), 4519. doi:http://dx.doi.org/10.3390/su12114519

Ncube, L. K., Ude, A. U., Ogunmuyiwa, E. N., Zulkifli, R., & Beas, I. N. (2020). Environmental impact of food packaging materials: a review of contemporary development from conventional plastics to polylactic acid based materials. *Materials (Basel, Switzerland), 13*(21), 4994. https://doi.org/10.3390/ma13214994

Ooi, J. Y., Wolfenden, L., Sutherland, R., Nathan, N., Oldmeadow, C., Mclaughlin, M., Barnes, C., Hall, A., Vanderlee, L., & Yoong, S. L. (2022). A Systematic Review of the Recent Consumption Levels of Sugar-Sweetened Beverages in Children and Adolescents From the World Health Organization Regions With High Dietary–Related Burden of Disease. *Asia Pacific Journal of Public Health, 34*(1), 11–24. https://doi.org/10.1177/10105395211014642

Pais, D.F., Marques, A.C. & Fuinhas, J.A. (2020). Reducing meat consumption to mitigate climate change and promote health: but is it good for the economy?. *Environ Model Assess 25*, 793–807. https://doi.org/10.1007/s10666-020-09710-0

Poore, J., & Nemecek, T. (2018). Reducing Food's environmental impacts through producers and consumers. *Science*, *360*(6392), 987–992. https://doi.org/10.1126/science.aaq0216

Rakhra, V., Galappaththy, S. L., Bulchandani, S., & Cabandugama, P. K. (2020). Obesity and the Western Diet: How We Got Here. Missouri medicine, 117(6), 536–538.

Renewable energy and agriculture: A natural fit. (2008, July 14).Union of Concerned Scientists. Retrieved April 12, 2022, from https://www.ucsusa.org/resources/renewable-energy-and-agriculture#:~:text=Solar%20energy%20can%20be%20used,%2C%20livestock%20buildings%2C%20and%20greenhouses.

Rizvi, S., Pagnutti, C., Fraser, E., Bauch, C., & Anand, M. (2018) Global land use implications of dietary trends. *PLOS ONE 13*(8): e0200781. https://doi.org/10.1371/journal.pone.0200781

Sahoo, A., Sarkar, S., Lal, B., Kumawat, P., Sharma, S., & De, K. (2021). Utilization of fruit and vegetable waste as an alternative feed resource for sustainable and eco-friendly sheep farming. *Waste Management, 128*, 232–242. https://doi.org/10.1016/j.wasman.2021.04.050

Sarkar, A. (2010). *The impact of agricultural practices on environmental health: a comparative analysis in India* (Order No. MR70067). Available from ProQuest Dissertations & Theses Global. (853293566). https://login.libproxy.aucegypt.edu/login?url=https://www.proquest.com/dissertations-theses/impact-agricultural-practices-on-environmental/docview/853293566/se-2?accountid=8423

Schanes, K., Dobernig, K., & Gözet, B. (2018). Food waste matters - a systematic review of household food waste practices and their policy implications. *Journal of Cleaner Production, 182*, 978–991. https://doi.org/10.1016/j.jclepro.2018.02.030

Schmidt Rivera, X. C., Espinoza Orias, N., & Azapagic, A. (2014). Life cycle environmental impacts of convenience food: Comparison of ready and home-made meals. *Journal of Cleaner Production, 73*, 294–309. https://doi.org/10.1016/j.jclepro.2014.01.008

Schneider, U. A. (2000). *Agricultural sector analysis on greenhouse gas emission mitigation in the United States* (Order No. 9994329). Available from ProQuest Dissertations & Theses Global; ProQuest One Business. (304665078).

Seferidi, P., Scrinis, G., Huybrechts, I., Woods, J., Vineis, P., & Millett, C. (2020). The neglected environmental impacts of ultra-processed foods. *The Lancet Planetary Health, 4*(10). https://doi.org/10.1016/s2542-5196(20)30177-7

The Food Program: Eco-labelling for Food - What Difference Could it Make? [Radio broadcast]. BBC Sounds. (2022, February 6). episode, United Kingdom. https://www.bbc.co.uk/programmes/m0014648

The problem of food waste. FoodPrint. (2022, March 15). Retrieved March 22, 2022, from https://foodprint.org/issues/the-problem-of-food-waste/#:~:text=Food%20is%20lost%20or%20wasted,at%20stores%20and%20in%20homes.

Thyberg, K. L. (2015). *Food waste and sustainability: quantifying food waste disposal and evaluating the environmental impacts of technologies and policies* (Order No. 3713827). Available from ProQuest Dissertations & Theses Global. (1698252163). https://login.libproxy.aucegypt.edu/login?url=https://www.proquest.com/dissertations-theses/food-waste-sustainability-quantifying-disposal/docview/1698252163/se-2?accountid=8423

Tuomisto, H. L. (2018). Importance of considering environmental sustainability in dietary guidelines. *The Lancet Planetary Health, 2*(8). https://doi.org/10.1016/s2542-5196(18)30174-8

Wood, SLR., Alam, M., & Dupras, J. (2019) Multiple pathways to more sustainable diets: shifts in diet composition, caloric intake and food waste. *Frontiers in Sustainable Food Systems, 3*:89. doi: 10.3389/fsufs.2019.00089

World Health Organization. (n.d.). *Biodiversity and health*. World Health Organization. Retrieved March 18, 2022, from https://www.who.int/news-room/fact-sheets/detail/biodiversity-and-health

Wrobleski, M. M. (2010). *The challenge of teen nutrition: An ecological view of socio-cognitive influences on urban, african-american adolescent diet quality* (Order No. 3426426). Available from ProQuest Dissertations & Theses Global; Publicly Available Content Database. (762374554). Retrieved from https://login.libproxy.aucegypt.edu/login?url=https://www.proquest.com/dissertations-theses/challenge-teen-nutrition-ecological-view-socio/docview/762374554/se-2

Zabel, F., Putzenlechner, B., Mauser, W. (2014). Global agricultural land resources – a high resolution suitability evaluation and its perspectives until 2100 under climate change conditions. *PLOS ONE 9*(9): e107522. https://doi.org/10.1371/journal.pone.0107522

Zhang, Z., Jackson, S. L., Steele, E. M., Gillespie, C., & Yang, Q. (2022). Relationship between ultraprocessed food intake and cardiovascular health among U.S. adolescents: Results from the National Health and Nutrition Examination Survey 2007–2018. *Journal of Adolescent Health, 70*(2), 249–257. https://doi.org/10.1016/j.jadohealth.2021.09.031