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Research Article

EVALUATION OF EDIBLE INSECT CONSUMPTION WITHIN THE SCOPE OF ECOLOGICAL FOOTPRINT

Ramazan KARAMAN[1*] (orcid.org/ 0000-0002-3801-2651)

[1]Dicle University, Diyarbakır Vocational School of Social Sciences, Hotel Restaurant and Catering Services, Diyarbakır, Turkey

Abstract

It is predicted that the world population will exceed 9 billion by 2050 and approximately 870 million people will be exposed to malnutrition due to lack of food. Based on this prediction, humanity must meet its needs for food, fuel, fiber and shelter with a minimum ecological footprint. In today's world, where ecological limits have been exceeded and resources have reached the point of depletion, it is important to increase ecological awareness. In this regard, the aim of the research is to reveal the importance of insect consumption within the scope of ecological footprint, to contribute to the relevant literature and to make suggestions to stakeholders. The data was obtained and compiled using the document analysis technique, which is one of the qualitative research methods. It is expected that this research will raise awareness in order to alleviate the burden of our world, which we have driven to irreversible ecological points, with alternative nutrition styles.

Keywords: Consumption, Edible İnsect, Ecological Footprint

Introduction

When we look at the industrial scenarios of the early 2000s, it is seen that the estimated human footprint for 2005 is 30% above the estimated rate. Looking at today's current data, even if it is accepted that there will be an increase in agricultural productivity, it is estimated that this increase will be 100% in 2030. This means that two more planets with the same biological environment as the earth will be needed in order for people to dispose of their waste and meet their demands. In addition to the planet's needs, it is predicted that major damage will occur as a result of pollution, loss of biocapacity and insufficient fresh water. In the long term, if the damage caused by humans to the environment continues, permanent productivity and production problems may arise and the ecosystem may completely collapse.

Increasing population, increasing consumption amount and production systems trying to keep up with this consumption put great pressure on the natural environment. In order to alleviate this pressure, a change in favor of the environment is required not only in the production processes but also in the consumption behavior of individuals. At this point, edible insects are seen as a strong alternative.

It is predicted that the world population will exceed 9 billion by 2050, and in this case, more than 870 million people will be exposed to malnutrition due to insufficient food. Based on this prediction, humanity must meet its fiber, food, shelter and fuel needs with a minimum ecological footprint (Ramaswamy, 2015; Baker et.all., 2016: 95). Nutrition and food is an issue that needs to be emphasized for the future. In order to meet the increasing food demand of the global population, food production must increase by 60 percent worldwide (Food and Agriculture Organization [FAO], 2009). In addition, the current structure of global agriculture requires 11 percent of the world's land area and 70 percent of the world's total water (Unesco, 2014). However, it is predicted that as a result of increasing food production by 60 percent, people will suffer from living space and drinking water shortages and deaths will occur. In addition to traditional agriculture, approximately 37% of methane gas is released in food production from animal husbandry.

This shows that animal farming causes serious damage to natural areas, water quality and forest areas (Goodland and Anhang, 2009: 15). For all these reasons, it is not right to rely on traditional agricultural

*Corresponding author: ramazan.karaman@dicle.edu.tr
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activities and the increase in existing livestock in order to meet the food demand of the increasing human population. Therefore, more alternative, ecological and sustainable ways of food production need to be researched and implemented. Based on all these concerns, FAO (Food and Agriculture Organization of the United Nations) recommends insect consumption as an alternative food source for people's nutrition (Gahukar, 2011: 129).

Conceptual Framework

Concept of Ecological Footprint

In today's world, the pressure of humanity on nature is increasing day by day due to the rapidly increasing human population and developing industry. It is seen that human beings, who try to dominate the natural environment in which they live, tend to consume constantly, ignoring the biocapacity and natural resource supply of the environment. It is stated that people are struggling to survive, especially in most of the developing countries, and accordingly, it is seen that natural resources are inevitably used as a result of this struggle (Ceyhanlı, 2019: 23). According to research reports conducted by the Living Planet Report (2020), if economic growth and energy consumption continue to increase so rapidly, carbon dioxide emissions are predicted to double compared to today by the mid-21st century. In addition, according to the data stated in the report, it is thought that the human population will reach 9 billion in this period, and therefore the need for food and fuel will increase accordingly. For this reason, it is stated that the natural environment will suffer great damage from this situation, the marine ecosystem will disappear by 90%, and accordingly the fisheries will disappear (Living Planet Report, 2008).

Since basic needs must be met consistently for the continuity of human life, it is stated that global economies are dependent on the biosphere. Failure to meet basic needs is of vital importance for human beings. Although the demand for basic needs increases day by day, this may cause natural resources to decrease or disappear. Since it is impossible to substitute natural resources, this situation can become a global problem. When humankind's increasing ecological demand for waste emissions and use of natural resources exceeds the level that nature can provide, this ecological overshoot is seen as a critical situation for the well-being of people and societies. Based on all these reasons, the focus is on the concept of sustainability (Ewing et al., 2010: 8). Sustainability is expressed as humanity meeting today's needs and requirements without harming the capacity of future generations to meet their needs and requirements. From this perspective, sustainability can be defined as the situation where natural resources do not exceed the level of resources that nature can produce within the time period in which they are used. Damaging nature and exceeding resource levels can hinder quality of life and sustainability. In this context, the concept of ecological footprint emerged in order to determine at what point sustainability is moved away (Galli et al., 2012).

The concept of ecological footprint was developed in the early 1990s by Mathis Wackernagel and William Rees to measure basic conditions for sustainability. Ecological footprint measures the biological amount of water and fertile land required to produce all the resources used by a person, society, population or activity and to absorb the waste they produce, considering existing resource management practices and technology applications (Ewing et al., 2010). In other words, it is a scientific tool used to measure human impact on the environment by calculating the amount of land required to provide all resources and absorb all waste for a given population (Cordero et al., 2008: 868).

Considering the industrial scenarios of the early 2000s, the estimated human footprint for 2005 was 30% above the estimated rate. Considering today's data, even if the increase in agricultural productivity is accepted, it is estimated that this increase will reach 100% by 2030. This means that human beings will need two more planets with the same biological environment as our earth in order to meet their demands and dispose of their waste. In addition, it is stated that deep damage may occur as a result of loss of biocapacity, pollution and insufficient fresh water. It is among the strong predictions that the long-term continuation of human damage to the environment may cause production and permanent productivity problems and the ecosystem may completely collapse (Living Planet Report, 2008).

According to the Living Planet Index, wild species and natural ecosystems are under threat in every region of the world. It is possible to classify the factors that directly affect biodiversity under four headings (Keleş, 2011). These factors are described as climate change, pollution in fishing and hunting, irregular treatment of species, dispersion of dominant genes and species, and changes in the natural environment due to agricultural activities. Human beings are shown as the main source of these threats (Akıllı et al., 2008).

Pollution is seen as one of the biggest factors in the decrease and extinction of biodiversity. Wastes, which can sometimes be a great source of nutrients for living things, cause an increase in phosphorus fertilizer and nitrogen use in agricultural activities. In this case, it is one of the main reasons for the increase in oxygen consumption. Chemical pollution occurs through methods such as industrial and mining wastes and pesticides used in agricultural activities. An increase in the amount of carbon dioxide in the atmosphere can cause serious damage to the marine ecosystem by causing increased acidification in the oceans (Jorgensen and Clark, 2011).

While applying or producing information and technology, processing the land, consuming natural resources, and meeting their wants and needs, people adopt an aggressive attitude and do not take the ecosphere, that is, their living spaces, into account (Jorgenson and Clark, 2011). Destruction becomes inevitable as a result of the destruction and disruption of the balance in the ecosystem. At the same time, it is stated that all living spaces on the planet are under threat. Ecological problems, which are quite complex in structure and can only be noticed after long periods of time, are increasing day by day and spreading all over the planet. Factors such as urbanization, industrialization, economic, political and technological developments cause increased ecological destruction and make ecological problems the main agenda item of advanced and contemporary societies (Akıllı et al., 2008; Çorman et al., 2017).

Edible Insect Consumption

Insect feeding comes to the fore as an alternative food source due to reasons such as access to sufficient and safe food due to population growth in the world and the decrease in protein resources (Güneş, Sormaz and Nizamlıoğlu, 2017: 64). In addition to population growth, factors such as decreased interest in agriculture and animal husbandry, unconscious nutrition, migrations, household waste and food waste also cause changes in nutrition patterns. In order to access sustainable and safe foods, people turn to various protein sources such as algae, rapeseed, seaweeds, cultured meats and insects (Becker, 2007; Post, 2012; Van Der Spiegel, Noordam and Van Der Fels-Klerx, 2013; Van Huis, 2015). Insect feeding has been an increasing area of interest since the 2000s and has been the subject of a wide range of events, from insect eating festivals to international conferences, from film festivals to documentaries (Güneş et al., 2017: 64).

Due to rapid urbanization and emerging economies, the direction of global food demand in developing countries has changed significantly, especially in the last decade. In particular, the inadequacy of meat production from animal husbandry causes people to turn to alternative sources. It is predicted that by 2050 the human population will exceed 9 billion and the current food demand will increase by 70%. This situation is becoming more noticeable in developing countries, and a decrease in the amount of meat per capita is predicted. This causes people to turn to alternative sources to meet their animal protein needs. (Paul, Uyttenbroeck, Hatt, Malik, Lebecque and Deleu, 2016: 338; Premalatha, Abbasi, Abbasi and Abbasi, 2011: 4358; Caparros Megido, Sablon, Geuens, Brostaux, Alabi, Brecker and Francis, 2014: 14). One of these alternative sources is edible insects.

Historically, the habit of eating insects appears as a phenomenon that dates back to ancient times, has been adopted by different cultures throughout history, and continues to the present day (Anankware, Fening, Osekre and Obeng-Ofori, 2015: 149; Yen, 2009: 291; Kouřimská and Adámková, 2016: 23). Although using insects as a food source and gaining popularity around the world may seem like a new idea, this idea has actually been around for centuries. It appears that some industrialized nations are beginning to consider entomophagy as a viable option. But cave drawings and other records from ancient civilizations reveal that insects were part of our ancestors' cuisine. Since the existence of human beings, insects have been used not only for feed, medical treatments and religious rituals, but also for nutritional purposes (Ramos-Elorduy, 1998: 2).

Insects represent an important biological resource that is still not fully exploited worldwide. There are many species and many insects on earth. Insects also have very rich content in terms of protein, carbohydrates, fat, amino acids, vitamins and trace elements (Mitsuhashi, 2016; Rumpold and Schlüter, 2013; Makkar et al., 2014; Chen and Feng, 1999; DeFoliart, 1992). Insects are seen as healthy and nutritious alternatives to staple foods such as chicken, fish and beef. Because insects have much more protein, iron, calcium and zinc content, they are of higher quality and contain less fat than traditional meat (Anankware et al., 2015: 143-144). In addition, since insects are cold-blooded creatures, their rate of converting food into protein is quite high. For example, in order to produce the same amount of protein, crickets require 12 times less feed than cattle, 4 times less than sheep and goats, and half as much as chicken. This shows that insects save a significant amount of energy and natural resources and leave less ecological footprint than traditional animal husbandry because they require less food and space (Van Huis et al., 2013: 2).

The nutritional advantages of edible insects can be listed as follows (Bugs on the Menu, 2017);

• They have a very rich content in terms of protein,

• B12 content is 20 times higher than steak,
• They have low saturated fat content,
• Calcium rates are higher than milk,
• Magnesium content is 5 times higher than steak,
• They are very beneficial for the intestines thanks to the beneficial probiotics they contain,
• The 9 essential amino acids they contain have an important effect on the development of muscles,
• They do not contain chemicals, sugar and GMOs,
• They are very rich in chitin.

Consuming insects as food does not pose any danger to most people, except for individuals who are particularly allergic to insects or other arthropods. However, people who are allergic to insects and arthropods should be careful in this regard. Since insects and shellfish have the same properties, individuals who are allergic to lobsters, shrimps, crayfish and similar crustaceans should avoid consuming insects. Since there are enough edible insect species, it is considered dangerous to choose an unknown species (Ramos-Elorduy, 1998: 13).

There are not enough studies and tests on the transmission of diseases to humans by insects as food items (Slingenberg, Gilbert, de Balogh, and Wine, 2004). However, the fact that insects are taxonomically further away from humans than traditional animals causes the risk of zoonotic infection to be expected to be low. However, more research is needed to reach definitive conclusions and conclusions (Van Huis et al., 2013: 66).

Method

In line with the purpose of the research, it was decided that it would be appropriate to use qualitative research method as the research method. Qualitative research is research that examines and understands the subject in detail, rather than measuring events, people or facts in terms of quantity, average and number. In qualitative research, data is obtained through observation, interview and document review (Kozak, 2014: 86; Kıral, 2020: 172). In the study, scanning and document analysis, which is one of the qualitative research methods, were used. In document analysis, also known as documentary scanning, data is obtained by examining existing records and documents. Document analysis includes the processes of finding, reading, taking notes and evaluating sources for a certain purpose (Karasar, 2005). In other words, document analysis is a series of processes that occur during the examination and evaluation of printed and electronic (computer-based and internet-accessible) materials (Bowen, 2009). Printed and electronic materials and documents were used for this purpose. Therefore, no ethics committee approval is required.

Results

Evolution over the last 400 million years has produced a wide variety of arthropod species adapted to the environment. Of the 1.4 million animal species described in the world, 1 million are insects. Contrary to popular belief, of the 1 million described insect species, only 5 thousand are harmful to plants, animals and humans (Van Lenteren, 2006). Regarding the benefits of insects for nature, insects provide many ecological services that are essential for human survival. For example, insects play an important role in the reproduction of plants. An estimated 100 thousand pollinator species have been identified for plant reproduction, and almost all of these species (98%) are insects. While more than 90% of the 250,000 plant species depend on pollinators for reproduction, this is true for three-quarters of the 100 crops that are the most widely produced and staple foods in the world. The importance of this ecological service for agriculture and nature is seen as indisputable. (Ingram, Nabhan and Buchmann, 1996: 2; Van Huis et al., 2013: 5).

Insects also play a vital role in waste biodegradation. Insect larvae, flies, termites and ants clear dead plant matter, allowing organic matter to break down until consumed by fungi and bacteria. In this way, the minerals and nutrients of dead organisms become ready for plants to absorb in the soil. In agricultural ecosystems, beneficial insect species typically far outnumber harmful insect species. For example, a study of rice fields in Indonesia recorded 500 species of beneficial insects and 130 species of harmful insects. (Van Huis et al., 2013: 5). Considering the benefits of insects for humans, in addition to serving as a source of food, insects provide people with other food products such as honey, silk and milk, the hills built by insect species such as termites shed light on today's architecture, their use in the treatment of some diseases and various products in areas

such as cosmetics. Honey and silk are the most well-known insect products. While bees produce approximately 1.2 million tons of commercial honey annually, silkworms produce more than 90 thousand tons of silk (Van Huis et al., 2013: 6). Another known species is the carmine beetle. Carmine is a species used to color food, textiles, cosmetics and some medicines. In addition, Resilin, a rubber-like protein that enables insects to jump, is used in the medical field to repair arteries due to its elastic properties (Elvin, Carr, Huson, Maxwell, Pearson, Vuocolo, Liyou, Wong, Merritt and Dixon, 2005: 999-1001).

As a result of the research, edible insects have many ecological advantages as well as their nutritional content. The fact that insect breeding does not require large amounts of water and agricultural land required in traditional animal husbandry provides a very important advantage in this regard. At the same time, if given the same amount of food, insects can produce at least 2-3 times more food than animals such as sheep, goats and cattle. In addition, greenhouse gas emissions from insects are much lower than traditional animal husbandry. Considering all these, it is predicted that insect consumption within the scope of ecological footprint is very important for the future and will provide a great advantage. Although insect consumption continues to become widespread in today's world, it is still at very low levels in our country. However, it is thought that in the future, insect consumption will become widespread in our country, based on the fact that it is a very important alternative to humanity in an ecological sense.

Insect consumption has attracted attention as a potential solution to reduce the ecological footprint associated with traditional livestock farming and the production of animal-based protein sources. Here are some important points to consider when examining the relationship between insect consumption and ecological footprint:

Lower Resource Requirements: Insects are very effective at converting feed into edible protein. They generally require fewer resources such as water, land and feed compared to traditional livestock farming such as cattle, pigs or poultry. This efficiency can significantly reduce the environmental impact associated with food production.

Reducing Greenhouse Gas Emissions: Insects generally produce fewer greenhouse gas emissions (e.g. methane and carbon dioxide) than larger livestock. Raising insects emits fewer greenhouse gases, which contributes to a lower carbon footprint.

Less Land Use: Since insects can be grown in vertical or indoor farming systems, the land required to grow insects is minimal. This is in contrast to the large land requirements required for grazing cattle or growing forage crops for livestock.

Less Water Usage: Insects require much less water to grow compared to conventional livestock farming. Reduce water consumption contributes to a lower water footprint.

Waste Reduction: Organic waste materials such as food residues and agricultural residues can be used as feed in insect farming. This can help reduce the environmental impact associated with waste disposal.

Biodiversity and Habitat Conservation: Traditional animal husbandry often leads to deforestation and habitat destruction. When insect farming is done sustainably, it poses fewer threats to biodiversity and natural habitats.

Domestic and Sustainable Production Potential: Insects can be grown locally, reducing the need for long-distance transportation. Local insect farming can be more sustainable and support food security.

However, it is important to remember that the environmental benefits of insect consumption depend on sustainable practices. Unregulated or unsustainable insect farming can also lead to negative ecological impacts, such as overharvesting of wild insect populations, pesticide use, or habitat destruction. Consequently, insect consumption has the potential to reduce the ecological footprint of food production when managed sustainably. As the world faces increasing pressures related to population growth and climate change, the search for alternative sources of protein, such as insects, may help alleviate some of the environmental challenges associated with traditional animal agriculture.

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