Correlation Analysis: How Over-Consumed Ingredients Influence Carcinogenesis in Asian Populations

Aarthi Raghavan[1]*, Azhahini Krishnamoorthy[1], Nihithasri Anepally[1]

[1]American High School, Fremont, CA, USA
*Corresponding Author: aarthiraghavan06@gmail.com

Advisor: Dr. Jeanine M. Genkinger, jg3081@cumc.columbia.edu

Abstract

The human immune system consists of a complex network of cells, tissues, organs, and substances that help the body protect itself from infectious diseases. Simultaneously, the immune system cells can recognize and remove damaged or abnormal cells with the potential to become cancerous. Early Greek physicians discovered that maintaining a healthy immune system is crucial to survival and unhealthy food consumption can undernourish the immune system and cause a state of failure. In a weakened state, the body can be infiltrated by several harmful pathogens. Specifically, Asian populations in Mongolia, Bangladesh, the Maldives, and Japan have higher rates of liver, oral, nasopharyngeal, and stomach cancer cases, which all stem from the body's digestive system. These cancers can form when a balanced diet is disrupted. Commonly eaten foods in these countries have been proven to impair the immune system's ability to attack cancer cells. More research is needed to fully understand the relationship between per capita food consumption of commonly consumed foods and cancer rates, and understanding this relationship could allow these populations to avoid overconsumption of harmful ingredients. This research paper examines the correlation between the most consumed foods in these specific countries and the respective high prevalence of cancer. The findings are promising and can be used to spread awareness on this issue in hopes that preventative action is taken to have populations reduce their consumption of such foods.

Keywords: Digestive Cancer, Nutritional Science, Oncology, Immunology, Correlation Analysis, Asian Populations

1. Introduction

The relationship between food and health has always been complex. Ancient Greeks believed that health was dependent on diet. The health and strengthening properties of herbs made them staples of the ancient Greek regime (Bramen, 2009). Most people now aim for healthier eating habits because our bodies rely on food for development. Scientifically, a primary hypothesis linking nutrition and health has to do with disruption to the immune system. The immune system allows the body to fight transmissible diseases and, put simply, is a human's protective armor. Nutrients can help natural resistance in several ways: serving as antioxidants, boosting immune cell activity, and producing necessary antibodies that assist our defense mechanisms. On the other hand, nutrient deficiency can significantly alter the body's immune responses (Bramen, 2009). Figure 1 illustrates how with the continued consumption of unhealthy foods and overall poor nourishment, the immune system's capability becomes damaged, making it more susceptible to bacterial, viral, and other infections.

Thus, select foods may affect the likelihood of health problems like cancer through the immune system. Focusing on improving the immune system with nutrient-filled diets could have promising effects on public health. In fact, around 40% of cancer cases could be prevented by focusing on nutritional improvement in patients (WCRF International, 2021).

Previous research has expanded on the Greeks' discoveries, as epidemiological studies as early as the 1960s showed that cancer rates varied widely between populations and connected the differences to diet (Key et al., 2020). This was supplemented by experiments in animals that showed that cancer rates could be altered by manipulating diet and how energy intake causes a general reduction in cancer development (Key et al., 2020).

This paper makes the following contributions: (1) Determines the correlation between per capita consumption of commonly consumed foods in a country and the country's rate of certain cancers, (2) Examines whether the commonly consumed food in countries based on per capita consumption with the rates of digestive system cancers can be compared to the other countries with similar rates, and (3) Proposes future potential steps to prevent the high rates of cancer in these countries from increasing. As supported by this paper, the national cuisine of certain Asian countries contributing to damaged immune systems could be a reason behind their
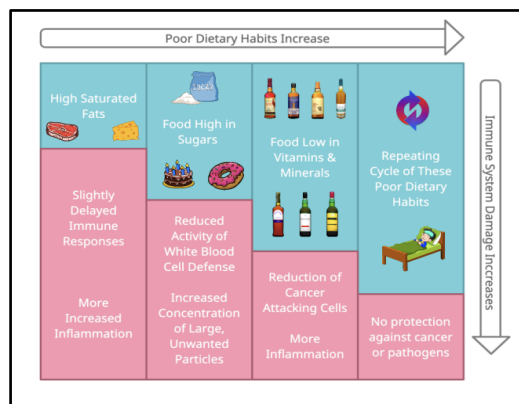

Figure 1. Dietary Habits versus Immune System Damage: The diagram shows how an increase in poor dietary habits causes magnified disruption to the immune system. This image is adapted from Chaari et al.(2020) Importance of Dietary Changes During the Coronavirus Pandemic: How to Upgrade Your Immune Response. Frontiers in Public Health.

increasing cancer rates. We hypothesize that there will be a moderate to high correlation for each of the respective cancers and that this correlation will be observed consistently with other highly-rated countries.

If the findings of this study are promising, they will serve as a powerful catalyst for raising awareness about this critical issue. We hope to encourage communities and countries alike to reconsider their food choices and take proactive steps toward reducing their consumption of these detrimental foods. Ultimately, this concerted effort can lead to improved health outcomes in terms of cancer rates in society as a whole.

2. Materials and Methods

2.1. Description of Cancer Rates and Sources

The cancer rates in four Asian countries – Mongolia, Bangladesh, Maldives, and Japan – was extracted from data presented in the World Cancer Research Fund International Report (WCRF International, 2021). The data includes 18.1 million global cancer cases from 2020. The cases were categorized by the type of cancer (excluding non-melanoma skin cancer). They showed the top 10 countries with the highest specific age-standardized rate (ASR) – the rate of cancer that would be observed in a country with a standard-aged population. The ASR creates standardized cancer rates using the same age distribution which is crucial when comparing populations that differ in the countries' age distribution since age has a powerful influence on cancer rates. Based on the WCRF data, Asian countries typically had the highest ASR for liver, oral, nasopharyngeal, and stomach cancer. The countries marked in green below in Table 1 have one of the highest rates of these four cancers and reflect overall Asian populations. Thus, they were used for further analysis

Table 1. Highest Age-Standardized Rates of Digestive System Cancers in Different Countries: The numbers represent the age-standardized rates (ASR) of the respective cancers. The countries in green were chosen for the study based on their status as Asian countries and a high ASR.

Liver Cancer	Oral Cancer	Nasopharyngeal Cancer	Stomach Cancer
Mongolia: 85.6	Papua New Guinea: 25.7	Brunei: 9.9	Mongolia: 32.5
Egypt: 34.1	Bangladesh: 21.0	Maldives: 7.4	Japan: 31.6
Laos: 24.4	Romania: 17.2	Indonesia: 6.8	South Korea: 27.9
Cambodia: 24.3	Hungary: 17.2	Malaysia: 6.4	Tajikistan: 23.4

in determining the correlation between country level food consumption patterns and the cancer rate in that country.

2.2. Description of Per Capita Food Consumption by Country and Nutrition Data

Food consumption per capita for each of the four studied countries was obtained using national diet and nutrition databases from various publicly-available sources. These commonly consumed foods were taken into consideration to determine the link between a country's cuisine and rates of four cancers.

Using existing studies on the health impacts of over-consumed ingredients within each country's cuisine allowed for the formation of educated guesses concerning how certain ingredients could boost or impair an immune system's ability to combat cancer. In addition to analyzing the selected countries, the other three countries that showed similar cancer rates were studied to determine whether the highest-consumed foods at a per capita level were correlated with the respective cancer.

3.   Results and Discussion

3.1. Liver Cancer

Mongolia showed the highest ASR for liver cancer in the world and in comparison to Asian countries. Liver cancer is characterized by the growth of cancer cells in the liver. The liver is an organ on the upper right side of the body that stores nutrients and filters out waste (Villines, 2020). The most commonly consumed foods in Mongolia include meat, vegetables, and noodles. Furthermore, the country is regarded to have, by far, the highest consumption of sheep and goat meat in the world, with the average Mongolian eating 50kg annually (Helgi Library, 2016).

Unfortunately, red meat is associated with an increased risk of liver cancer. A number of mechanisms could explain these findings. First, it is hypothesized that saturated fats, a macronutrient found in red meat, can delay immune responses to cancer cells (Freedman, 2010). Secondly, due to the presence of aflatoxins, a potential carcinogen that has led to an increased risk of liver cancer. These aflatoxins are known to contaminate animal products such as meat through the animal consuming contaminated feed (National Cancer Institute, 2022). Another possible explanation is the polycyclic aromatic hydrocarbons (PAHs) and heterocyclic amines (HCAs) that are produced when red meat is heated at high temperatures. Both compounds are known to be cancer-inducing (Medical College of Wisconsin, 2018). Therefore, the overconsumption of red meat (specifically sheep and goat meat) is likely linked to Mongolia's high rates of liver cancer among its population.

To determine whether red meat truly is liver cancer-causing, the levels of red meat consumption in Egypt, Laos, and Cambodia were also studied due to the similarities in liver cancer ASR when compared to Mongolia. Since ancient times, Egyptians have been known to eat high amounts of red meat, specifically preferring beef, mutton, and goat meat (Ramadan, 2022). In tandem with Mongolia, it is likely that the high red meat consumption in Egypt is a driving factor in the country's high liver cancer rates.

In Laos, bushmeat makes up over 75% of the meals of households whereas domestic meat such as pork, beef, and sheep meat is eaten in lower quantities (Napasirth et al., 2020). Bushmeat is raw or minimally processed meat that poses a communicable disease risk (Center for Disease Control and Prevention, 2022). In the case of Laos, it is likely that bushmeat is what causes the high rates of liver cancer as a study determined viruses and the liver fluke Opisthorchis viverrini, commonly occurring in bush meat, to be the main cause of the high liver cancer incidence in Laos (Sitbounlang et. al, 2021).

Finally, in Cambodia, red meat consumption is known to be extremely high, where each person on average consumes 17.6kg of meat per year (Vireak, 2020). Comparing this to Mongolia's average annual meat consumption per person of 8.5kg, it is clear Cambodia consumes more red meat on average (United Nations, 2021). However, Cambodia still consumes less sheep and goat meat than Mongolia, so it is likely that sheep and goat meat are more cancer-causing than general red meat.

Overall, it is evident that in three out of the four countries, the high consumption of sheep and goat meat, as well as red meat in general, is associated with the high liver cancer rates.

3.2. Oral Cancer

Bangladesh showed the second-highest ASR for oral cancer in the world and the highest amongst Asian nations, reaching an ASR of 21.0. The rates of oral cancer are rising, with more than 7000 people diagnosed each year (Sultana, 2014). Bangladesh has two risk factors related to high consumption — tobacco and rice.

The most common form of tobacco chewing in Bangladesh is known as betel quid chewing, consisting of Areca nut, betel leaf, catechu, zarda, and slaked lime (Malik, 2014). This tobacco contains harmful chemicals such as nitrosamines and benzene, which lead to cancer-causing mutations and abnormal cell growth when they come into contact with the tissues of the mouth and throat. This is likely why those who chew betel quid are at 4 times higher risk of developing oral cancer compared to non-smokers (Ahmed, 1990).

In terms of rice, it is the staple food of Bangladesh and Bangladesh has the highest per capita consumption of rice in Asia (Ali, 2020). Studies have revealed that rice is a major source of arsenic, which is known to be a substance that promotes the formation of cancer under the condition of long-term consumption (Columbia University, 2023).

To determine whether tobacco and rice truly contribute to high oral cancer rates, the levels of tobacco and rice consumption in Papua New Guinea, Romania, and Hungary were studied due to the similarities in oral cancer ASR when compared to Bangladesh. Papua New Guinea is currently among the top ten countries in the world in terms of tobacco consumption, with around 40% of the population consuming tobacco (Hou et al., 2015). This aligns with Bangladesh's high tobacco consumption rates. Furthermore, Papua New Guinea also has extremely high rice consumption rates among its population. This is likely why there have been rice price increases in Papua New Guinea since 99% of rice is imported to the country (Schmidt, 2021). Again, Papua New Guinea shows a similar per capita food consumption level for rice. It is likely that both tobacco and rice contribute to the high ASR of oral cancer in Papua New Guinea as it does in Bangladesh.

Romania has some of the highest rates of smoking – it is currently third in men and first in women amongst European countries and one of the top countries for tobacco use overall in the world (Euro News, 2023). Although in recent years its rates of tobacco use have been falling, it still has one of the highest tobacco consumption rates in the European Union. In terms of rice consumption, Romania consumes significantly more rice than other European countries (Landgeist, 2022). Although Romania's levels of tobacco and rice are much lower than in Asian countries, it is still among the top consumers of these goods in Europe, which is likely why it has the highest ASR for oral cancer among European countries.

Finally, Hungary is known to have about a third of its population smoking daily, which would explain why it has the fourth highest rate of oral cancer in terms of ASR (National Institute of Health, 2013). For rice consumption, much like Romania, Hungary also consumes far more rice than other Eastern European countries, and consumption rates have been continuously growing (Landgeist, 2022).

In conclusion, all four of the countries show a strong positive correlation between tobacco and rice consumption rates and their respective high ASR for oral cancer.

3.3. Nasopharyngeal Cancer

Globally, the Maldives showed the second highest ASR for nasopharyngeal cancer – abnormal cancer growth that stems in the back of the throat. The nasopharynx is an essential component of the digestive system by connecting the throat to other digestive organs (Villines, 2020). The Maldives' daily diet primarily consists of fish and plant foods. Fish meat is of particular importance, as Maldivians have the highest per capita consumption of fish in the world (RISE Seafood). This poses a major issue, as recently it was discovered that there are several contaminants in tuna, such as fungi and mercury, that can increase the risk of cancer (Swiers, 2022). The Maldives presents yet another case in which the likelihood of certain food consumption may lead to higher cancer rates.

Looking at Brunei, it is known that seafood is one of the principal sources of protein. Indeed, the per capita consumption of seafood in Brunei is one of the highest in the world as per data in 2021 (Department Of Fisheries, 2021). This could explain why Brunei has the highest ASR of nasopharyngeal cancer in the world.

The case in Indonesia, with the third highest ASR of nasopharyngeal cancer, is slightly different from Brunei and the Maldives. Despite an increase in fish consumption within the country, fish consumption is still lower in Indonesia than in some other Asian countries (Anyanwu et al., 2023). There are likely other factors than nutrition contributing to the high nasopharyngeal cancer rates in Indonesia.

Fortunately, fish consumption in Malaysia confirms that nutrition may be a key reason behind its almost equally high ASR. Malaysians, in particular, consume fish at least once a day (Ahmad et al., 2016). In comparison to all Asian nations, the annual per capita fish consumption of Malaysians was the second highest after Japan and is ranked number five globally.

In summary, three of the four countries with the highest ASRs for nasopharyngeal cancer appear to have high fish consumption, which has been previously linked to increasing the risk of cancer.

3.4. Stomach Cancer

Stomach cancer rates in Japan are the second highest in the world, with an ASR of approximately 31.6. There are a few risk factors within Japanese diets that could possibly lead to these high rates.

First is salted foods. Due to high rates of Helicobacter pylori infection and increased intake of salted and smoked foods, several Asian nations, including Japan, have disproportionately high incidences of stomach cancer (Yang, 2021). However, Japan specifically is higher at risk as the Japanese generally consume more salt than people in other countries with lower per capita salt intake (Tanaka et al., 2023).

The second major risk factor is tea consumption. According to a study, the risk of stomach cancer according to the frequent intakes of total tea, green tea, black tea, and oolong tea was tested and showed a connection to high rates of stomach cancer (Sheerah et al. 2020). This confirms that the rates of stomach cancer can partially be caused by the high rates of salted/smoked foods as well as tea because stomach cancer is a multifactorial illness with a complicated interplay of genetics, lifestyle, and environmental variables (Lin, 2011).

In Mongolia, with the highest ASR of stomach cancer in the world, salt consumption rates are extremely high. In fact, the World Health Organization recommends that people consume no more than 5-6 grams of salt per day (World Health Organization, 2023). However, on average, Mongolians consume two-fold more salt than or around 11.5 grams of salt. Fortunately, current efforts are being made to limit salt consumption amongst the population and prevent increasing risks of a variety of diseases (Montsame, 2018). Furthermore, tea is known to be the most consumed drink in Mongolia and is seen as a staple drink, a medicinal potion, or a food supplement (Bamana, 2015).

For South Korea, with the third highest ASR of stomach cancer in the world, the amount of salt consumed exceeds the daily sodium intake recommended by the WHO as similarly seen in Mongolia (Pyo et al., 2023). Tea consumption is the opposite, however, with Korea having a relatively low tea consumption despite tea drinking being a part of Koreans' daily lives (Hyun-kyung, 2018).

Finally, Tajikistan has unhealthily high salt consumption rates. In fact, the World Health Organization in 2017 found that the dishes surveyed in the country contained up to 124.5% of the maximum recommended daily intake of salt. However, Tajikistan does not have very high tea consumption rates, with its per capita consumption being 54th in the world (World Population Review, 2023).

Based on these results, salt consumption has a much stronger correlation to high stomach cancer ASR as confirmed by all four countries. Tea consumption has a much weaker correlation, with only two of the three countries showing high tea consumption rates.

4. **Conclusion**

In conclusion, our comprehensive examination of digestive cancer rates in various countries has shed light on intriguing correlations between dietary habits and the prevalence of these cancer types. While the findings reinforce some well-established connections, they also reveal nuances that call for a more critical evaluation and targeted recommendations. For liver cancer, there appears to be a fairly strong correlation between sheep and goat meat and cancer rates as confirmed by three of the four countries with the highest liver cancer ASR. Second, there is a highly

strong positive correlation between oral cancer ASR and tobacco and rice consumption in all four of the countries examined. Third, nasopharyngeal cancer rates in the Maldives, Brunei, and Malaysia highlight the large potential role of high fish consumption in cancer risk. Finally, salt consumption appears to play a strong role in the high stomach cancer rates in Japan, Mongolia, South Korea, and Tajikistan. In light of these findings, it is evident that a one-size-fits-all approach to cancer prevention may not be sufficient. In the cases where only three of the four countries confirmed our hypothesis, further research is needed to confirm whether food consumption truly contributes to the respective cancer risk. From there, it will be important to identify potential mitigating strategies in hopes that preventative measures can be taken within the countries with the highest cancer rates. Collaborative efforts involving healthcare professionals, policymakers, and the community are needed to develop targeted and tailored strategies for cancer prevention and awareness campaigns in each country. Future research should delve deeper into other possible genetic and environmental factors contributing to cancer risk in these regions. Understanding the interplay of genetics, lifestyle, and environmental variables will enable more precise and effective cancer prevention strategies.

Acknowledgment

References

Ahmad, N. I., et al. (2016). Fish consumption pattern among adults of different ethnics in Peninsular Malaysia. *Food & Nutrition Research*, *60*(1), 32697. https://doi.org/10.3402/fnr.v60.32697

Ahmed, F., & Islam, K. M. (1990). *Site predilection of oral cancer and its correlation with chewing and smoking habit--a study of 103 cases*. Bangladesh Medical Research Council bulletin. https://pubmed.ncbi.nlm.nih.gov/2400388/

Ali, M. (2020, November 12). *Per capita rice consumption in Bangladesh to be highest in Asia in 2021: FAO*. The Business Standard. https://www.tbsnews.net/bangladesh/capita-rice-consumption-bangladesh-be-highest-asia-2021-fao-157333

Anyanwu, O. A., et al. (2023). Fish—to eat or not to eat? A mixed-methods investigation of the conundrum of fish consumption in the context of marine pollution in Indonesia. *International Journal of Environmental Research and Public Health*, *20*(8), 5582. https://doi.org/10.3390/ijerph20085582

Bamana, G. (2015). Tea practices in Mongolia: A field of female power and gendered meanings. *Asian Ethnology*, *74*(1). https://doi.org/10.18874/ae.74.1.09

Bramen, L. (2009, October 7). *The history of Health Food, part 1: Antiquity*. Smithsonian.com. https://www.smithsonianmag.com/arts-culture/the-history-of-health-food-part-1-antiquity-69835382/

Centers for Disease Control and Prevention. (2022, October 31). *Bushmeat importation policies*. Centers for Disease Control and Prevention. https://www.cdc.gov/importation/bushmeat.html#:~:text=The%20term%20%E2%80%9Cbushmeat%E2%80%9D%20refers%20to,pose%20a%20communicable%20disease%20risk

Chaari, A., et al. (2020). Importance of dietary changes during the coronavirus pandemic: How to upgrade your immune response. *Frontiers in Public Health*, *8*. https://doi.org/10.3389/fpubh.2020.00476

Columbia University. (2023, January 31). *Rice consumption and cancer risk*. Columbia University Mailman School of Public Health. https://www.publichealth.columbia.edu/research/centers/niehs-center-environmental-health-justice-northern-manhattan/news-events/newsbriefs/fall-2020/rice-consumption-cancer-risk

Department of Fisheries (2021) *Brunei Darussalam Fisheries Statistics*. Department of Fisheries. http://www.fisheries.gov.bn/SiteCollectionDocuments/statistic%20fisheries/BOOKLET%20STATISTIC_26.10.2022%20(1).pdf

Euro News. (2023). *Where in Europe do people smoke the most and the least?*. euronews. https://www.euronews.com/next/2023/08/14/smoking-in-europe-which-countries-are-the-most-and-least-addicted-to-tobacco-and-vaping

Freedman, N. D., et al. (2010). Association of meat and fat intake with liver disease and hepatocellular carcinoma in the NIH-AARP cohort. *JNCI Journal of the National Cancer Institute*, *102*(17), 1354–1365. https://doi.org/10.1093/jnci/djq301

Helgi Library. (2016). *Which country consumes the most lamb meat?*. Helgi Library. https://www.helgilibrary.com/charts/which-country-consumes-the-most-lamb-meat/

Hou, X., Xu, X., & Anderson, I. (2015). Determinants of Tobacco Consumption in Papua New Guinea: Challenges in Changing Behaviours. *Asia & the Pacific Policy Studies*, *2*(2), 255–265. https://doi.org/10.1002/app5.85

Hyun-kyung, K. (2018, August 27). *How coffee, not tea, became Koreans' favorite drink*. Korea Times. https://www.koreatimes.co.kr/www/culture/2023/09/135_254502.html

Key, T. J., et al. (2020). Diet, nutrition, and cancer risk: What do we know and what is the way forward? *BMJ*, m511. https://doi.org/10.1136/bmj.m511

Landgeist. (2022, June 23). *Rice consumption in Europe*. Landgeist. https://landgeist.com/2022/06/25/rice-consumption-in-europe/

Lin, Y., et al. (2011). Comparative epidemiology of gastric cancer between Japan and China. *World Journal of Gastroenterology*, *17*(39), 4421. https://doi.org/10.3748/wjg.v17.i39.4421

Medical College of Wisconsin. (2018). *Techniques for healthier grilling*. Medical College of Wisconsin. https://www.froedtert.com/stories/reduce-your-cancer-risk-techniques-healthier-grilling

Montsame. (2018). *Mongolians consume 2.5 times higher salt*. MONTSAME News Agency. https://www.montsame.mn/en/read/133074

Napasirth, P., & Napasirth, V. (2018). Current situation and future prospects for beef production in Lao People's Democratic Republic — a review. *Asian-Australasian Journal of Animal Sciences*, *31*(7), 961–967. https://doi.org/10.5713/ajas.18.0206

National Cancer Institute. (2022). *Aflatoxins - cancer-causing substances*. National Cancer Institute. https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/aflatoxins

National Institute of Health. (2013). *Smoking research influenced policy in Hungary*. Fogarty International Center. https://www.fic.nih.gov/News/GlobalHealthMatters/march-april-2013/Pages/implementation-science-policy-smoking-hungary.aspx

Ramadan, S. (2022). *Ancient Egyptian cuisine*. SCIplanet. https://www.bibalex.org/SCIplanet/en/Article/Details.aspx?id=14792

RISE. (2021, October 13). *Maldives pole-and-line tuna*. RISE Seafood. https://riseseafood.org/casestudies/maldives-pole-and-line-skipjack-tuna-fisheries-livelihood-security-and-nutrition/

Schmidt, E., Dorosh, P., & Gilbert, R. (2021). Impacts of Covid-19 induced income and rice price shocks on household welfare in Papua New Guinea: Household model estimates. *Agricultural Economics*, *52*(3), 391–406. https://doi.org/10.1111/agec.12625

Sheerah, H., et al. (2020). Association of tea consumption and the risk of gastric cancer in Japanese adults: The Japan Collaborative Cohort Study. *BMJ Open*, *10*(10). https://doi.org/10.1136/bmjopen-2020-038243

Sitbounlang, P., et al. (2021). The threat of multiple liver carcinogens in the population of Laos: A Review. *Livers*, *1*(1), 49–59. https://doi.org/10.3390/livers1010005

Sultana, N., & Malik, M. (2014). The overview of oral cancer and risk factors in Bangladesh. *International Journal of Dental Sciences and Research*, *2*(5A), 8–10. https://doi.org/10.12691/ijdsr-2-5a-3

Swiers, A. (2022, June 11). *New study finds a link between tuna and increased cancer risk*. Tasting Table. https://www.tastingtable.com/892444/new-study-finds-a-link-between-tuna-and-increased-cancer-risk/

Tanaka, S., et al. (2023). Modelling of salt intake reduction by incorporation of umami substances into Japanese foods: A cross-sectional study. *BMC Public Health*, *23*(1). https://doi.org/10.1186/s12889-023-15322-6

United Nations. (2021). *Survey on the domestic and export meat value chain in Mongolia*. UNCTAD. https://unctad.org/publication/survey-domestic-and-export-meat-value-chain-mongolia

Villines, Z. (2020, May 22). *Organs in the body: Diagram and all you need to know*. Medical News Today. https://www.medicalnewstoday.com/articles/organs-in-the-body

Vireak, T. (2020, February 4). *"not enough local meat production."* "Not enough local meat production" | Phnom Penh Post. https://www.phnompenhpost.com/business/not-enough-local-meat-production

World Cancer Research Fund. (2022, April 21). *Global cancer data by country: World Cancer Research Fund International*. WCRF International. https://www.wcrf.org/cancer-trends/global-cancer-data-by-country/

World Health Organization. (2017). *New studies of street food in Kyrgyzstan and Tajikistan show alarming levels of trans fat and salt*. World Health Organization. https://www.who.int/europe/news/item/08-11-2017-new-studies-of-street-food-in-kyrgyzstan-and-tajikistan-show-alarming-levels-of-trans-fat-and-salt

World Population Review. (2023). *Tea Consumption by Country 2023*. World Population Review. https://worldpopulationreview.com/country-rankings/tea-consumption-by-country