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Antibiotic Awareness & Healthcare Contentment: A Comparative Analysis Between Korea and the US

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ABSTRACT

The following study set out to investigate public perspectives of healthcare and food choices across South Korea and the United States. A total of 63 people from South Korea and the US participated in the study. The result revealed that there are gender differences with women showing less healthcare satisfaction and a greater aversion to meats treated with antibiotics. Education levels showed a complex relationship with healthcare satisfaction. The family dynamics seem to affect healthcare satisfaction and dietary concerns. Geographical factors were also evident. Korean participants exhibited less healthcare satisfaction and more aversion to antibiotic-treated foods than their American counterparts. This research unveiled a complex interplay between gender, education, geography and healthcare perception, and food consciousness, emphasizing the need to devise targeted interventions and sound healthcare policy to raise public awareness about antibiotics.

Introduction

The discovery of antibiotics marked an important stride in medical history and beyond. The compounds have yielded countless benefits, revolutionizing our ways to treat intractable medical challenges. Though antibiotics have tremendous benefits, their values have been underplayed because of widespread misuse. Worse is the fact that antibiotic resistance can develop when we overuse the substance or inappropriately administer them to patients, making some illnesses resistant to antibiotic treatment. The growing awareness of the importance of the appropriate use of antibiotics has promoted numerous initiatives whose goals are aimed at curbing the proliferation of antibiotic resistance.

Many countries take more substantive measures to regulate the use of antibiotics. Some countries impose severe regulations and responsibilities to minimize the spread of antibiotic resistance, while others simply promote awareness about the danger of overprescribing antibiotics in a clinical setting. Understanding one's precise antibiotic intake is vital to promoting well-being and avoiding undesirable consequences resulting from the overdose.

To combat antibiotic resistance, a thorough understanding of the inappropriate use of antibiotics is essential. Also, it is important that people make needed efforts to educate the general public about the proper use of antibiotics, which aligns with the broader goal of advancing the medical profession as a whole. The problems of rising antibiotic resistance make raising awareness about antibiotic use important to maintaining a lasting quality of life for many people by decreasing susceptibility to illness.

Literature Review

History and the Impact of Antibiotics

Since the discovery of antibiotic, an antimicrobial substance, humans have found numerous ways to beneficially use such medicines for the best of us, humans. Antibiotics are consistently being used in agriculture, humans and even animals to promote their growth or other reasons such as therapeutic and prophylactic uses. The first ever antibiotics dates all the way back to 1928, when penicillin was discovered by Sir Alexander Fleming (1881 – 1955), who pioneered the golden age of natural antibiotics. Different antibiotics were all found from various locations including actinomycetes, bacteria, fungi and some are now even medically synthesized in labs. Although Louis Pasteur initially proposed that microbes had the ability to kill bacteria, penicillin sparked the study of production of antimicrobial compounds (Hutchings, Truman, & Wilkinson, 2019).

During the Golden Age of antibiotic discovery (mid 1950s), most of the antibiotics that are still in clinical use today were discovered. Because it was too easy to discover new classes of antibiotics in such a short time, it resulted in the worst-case scenario: immoderate quantity of drugs was utilized. This situation had carried on until the 1970s when the severe issue of antibiotic resistance crisis came to rise. Since the easy access of antibiotics in soil samples back in the Golden Age, no new antibiotics were discovered, but existing drugs are still being modified. Prior to the end of the Golden Age, there were still some genuine advantages with the exploitation of antibiotics. For example, life expectancy at birth ascended to "78.8 years, and the older population changed from 4% to 13% of the entire U.S. population." In addition, most causes of death shifted from "communicable disease to non-communicable diseases such as cardiovascular disease, cancer and stroke." Although, these remarkable benefits account for the developed countries primarily, antibiotic supplements were soon aided to other countries which sought for help in terms of medical issues (Adedeji, 2016).

Antibiotics as Virulence Modulators: Mechanisms and Implications

Antibiotics are surely a great source of substance assembled through microbial fermentation that can perform a great number of functions in our lives today. Predominantly, antibiotics can produce lavish benefits in mitigating virulence in our bodies. For instance, subinhibitory concentration of antibiotics like metronidazole, vancomycin, clindamycin, and linezolid acquire the ability to destroy toxins and specific pathogens that could lead to diarrhea (Gerber, et al., 2008). In addition to antibiotics mentioned above, there are plenty of other antibiotics that could outperform others and function in entirely different ways. To name a few, Imipenem can eradicate *beta-lactamase* and alginate; tobramycin could deteriorate biofilm formation in *Pseudomonas aeruginosa* and *Escherichia coli*; some antibiotics can perform functions that are exactly the opposite of other antibiotics (McPhee, Lewenza, & Hancock, 2003). Subsequently, antibiotics are a great source to disseminate virulence in our bodies.

Besides, antibiotics can balance out host immune cell response. Specifically, antibiotics encourage phagocytosis through the change of pathogens' surface properties. The importance of changing the surface properties of pathogens is noteworthy as they are one of the most significant factors of bacterial adhesion. These factors include "surface charge, surface wettability, roughness, topography, stiffness." (Zheng, et al., 2021). The ability to alter these surface properties of pathogens would greatly influence the chance of ravaging any bacteria/viruses inside our bodies. By reducing the high number of chances of being afflicted by either bacteria or virus, antibiotics can certainly and significantly lessen the possibility of disease infections.

SOS response, a response to the damage of DNA was shown to be spurred by antibiotics, which fosters mutagenesis and virulence. With its ability to respond so quickly to the deterioration of DNA in our bodies, we can withstand acute issues and come up with a solution as swift as possible. The SOS response not only aids in detecting the damage of DNA in our bodies, but also further carries out the process by inducing any mutagens present in our bodies via the repair of DNA and the cell cycle (Sengupta, Chattopadhyay, & Grossart, 2013).

Although the antibiotics are apparently one of the best founding form humans that has enhanced today's healthcare system, frequent utilization of antibiotics in medical cares have resulted in the emergence of drug-resistant bacterial pathogens. These antibiotic resistance genes have allowed further transfer and spread of pathogens. Due to the high risk of dissemination of viruses or bacteria in our bodies, countries worldwide have contributed to creating policies and restrictions in the use of antibiotics. For instance, in 1999, the U.S. Food and Drug Administration (FDA) has introduced numerous policies related to the limits on the quantity of antibiotics consumed per person or food-producing animal. These policies are increasingly becoming stricter to prevent the harmful, negative causes of over prescription of antibiotics. Internationally, WHO has made progressions in research to promote a healthier and safer world with the use of antibiotics to the society. This has led to some countries even banning the use of antibiotics in food-producing animals and a significant decline of antibiotic uses (Isaacson & Torrence, 2002).

Overuse of Antibiotics: Health Risks and Challenges

In most cases, side effects are fomented due to overuse of antibiotics. Although antibiotic is one of the most advanced medicines in our contemporary society, overprescribing it – just like any other medicine – could potentially lead to resistant bacteria/viruses that are more difficult to treat. Furthermore, antibiotics are not only utilized in humans to prevent multiplication of bacteria/viruses in our bodies, but also applied in food to ensure more healthy nourishment of animals and prevent the widespread of illness or infections that are pioneered from animals. However, the amount of antibiotics exploited differs variously in all countries all over the world. Specifically, to correlate with the two countries – South Korea and US – implemented as the countries for methods of the paper can be specifically contrasted.

According to the data provided by the Organization for Economic Co-operation and Development (OECD) in 2022, they have postulated that the rate of antibiotic consumption was 21.0 defined daily doses per 1,000 inhabitants/day. Meanwhile, a significantly lower measure of 15.4 DID was the average rate use in all OECD countries (OECD.Stat, 2023). South Korea was found to be one of the highest antibiotics consumption countries among all the other high-income countries. Indeed, South Korea's overuse of antibiotic has increasingly become one of the most significant medical issues. The focus on the use of antibiotics on kids are particularly gaining high attention because of their "frequency of community-associated infections, long life expectations, and elevated risk of exposure to antibiotic-resistant pathogens in case of drug control." (Choe & Shin, 2019).

In fact, South Korea is renowned for the use of antimicrobials in fried chickens for prudent care to avoid unnecessary diseases and parasites, but also to improve their growth performance. Specifically, it was reported that approximately 936 tons of animal production were injected with antibiotics just in 2012, with chicken meats covering up most of the proportion of use in animals. Although quite several countries have banned the implication of antimicrobials in animal productions, there are still numerous exploitations of antibiotics detected in food produced from animals (Lee, Cho, Shin, & Kang, 2018). On the other hand, the United States have attempted to reduce the overuse of antibiotics prescriptions on animals. This is because, according to the Centers for Disease Control and Prevention, "more than 2.8 million antibiotic resistant infections led to at least 35,000 deaths." Furthermore, antimicrobial resistance has been investigated to cause about "10 million deaths per year by the year of 2050." (Patel, Wellington, Shah, & Ferreira, 2020). Therefore, it is now illegal to utilize antibiotics for growth promotion, which led to a noticeable reduction in its use. Yet, its use in pork and beef industries remain high in the United States.

Due to the adverse effects of antimicrobial resistance in humans' lives today, WHO has collaborated with the Food and Agriculture Organization and World Organization for Animal Health to work on "One

Health" model in 2017. This project was planned to reduce the overall number of antibiotics uses in animals that produce food. Despite all the efforts that the global health organizations have set up to reduce the health risk of antibiotics on food-producing animals, South Korea is still one of the highest pharmaceutical consumption countries globally. Fortunately, the antibiotic stewardship, an effort to measure and be aware of the amount of antibiotics prescribed, has significantly resulted in positive results in both the United States and European countries, overall reducing the overuse of antibiotics. It is extremely vital to acquire the ability to enhance growth performance of food-producing animals without the use of antibiotics. However, more importantly, people should be conscious of how much antibiotics they are being exposed to, either through medication or food.

Research Questions

1. Is there a correlation between healthcare satisfaction and the willingness to eat antibiotics-treated meat to eat?
2. Is there a geographic difference in people's willingness to eat antibiotics-treated meat and food consciousness?
2. What are the factors influencing the willingness to eat antibiotics-treated meat?

Methods

To address the research questions, we designed a survey questionnaire and distributed to 63 people. Participants were living in either Korea and the US. To ensure the credibility of the collected sample, we assured the participants that their anonymity will be protected, and their response will not be used outside the scope of this research.

Table 1. Descriptive Statistics

Variable	*N*	Mean	SD	Min	Max
Gender	63	.46	.53	0	2
age	63	18.76	5.02	15	47
SES	63	6.4	1.74	1	10
Married	63	.05	.21	0	1
Education	63	3.35	.63	2	5
Number of Family	63	3.11	1.47	1	6
Geography	63	.49	.50	0	1
# of Doctor Visit	63	5.13	3.49	1	15
Know Antibiotics	63	.98	.13	0	1
Satisfied w/ Healthcare	63	3.60	.89	1	5
Antibiotics Food	63	2.31	.91	1	5
Food Conscious	63	3.78	.93	1	5
Healthy	63	4.08	.55	2.33	5

Table 1 details the demographic of the collected data. Females constituted 46% of our participants while only 1 person identified as neither male nor female. On average, the participants were young adults with an average age of 18.76 (SD = 5.02). Most of them were singles and have perceived socioeconomic status of

6.4 (SD = 1.74) on a 10-point scale. As the age indicates, most of them were high-school educated and have three people in their families (Mean = 3.35, SD = 1.47). 49% of them are living in the US.

Our participants visit doctors about five times a year (SD = 3.49), and 98% of them knows what antibiotics is (SD =.13). When it comes the satisfaction with the existing healthcare system, most of our respondents are fairly well-satisfied (Mean = 3.60, SD = .89). The willingness to eat food (mostly meat) that are administered with antibiotics shots are slightly low (Mean = 2.31, SD = .91). Their consciousness with the contents of the food is fairly high (Mean = 3.78, SD = .93). Lastly, our respondents are more likely to think they are healthy (Mean = 4.08, SD = .55).

Results

Table 2. Cronbach's *Alpha* of Question Items

Variables	Sample Question Items	*Cronbach's alpha*
Food in Antibiotics	I can eat chickens that were injected with antibiotics for years. I can eat any meats that were injected with antibiotics for a long time. I can eat meats that were exposed to antibiotics for years.	.93
Satisfaction w/ Healthcare Sys.	I'm satisfied with the existing healthcare system. I'm satisfied with the access to clinical services in my community. I'm satisfied with the quality of medical services I can receive.	.91
Food Consciousness	I'm very conscious of what I eat. I care a lot about a healthy diet. I try to avoid unhealthy foods.	.80
Being Healthy	I am healthy I am in shape. I care about my health.	.72

The sample question items used in our study are provide in Table 2. We calculated Cronbach's alpha coefficient to evaluate each scale's internal consistency. According to Field (2013), a value of 0.7 or greater is typically regarded as acceptable, and a minimum threshold of 0.8 is advised when using psychometrics. All constructs have alpha coefficients of 0.7 or greater as shown in Table 2, indicating that they have significantly more than 50% of covariance and can therefore be combined into a single variable.

	gender	age	SES	married	education	Family#	nationality	DocVisit	Know Antibiotic	SatisHealth	AntibioFood	FoodConsci
age	.23											
SES	-.10	-.01										
married	.23	.86**	.04									
education	.28*	.72**	-.06	.59**								
Family#	-.13	-.03	.11	-.02	-.31*							
geography	.40***	.02	-.10	-.07	.11	-.53**						

DocVisit	.05	-.11	-.06	-.01	-.04	.20	-.20					
KnowAntibio	.11	.02	.10	.03	.07	-.08	.13	.11				
SatisHealth	-.42**	-.14	.02	-.04	-.35***	.36***	-.56**	.03	-.06			
AntibioFood	-.38***	.14	.03	.17	.01	.30*	-.53**	.02	-.05	.55**		
FoodConsci	.34***	.10	-.11	-.08	.08	-.40***	.72**	-.30*	.06	-.31*	-.37***	
Healthy	.12	-.13	.16	-.22	-.07	-.03	.08	-.09	.25*	-.06	-.23	.23

* = *p* < .05 / ** = *p* < .01 / *** = *p* < .001

Then we explored various association related to antibiotics awareness. We found that gender was moderately associated with participants' healthcare satisfaction (r = -.42, p < .01) and willingness to eat antibiotics-treated meat (r = .38, p < .001) and food consciousness (r = .34, p < .001). Participants' education level was negatively associated with the healthcare satisfaction (r = -.35, p < .001). The number of family has positive and moderate correlation with the healthcare satisfaction (r = .36, p < .001) and the willingness to eat antibiotics-treated meat (r = .30, p < .05) and have negative and moderate correlation with food consciousness (r = -.40, p < .001).

Where people live (either Korea or US) has moderate correlation with healthcare satisfaction (r = -.56, p <.01) and willingness to eat antibiotics-treated meat (r = -.53, p < .01) and strong correlation with food consciousness (r = .72, p < .01). Food consciousness has negative correlation with the number of doctor visits (r = -.30, p < .05). The knowledge about antibiotics has positive correlation with health perception (r = .25, p < .05). The healthcare satisfaction has positive correlation with the willingness to eat antibiotics-treated meats (r = .55, p <.01) and negative correlation with food consciousness (r = -.31, p < .05). And lastly, the willingness to eat antibiotics-treated meats has a negative and moderate correlation with food consciousness (r = -.37, p < .001).

Table 6. Regression Model Predicting Perceived Memory Retention

	Unstandardized Coefficient		*Standardized*	*t*	*p*-value
	B	Standard Error			
Const.	.95	1.30		.73	.47
Age	.06	.04	.36	1.63	.11
Married	-.72	.93	-.17	-.77	.44
Doctor Visit	-.01	.03	-.04	-.37	.72
Know Antibiotics	.25	.78	.03	.31	.75
Satisfied Healthcare	.52	.11	.51	4.67	**.00**
Food Conscious	-.24	.12	-.24	-2.04	**.047**
Healthy	-.24	.18	-.15	-1.30	.20

To investigate the relationship between independent variables and people's willingness to eat antibiotics-treated meats, a regression model was fitted. The R^2 value of the model was .42, indicating that approximately 42% of the variance in the willingness can be explained by the independent variables included in this model. The fitted regression model was more predictable than a model using the mean values of the independent variables.

The result shows that people's satisfaction with healthcare system predicts the willingness to eat antibiotics-treated meats. For every one-unit increase in their satisfaction with healthcare system, there is an expected increase of .52 units in the willingness to eat antibiotics-treated meats, holding other variables constant. And people's food consciousness predicts the willingness to eat antibiotics-treated meats. For every one-unit increase in food consciousness, there is an expected decrease of .24 in the willingness to eat antibiotics-treated meats, holding other variables constant. This result confirms that the observed relationship is unlikely to have happened by chance.

Table 7. Variance Inflation Factor

	VIF	*1/VIF*
Married	4.54	.22
Age	4.54	.22
Food Consciousness	1.35	.74
Healthy	1.19	.84
Doctor Visit	1.16	.87
Satisfied Healthcare	1.13	.88
Know Antibiotics	1.10	.91
Mean VIF	*2.15*	

To assess the possibility of multicollinearity in the regression model, we examined the variance inflation factor (VIF) as recommended by James et al. (2013). A VIF value greater than 10 indicates a high correlation between independent variables, suggesting the presence of multicollinearity. However, we found no VIF value that exceeded 10, indicating that multicollinearity is not a concern in our model.

Table 8. Normality Assumption Check

Variable	Observation	Skewness	Kurtosis	Adj. Chi^2	Prob. > Chi^2
Residuals	63	.67	.33	1.16	.56

To examine the normality assumption of the regression mode, we examined the skewness and kurtosis of the residuals. The skewness of the residuals was .67, which is well below the threshold of 2. The kurtosis was .33, which was also well below the threshold of 7. These results indicate that the normality assumption of the regression model was satisfied, and the distribution of the residuals is close to a normal distribution.

Conclusion

Our research result revealed that women are less satisfied with the healthcare system and are more reluctant to eat meat that has been treated with antibiotics. This gender difference suggests that females are more aware of the dangers of antibiotic overuse. A thought-provoking finding is the negative correlation between education level and satisfaction with the healthcare system. Highly educated people can be expected to be more cognizant of health-related issues, such as their dietary choices. It is interesting to note that as people enter marriage and have larger families, their satisfaction with their healthcare increases, and their concern over eating meat treated with antibiotics decreases. This progression raises the possibility of a priority change after a family is formed, which affects their perception of healthcare and dietary risks.

Geographic location, whether people live in Korea or the US, has a negative correlation with healthcare satisfaction and willingness to eat antibiotic-treated meat, implying that people in the United States are more satisfied with healthcare and more willing to consume antibiotic-treated meat than those in Korea. In contrast, the substantial positive association with food consciousness suggests that people in Korea have a higher level of food consciousness. Other associations, such as those between food consciousness and the number of doctor visits or between antibiotic knowledge and health perception, can be interpreted similarly.

The impact of geographical location is another interesting discovery drawn from the present research. Despite the fact that American mass media tend to highlight public discontentment about their healthcare system, Koreans have proven to be even less satisfied with their healthcare system than Americans. And Koreans show lesser willingness to eat meat that has been treated with antibiotics. Further research must be conducted to investigate the underlying factors driving this distinction.

Also, the impact of food consciousness on people's willingness to eat meat treated with antibiotics is substantial. This result highlights the importance of promoting food awareness among people of all ages. We can raise people's awareness of the ramification of eating antibiotic-treated foods through helping them make educated choices about their diets.

Our analysis unveiled complex relationship between gender, education, geographic location, and satisfaction with healthcare, and food consciousness. The relationship explains the importance of educational and policy initiatives to better investigate the root causes of the factors so that people can make safer choices for their health and well-being.

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