High School Students' Perceptions:

The Usage of Estrogen in Livestock and Its Effects on Breast Cancer in America

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Introduction with Literature Analysis

Recently, the World Health Organization released data from a study investigating the carcinogenicity of red and processed meats stating that these meats increase the risk of getting cancer (Bouvard et al., 2015; International Agency for Research on Cancer, 2015; World Health Organization, 2015). Americans, however, had already suspected that these meats were not healthy and had began to consume less meat (Barclay, 2012). However, poultry is considered to be white meat, not red meat. This leads many to wonder if poultry meat is also carcinogenic. Scientists do know, however, that estrogen is linked to breast cancer (Yue et al., 2010), and the chickens from America observed by Handa et al. (2010) revealed to have a much higher concentration of estrogen than chickens from Japan and Brazil. This makes one wonder if the estrogen in these chickens might be linked to a higher incidence rate of breast cancer in Americans.

The purpose of this research, however, will not be to find the strength of such a link. It will instead focus on the perception of high school students at a large high school in the southeastern United States; what do they know about poultry meat and breast cancer and what their opinions are on this topic.

The reason high school students have been chosen is because of limitations; more precisely, the the resources available to take a simple random sample of American adults throughout the United States and survey them. Instead, this study will be surveying students from a large high school in the southeastern United States. Because there will not be any generalizing any population outside of the given student body, there is no worry about bias that results from this otherwise apparent convenience sampling.

Instead of a simple random sample, though, this study will use a stratified random sample, as the school is divided between three programs, two of which will be grouped together. As the school has a medical magnet program, one of the hypothesis is that these students will have a better understanding of hormones, specifically estrogen, and breast cancer will be made. The students from the traditional and fundamental programs do not have to take the health classes that the medical magnet students are required to take, so another hypothesis states that their understanding of hormones and breast cancer will differ between these non-medical programs and the medical program.

This study serves as a starting point for subsequent research designs where the general knowledge base, specifically that of medicine, is measured and the opinions collected of Americans. Studies related to estrogen levels in poultry products and to breast cancer exist, but is the general populace aware of the results from these studies? Are their opinions formed by accepted facts, or are they based off of misconceptions? In order to answer these questions, we must first know what are the currently accepted facts. For example, through Yue et al. (2010), mice, that were designed to be susceptible to breast cancer, without estrogen receptors had a proliferative effect in the formation of tumors in mammary tissue; they also found that by removing the mice's ovaries, which prevented it from producing estrogen, the onset of tumors was delayed by 50 percent, demonstrating that estrogen might play a role in the development of breast cancer in humans.

Research from Handa et al. (2010) demonstrates that chickens from the United States have a significantly larger amount of estrogen in their fat than that of chickens from Japan or Brazil. Not only is this concerning because this additional estrogen from eating chicken meat

might lead to higher incidence rates of breast cancer, but because of the disparity that exists between the amount of estrogen in the fat of U.S. chickens (170.5 picograms of estrogen hormones per gram of chicken fat (pg/g)) and that of Japanese chickens (113 pg/g) and especially that of Brazilian chickens (2.9 pg/g)(Handa et al., 2010).

How might chickens achieve such high levels of estrogen? Even though it has been shown that additional estrogen supplements do help produce more meatier chickens (Lorenz, 1949), a few students from the University of Mississippi have released a claim that chickens do not receive additional estrogen supplements (Tabler, Wells, & Zhai, 2013). The students argue that the regulations set by the government (U.S. Government Publishing Office 2015a, 2015b) only allow supplements to be given to cattle (Tabler, Wells, & Zhai, 2013). The students also offer an explanation that might help find why there exists a difference among estrogen levels in chickens from varying countries (Handa et al., 2010): the chickens in America are selectively bred to be big and given a diet and placed in an environment that enhances growth (Tabler, Wells, & Zhai, 2013). Besides, only injected estrogen would work, and not only are these injections expensive, but it would be time-consuming to inject every bird (Watkins, Clark, & Thaxton, 2013). The diet, however, is an important note. Soybeans, in particular, are added to chicken feed as a way to provide protein to the birds (Jacob, J., 2015). Soy contains phytoestrogens, which are very similar to estrogen found in animals. Although Patisaul and Jefferson (2010) do affirm that, "estrogens promote breast tumorigenesis," there is much research to be conducted on the, "[d]etermining if phytoestrogens increase or reduce the risk of developing breast cancer has proven to be one of the most challenging human health impacts to address," as evidence exists to both support the proliferative and antiproliferative effects of soy.

One more thing to add: table 1 from Tabler, Wells, & Zhai (2013) contains data that demonstrates that the meat we consume does not contain estrogen levels nearly as high as our own body's natural production level of estrogen, insinuating that we should not be concerned about developing breast cancer through our consumption of meat.

To reiterate what is currently known to be scientific fact: estrogen is linked with breast cancer (Yue et al., 2010), chickens from the United States have relatively high levels of estrogen (Handa et al., 2010), U.S. chickens have high levels of estrogen due to genetic and environmental factors not related to hormone implants or injections (Tabler, Wells, & Zhai, 2013), and the meat we consume contains relatively small levels of estrogen when compared to a human's own naturally-produced estrogen levels (Tabler, Wells, & Zhai, 2013).

Methods

Ten high school students hand-selected from a large high school in the southeastern United States to survey. This survey asks survey questions involving basic knowledge on the use of estrogen hormones on livestock and on breast cancer based off of literature on the correlation between estrogen hormones in livestock and breast cancer in Americans.

To select the 10 students, a stratified sample was used with one factor: program. Instead of the students being randomly selected from a list, they were hand-selected. The questionnaire was distributed and was be done on paper.

The following data about the school has been gathered from the senior data management technician from the school. There are a total of 1676 students at the school, so the 10 students that were randomly selected represents about 0.6 percent of the total student body. There were 5 students selected from the medical magnet program and 5 students

selected from the non-medical magnet programs There are 497 medical magnet students, so the 5 medical students will represent about 1.0 percent of the medical magnet program. There are 1179 non-medical students, so the 5 non-medical students will represent about 0.4 percent of the non-medical magnet programs.

The students were selected on the sole basis of convenience. The consent forms and the surveys were given out to the students at the same time so that both would be received back simultaneously, in order to save time. The surveys will have to be distributed during school hours, so permission from the teachers will have to be obtained in order to temporarily borrow the students.

Results

Five students were asked from the medical program and five students from non-medical programs to partake in a survey; however, only three students from the medical program and three students from non-medical programs returned their consent forms. As a result, the data provided comes from three medical students and three non-medical students. The answers, along with discussion on the importance of the question asked and what the results imply, are as follows:

Table 1. *Participant responses to question one*.

Question 1: Select the best definition of estrogen.

	Medical	**Non-medical**
A hormone responsible for female development	3	3
A hormone responsible for male development	0	0
An animal hormone not found in humans	0	0
I don’t know	0	0

The question here asks the participants to select the best definition of estrogen. This questions serves as a way to measure whether or not students understand what estrogen is responsible for. All the students who responded answered accurately, which demonstrates that the students, both medical and nonmedical, understood what estrogen was at the most basic level.

Table 2. *Participant responses to question two.*

Question 2: Is estrogen produced by men, women, both, or neither?

	Medical	**Non-medical**
Men	0	0
Women	0	2
Both	3	1
Neither	0	0
I don't know	0	0

This question asks the participants who produces estrogen. The question analyzes students' knowledge of who produces estrogen. Both men and women produce estrogen, but 67 percent (two out of three) nonmedical students understood estrogen to be produced only by women. This may be due to the simple fact that women produce much more estrogen than their male counterpart, thus leading the students to falsely believe that only women produce estrogen. The medical students answered accurately, demonstrating that they knew estrogen was a hormone produced by both men and women.

Table 3. *Participant responses to question three.*

Question 3: Do you think that estrogen is supplemented into commercial poultry through injections?

	Medical	**Non-medical**
Yes	2	3
No	0	0
I don't know	1	0

The purpose of this question was to see whether or not students think that estrogen is being injected into poultry. The article from Watkins, Clark, and Thaxton (2013) states that estrogen is not being injected into poultry. None of the participants responded accurately. Because the majority of these students have been exposed to the practices of factory farms through advanced classes, it could be presumed that the knowledge of these practices lead many to believe that poultry are injected with hormones in the same manner cattle are.

Table 4. *Participant responses to question four.*

Question 4: Do you think that estrogen is supplemented into commercial poultry through diet?

	Medical	**Non-medical**
Yes	2	0
No	0	2
I don't know	1	1

Like the previous question, this question was asked to find out whether or not students think that estrogen is being fed to poultry through their diet. Tabler, Wells, and Zhai (2013) note that one of the reasons that chickens get to grow quickly large is because of their diet. Dr. Jacob from the University of Kentucky College of Agriculture, Food and Environment (2015) adds that soybeans in particular are being used as a source of protein for the birds, and these soybeans

contain phytoestrogens, which are similar to estrogens found in humans and animals. As we can see from the table, 67 percent (two out of three) of the medical students answered this answer accurately. What is interesting to note here is that although all three of the nonmedical students think that chickens are getting estrogen injected into them, two of them do not think that chickens receive estrogen, or more specifically, phytoestrogen, from their diet. The wording of the question here might have confused respondents though, as it appears that the question is asking if estrogen by itself is being purposely added to feed. This may have given the students the thought that something, like estrogen pills, is mixed into the feed. The soy itself is part of the feed and acts as a protein supplement. Overall, from the responses of this question and question four, it can be determined that students are not well aware of the farming practices for poultry.

Table 5. *Participant responses to question five.*

Question 5: When compared to chickens around the world, do you think that the estrogen level in American chickens is about the same, higher, lower, or don't know?

	Medical	**Non-medical**
Average	0	0
Higher	2	3
Lower	0	0
I don't know	1	0

This question stemmed from the research conducted by Handa et al. (2010). It asks students what they think is the relative estrogen level is in American chickens. Most students, 83 percent (five out of six) responded that estrogen levels are higher in American chickens, relative

to chickens from other countries, demonstrating that they are accurately aware of the high levels of estrogen in our chickens.

Table 6. *Participant responses to question six.*

Question 6: Who can get breast cancer?

	Medical	**Non-medical**
Men	0	0
Women	0	0
Both	3	3
Neither	0	0
I don't know	0	0

This question was used to assess participants' knowledge in basic oncology. All the students answered accurately, as they all think that both men and women can get breast cancer. This question was asked because there are many people that do not think that men can get breast cancer. This inaccurate statement stems from ignorance, and partly due to media, as much of the resources for breast cancer research and awareness are targeted towards women, and rarely depict men as potential patients of breast cancer.

Table 7. *Participant responses to question seven.*

Question 7: Do you think that there is a connection between estrogen and breast cancer?

	Medical	**Non-medical**
Yes, too much estrogen can lead to breast cancer.	0	1
No, no amount of estrogen can cause breast cancer.	0	0
Yes, but only for people who are already at risk of getting breast cancer.	0	0
No, estrogen is an animal hormone, so it has no effect on humans.	0	0
I don't know	3	2

This last question was meant to sum up the basis of my research. Through the literature review, it has been determined that although science is still unaware of the effects of estrogen that is ingested through our food, specifically poultry, we do know that there is a link between estrogen and breast cancer. Seeing as most students (5 out of 6) do not know whether or not a link exists, and one participant responding that too much estrogen can lead to breast cancer, it shows that the participants are not fully aware of how estrogen and breast cancer are linked.

Discussion

The data gathered from this research is not representative of the school. First and foremost, the participants were not randomly selected; they were hand-picked by me. Initially, I wanted to conduct a stratified random sample with 80 students; however, due to time constraints, I only ended up hand-selecting 10 students I knew who would have acted as participants. In the end, I only received 6 surveys back. Because of this, my data is not useful in determining the general attitude that this school has towards estrogen in poultry and the incidence rate of breast

cancer. Despite this fact, I found that there was almost no difference between medical and non-medical students when it came to general knowledge on the topic. The reason behind this is probably due to the fact that all of my participants had taken AP and honor courses. Along that fact, all these students have taken the honors version of biology and chemistry, and some have gone on to take the respective AP courses as well. Since these students demonstrate a desire to learn, and are able to keep up with a fast-paced learning environment, it is likely that these students have a decent base of knowledge when it comes to estrogen and breast cancer.

For this reason, it is imperative that another study be done with my original intentions in order to gather more reliable data. Although my original population was from a certain high school, the succeeding studies could have populations from a school district, or, more preferably, the entirety of the United States. The reason why this study should be replicated is because it is important that the general knowledge base of people, from high school students to U.S. adults, be studied so that the scientific community is aware of how close to the truth the people are on certain subjects. Just as it is important for the scientific community to be aware of how many people believe that global warming is caused by human activity and how much these people support alternative fuel sources, it is important for the scientific community to be aware of how many people know about what goes on in poultry farms and how the methods used in these farms may or may not impact their health, as well as how many people know about breast cancer and who can get them - as breast cancer prevention programs and support groups are generally aimed towards women, which may lead to the false belief that breast cancer does not occur in men. By knowing how much the public knows, we can then determine what is needed to build support for programs that could aim at increasing regulation to prevent excess estrogen from

entering our diet, assuming that there is a link between estrogen and breast cancer in those people who are already susceptible to breast cancer.

Conclusion

Estrogen has been linked to increased incidence rates of breast cancer in rats that were susceptible to breast cancer, which led to further research in an attempt to find a link between the estrogen found in poultry and breast cancer in humans. Although the literary review includes a study that states that the minute traces of estrogen found in chicken meat do not compare to the amount of estrogen that the human body naturally produces every day, another study revealed that chickens bred in the U.S. have relatively higher levels of estrogen than chickens bred in Japan and in Brazil. This excess estrogen is a result of the exploitations of biology, by naturally selecting for bigger chickens and then supplementing soy, a natural source of phytoestrogens, estrogens found in plants, into their diets. To reiterate, although these methods allows for a chicken with elevated levels of estrogen, the amount of estrogen found in these chickens do not compare to the estrogen our bodies produce naturally, demonstrating that a link between the estrogen we consume from poultry and the incidence rate of breast cancer in America may not be plausible.

After learning about this information, I wanted to conduct a study in which I collect data on the general knowledge base of these subjects among high school peers. Although coming up with an ideal model of collecting data that would have allowed me to perform descriptive and inferential statistics where I could then compare data among school programs and grade levels, time constraints and laziness forced me to reduce the number of participants and to have the participants hand-selected, rather than be gathered randomly. This led to skewed results that,

unfortunately, cannot be used to generalize the knowledge base of the students at this particular high school on the subjects involving estrogen, poultry, and breast cancer.

What we did learn, at least from the data I collected, was that students who were active in rigorous courses, such as AP and Honors, especially those courses in biology and chemistry, regardless of the program they were in, scored about the same; however, because this data is based off of 6 peers, another, better constructed research survey could reveal a different pattern. This research survey can also be conducted around the nation, collecting data on what a typical American adults would know about the subjects involving estrogen, poultry, and breast cancer. With this information, the scientific community can determine what could be done next, if need be, to further educate Americans on the potential dangers involved with excess estrogen in poultry products, and how this could impact those at risk for breast cancer.

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