www.irbas.academyirmbr.com January 2022
International Review of Basic and Applied Sciences Vol. 10 Issue.1

Economic Valuation of Intangible Cost of Food Borne Risks

MUHAMMAD ZEESHAN
Research Scholar, Institute of Management Sciences Peshawar.

LAILA TASKEEN QAZI
Assistant Professor Institute of Management Sciences Peshawar.

ATTA UR RAHMAN
(Corresponding Author)
Professor Institute of Management Sciences Peshawar.
Email: attaurrahman@imsciences.edu.pk

Abstract

The present research study particularly focused on estimating the intangible cost of food borne illnesses by assessing the household's willingness to pay for irradiation. In order to measure the willingness of consumers for irradiation, the contingent valuation method (CVM) method was used. To assess the consumer's attitude, the primary data was gathered through questionnaire in Peshawar from 207 households to examine their willingness to pay for irradiated poultry meat. In this Tobit regression model was used check the effect of significant factor on willingness to pay for irradiation of poultry meat. The households which suffered from food borne illnesses put significant premium amount for irradiated poultry meat and the age variable were also significant at 5% significance level. Also, the households with higher education and high-income households showed significantly maximum willingness to pay for irradiated poultry meat. As households perceived unsafe the poultry meat. Thus the findings of present research study will help the concerned authorities to know about the consumers attitude towards irradiated poultry meat and the consumers concerns about irradiation process and by it the concerned authorities will be able to take necessary steps in order to bring down the reluctance of consumers about safety of poultry meat by encouraging the acceptance of irradiated poultry meat in consumers.

Keywords: *Irradiated Food, Food Borne Illness, WTP, Tobit Model, Public Health.*

Introduction

In the evaluation of economic burden of food borne illnesses, the number of research papers estimated the cost of food borne illnesses by time off from work and treatment cost but such research papers ignored the intangible cost (pain, suffering and insecurity of consumers about safety of poultry meat) of food borne illnesses which underestimate the economic burden of food bone illnesses.

As different outbreaks of human diseases related to poultry meat in different cities and news on media regarding the use of contaminated poultry meat in restaurants create a panic in consumers about the safety of poultry meat. This panic in consumers regarding a safety of poultry meat have also an economic value which should be incorporated in evaluation of economic burden of food borne illnesses for complete estimation of cost. Therefore, the present research paper reported the results and lessons of a study which estimated the economic value of consumers' insecurity about the safety of poultry meat. In order to measure the consumers' insecurity about safety of poultry meat, the consumers' willingness to pay for

irradiated poultry meat was used as proxy variable. To estimate the intangible cost (insecurity about safety of poultry meat), those surveyed were asked about willingness to pay for irradiation processed poultry meat over and above the current expenditures for poultry meat.

In the following section, the background of the research paper is discussed which covers the problems of food borne illnesses and description of irradiation processed food. The study design, results and conclusion are discussed in subsequent section of the research paper.

Diseases Outbreaks

In Survey when people were asked to list their favorite food items of their diet, 52% of people prefer to poultry meat, 37% of people respond with vegetables and 10% respondents choose pulses (GALLUP, 2009). The poultry meat is the cheapest source of protein, but study found out that arsenic based poultry meat is dangerous for health. In Karachi and Khairpur, the arsenic and lead was identified in new born babies, and pregnant women which was exceeded from the safe limit and found that the carrier for arsenic and lead was poultry meat (Faiza, 2016). The chickens contain heavy growth promoters and antibiotics and the people were exposed to several health risks as people eat harmful drugs residues along poultry meat consumption. Also, the butcher added water after slaughtering to increase chicken weight which can lead to mouth and foot diseases (Abbasi, 2018).

The several cases of chickenpox and 20 deaths were reported in Faisalabad and its surrounding in a result of eating contaminated poultry meat (Yousaf et al, 2018). The Hydro Pericardium Syndrome appeared in 1990, Gumboro appeared in 1991in broilers, and avian influenza appeared in 1995 in broilers which caused abrupt damage to broilers in Murree and Abbottabad, and adversely affect the poultry industry. The avian influenza also causes several diseases and may become the cause of several mortality (Akhtar, 1994).

Duc et al, 2019, Examined the prevalence of salmonella serotypes isolated from broilers, commonly associated with human illness and serotypes mostly found in foodborne salmonellosis associated with chickens or chicken containing food. Therefore for the identification of salmonella species isolated from the different organs of the broiler chickens. Rafiullah,et-al, 2018 conducted a study in district Peshawar in which 200 samples tested including 40 samples from each liver, kidney, heart, lungs, and intestines. And found that prevalence rate was observed as S. gallinarum 63.3%, S. pullorum 35% and S, typhimurium 1.66% in broiler chickens.

The Nature of Food Borne Illness

According to World Health Organization (WHO) around the world 1.5 people annually died from diarrheal disease while one other medical literature found that 70% of diarrheal cases were caused by contaminated food intake and in USA 76 million people suffered from food borne illnesses in which 325, 00 patients get hospitalized and 5200 people died (Buzby and Roberts 2009). The economic cost of food borne salmonella infections are $2.3 billion based on productivity loss and medical care cost (Roberts, 1989). Similarly 209 poultry meat samples were collected randomly from different markets in greater regions of Bangkok Thailand and found that 5.26% poultry meat contains salmonella virus while the 18.18% contains staphylococcus aureus which was threat to people health and can cause drastic economic loss (Ali and Anil, 2013, abkar et.al, 2012). The salmonella and listeria are the major pathogens for food contamination which may cause large number of deaths and economic loss and found that $13500 was the estimated cost of per case caused by Listeria while $700 per case was the average estimated cost for salmonella caused illnesses (Roberts, 1989). The economic cost of O157 STEC infections based on centers for disease control and prevention estimate of annual cases approach and found that average cost of food borne illness due to O157 STEC was $405 million including the $370 million of premature deaths, $30 million for medical expenses, $5 million of time-off from work (Frenzen, 2005). The average cost of per case of food borne illness was

$1,608 by basic cost of illness model while by enhanced cost of illness model, the average cost of per case of food borne illness was$1,626 (Scharff, 2012).

Food Irradiation

In food irradiation process, the ionization rays can be used to ensure pathogens free food items without inducing radioactivity in food stuff (1). The irradiated food is wholesomeness and its consumption does not have any ill effect. In world food market, the irradiated food have practical operation in more than 30 countries. To ensure the safety of food and to lessen the economic loss, the US development of agriculture and food drug administration approved the irradiation processed technology along with other initiatives for the meat free from bacteria (Hartl and fox 2004). The categories of irradiation processed food which are selling worldwide are spices, herbs, dry vegetables, fruits, grains and sea food. In Russia the potential of irradiated meat and irradiated poultry meat production carcasses are approximately 9,899.2 thousand tons, 97.5 thousand tons were the potential of irradiated spices, and the potential of irradiated potatoes were 31,107.80 tons thus in Russia 100% of meat, 74% of vegetables, and 1% of spices might dealt with process of irradiation (Kume et al, 2018, Nawaz et al, 2020).

There are many technologies in world food market for the safety of foods but the irradiation is leading and more potential method to ensure the food free from pathogens. Despite endorsement by FAO, WHO and Codex Alimentarius commission, still the adaptation of irradiation processed food technology have been slow and the developing countries have many concerns regarding irradiation.

Given such differences of opinion as to whether or not food should be irradiated. Therefore, the consumers' willingness to pay for irradiated poultry was used as proxy, to measure the consumers' insecurity about safety of retail poultry meat. Hence, the consumers WTP for the irradiated poultry meat would consider the consumers' insecurity about safety of poultry meat (Intangible cost).

Materials and Methods

The respondents' consumption of poultry meat was measured in term of expenditure per week. The questions about the factors which may affect the willingness to pay for irradiated poultry meat were also asked. It was thought that food borne illness experience may influence the individuals' willingness to pay for irradiation processed poultry meat, the respondents were asked whether or not they ever suffered from food borne illnesses. The respondents were also asked to give their opinion that where the food is more exposed to several health risks and to whom they consider responsible for the food borne illnesses with the intention that when consumers consider responsible to others for the food safety then consumers might object to paying extra for irradiated poultry meat. The surveyed were asked that what preventive measure they adopt to avoid the chances of food borne illnesses to get some idea about the consumers' seriousness about food borne illness.

To allow for preferences whether irradiated poultry meat or status quo (retail poultry meat), the respondents were asked about willingness to pay for both an irradiated poultry meat and status quo retail poultry meat. Participants were asked how much extra they would be willing for poultry meat which had been treated by irradiation process to eliminate the pathogens from food. Only those consumers which preferred to irradiate poultry meat over retail poultry meat were asked about their WTP for irradiated poultry meat. Surveyed were also asked demographic question relating to Age, income, education and self-perceived health status to facilitate regression analysis.

Sample Design

In district Peshawar, the data was gathered from 207 households through questionnaire. To get response from diverse consumers and for accurately estimation the district Peshawar was divided into 3 cluster i.e.

Hayatabad region, Nasar Bagh road region, and Peshawar city region. The 69 consumers was selected by random sampling method from each cluster.

Model Specification for Measuring WTP

The consumers may willing to pay for irradiated food if their utility is greater by having the irradiated food available than those consumers utility without irradiated food.

$$v\,(A, Y - A, S) + \varepsilon_1 \geq v\,(0, y - A, S) + \varepsilon_0 \qquad (1)$$

Here, the v showed indirect utility i.e. reduction of health risks in food, the "A" shows the bid which the households' put some positive premium amount for irradiation processed food while the "0" shows no willingness of premium amount for the irradiated poultry meat and "S" is the other socio economic characteristic affecting the consumers' WTP. The "$Y - A$" is the compensated income remain on same utility function after paying premium amount for irradiated poultry meat and ε_1 and ε_0 are the identically, independent random variable with zero mean. If the consumers think that irradiated poultry meat reduces the probability of health risks in poultry meat, then their willingness to pay for irradiated poultry meat will be "A" but if consumers think that irradiated poultry meat does not reduces the probability of health risks in poultry meat, then respondents willingness to pay would be "0" for irradiated poultry meat.

The utility difference (Δv) between having irradiated poultry meat and not having irradiated poultry meat is:

$$\Delta v = v(A,\ Y - A,\ S) - v(\ 0,\ Y, S) + (\varepsilon_1 - \varepsilon_0) \qquad (2)$$

The truncated WTP is used which measure the individuals WTP from 0 to maximum. And to examine the relationship, the households' willingness to pay for irradiation processed poultry meat was regressed with the explanatory variable i.e. age, education, health status, income, experience, consumption, and responsibility. The dependent variable was consumers additional WTP for irradiated poultry meat. For regression analysis, the Tobit model was used. The Tobit is the hybrid of probit model and Ordinary least square method (OLS) and used where the values are clustered around zero and remaining values are normally distributed. The Tobit model also censored some values either lower or maximum for the estimation of regression. As in this research paper, the left censoring limit is zero while there was no right censoring limit for Tobit model analysis.

The results reported here are those obtained by backward elimination of Tobit analysis. The model was rerun and, again whereby the least significantly explanatory variables were removed from analysis. And this procedure continued until the remaining variables were only those which significantly affecting the WTP for irradiate poultry meat at 5% and 10% significance level. The coefficients obtained by maximum likelihood method (MLE) using Tobit model.

Results

The data presented in table 1 explain that, total questionnaires gathered from 207 households. Of these 86 percent households report that they eat poultry meat while the 46 percent households of these suffered from food borne illness. The 84 percent households report that retail poultry meat is not safe from health risks. The 80 percent households respond that at restaurants/cafes the food is more exposed to several health risks, 12 percent households respond that homemade cuisines are more expose to health risks, and 8 percent households consider that both restaurants/cafes and homemade cuisine were exposed to health risks.

Table 1: Demographic profile of respondents in percentages

Variables	Categories	Frequency (n = 207)	Percentage
Poultry meat	Eat Poultry meat	179	86%
	Does not eat poultry meat	28	14%
Food borne illness Experience	Suffered from food borne illness	95	46%
	Never suffered from food borne illness	112	54%
Health status	Poor	19	9%
	Fair	30	15%
	Good	64	31%
	Excellent	94	45%
Education	Middle	56	27%
	Matric	65	31%
	HSSC	24	12%
	Post-Graduation	62	30%
Insecurity	Insecure	174	84%
	Not insecure	33	16%
Prevalence to risks	At home	24	12%
	At restaurants/ cafes	166	80%
	At both	17	8%
Prevention	Boiling	93	45%
	Within a day	15	7%
	Within three days	1	1%
	Eat fresh	12	6%
	Never reheating	1	0%
	No prevention	85	41%
Responsibility	Government	85	41%
	Retailor	26	12%
	Supplier	21	10%
	Our self	75	37%
Government Initiative	Agree	179	86%
	Disagree	28	14%
Preference	Irradiated Poultry meat	162	78%
	Not irradiated poultry meat	45	22%
Willingness to pay for irradiation processed food	Willing	119	57%
	Not willing	88	43%
Income	0 to 10000	13	7%
	10001 to 20000	64	13%
	20001 to 30000	60	20%
	30001 to 40000	20	27%
	More than 40000	50	33%

To avoid food borne illness, the most common measure was boiling of chicken meat with tap water before it cooked (45 percent of respondents), 7 percent of surveyed households report that eating straight away instead the storage of poultry meat for several days, eating fresh fruits/vegetables to avoid poultry meat was report by 6 percent households, and only 1 percent of surveyed households said that never reheating of

chicken curry but 41 percent households respond that they adopt no preventive measure. The 41 percent surveyed households consider that government is responsible to ensure the safety, the 12 percent respondents consider that responsibility lie on retailor for food safety, 10 percent surveyed households said that supplier of chicken is responsible, while the 37 percent respondents consider ourselves for the food safety.

Of those who eat poultry meat, on average the surveyed households weekly spending on poultry meat ranges from Rs.300 to Rs.2100 (mean= Rs.470 per household). The 86 percent households were in favor of that government should start an initiatives to ensure the safety of poultry meat. The 78 percent households preferred to irradiate poultry meat while 22 percent households preferred to non-irradiated poultry meat. Of those households who preferred to irradiate poultry meat, the 57 percent respondents were willing to put premium amount for irradiated poultry meat and their mean premium amount was approximately Rs.26.

The 22 percent surveyed households which preferred to non-irradiated poultry meat, when asked why they would not purchase irradiation processed poultry meat, a several reason were expressed. The 25% surveyed households report lack of trust on irradiation process, 13% respondents report ignorance regarding irradiation processed food, 9% respondents said that irradiation process add chemicals contaminates in food and 53% surveyed households preferred to slaughter chicken in front of them rather irradiated poultry meat.

Table 2: Results of "backward elimination" Tobit regression

MaxWTP Irr	Coef	Std. Err	T	P > | t |
Higher education	24.53129	14.31068	1.71	0.088
Experience of food borne illness	24.65232	10.49924	2.35	0.020
Government	-24.09902	11.78136	-2.05	0.042
Income				
10001 to 20000	46.81996	23.67889	1.98	0.049
20001 to 30000	40.86173	23.54168	1.74	0.084
30001 to 40000	57.4186	27.08644	2.12	0.035
Age	-1.077193	.5024083	-2.14	0.033

In table 2, the results of backward elimination of Tobit model are represented. The higher education variable is significant at 10% significance level which signifies, that households with higher education put significant premium amount for irradiate poultry meat. For the irradiate poultry meat, the households which ever suffered from foodborne illness showed significant premium amount for irradiated poultry meat. When households considers responsible to government for the food safety, the households put significantly less premium amount for irradiated poultry meat. The positive sign coefficients of each category of income variable signifies, that households' willingness to extra payment for irradiate poultry meat increases as households' income increases. While the income variable's category (Rs.10100 to Rs.20000), category (Rs.20100 to Rs.30000), category (Rs.30100 to Rs.40000) p-values were significant (10% significance level or less) which showed, that high income households report significant premium amount for irradiate poultry meat. The negative coefficient sign indicate that older the respondents, the lesser the WTP for the irradiate poultry meat. And as age variable is significant at 5% significance level, signifies, that age of households significantly contributing to the repression equation.

Discussion and Conclusion

In situations where policy makers are interested in reducing the economic burden of food borne illnesses, the economic value of intangible cost is necessary for the complete spectrum of cost of food borne illnesses. The economic value of intangible cost of food borne illnesses are neglected in cost of illness

approach (Roberts, 1989). To address this limitation, this research paper estimated the economic value of consumers' insecurity about the safety of retail poultry meat by contingent valuation method (CVM).

The seventy eight percent of surveyed households were preferred to irradiated poultry meat but when they were asked for additional WTP for irradiate poultry meat, the fifty seven percent were willing for the extra WTP. These results suggest, that despite of eighty four percent respondents perceived unsafe the retail poultry meat still the irradiate food has not gained complete public acceptance.

The results of tobit model analysis indicate, that higher education of households, previous experience of food borne illness, age and high income factors are significant (10% significance level or less) factors affecting WTP for irradiate poultry meat. This significant premium amount for irradiate poultry meat signifies, the economic value of consumers' insecurity about safety of retail poultry meat because the WTP for irradiation processed poultry meat was used as proxy variable for the measurement of consumers' insecurity about safety of retail poultry meat. The results of economic value of consumers' panic regarding safety of retail poultry meat provide information that helps policy makers to take necessary steps, to bring down the reluctance of consumers about safety of poultry meat.

The results indicate, that households which suffered from food borne illnesses put significant premium amount for irradiated poultry meat are consistent with results of (Donaldson, et al, 1996) that suggest that households suffered from food borne illnesses showed more premium amount for prevention. Similarly the results of age and income variables are supported by (Ngigi, et al, 2011) who found, that high income households had more willingness for the quality of kale in vegetables and age of households is inversely related with willingness to pay for safe kale. The results suggest, that households with higher education put significant premium amount for irradiate poultry meat is supported by (Nayga,et-al, 2005) that suggest higher education households are 37.9% more likely to buy irradiated beef than high school education.

However, the future may be needed to investigate the relationship between the level of consumers' insecurity and WTP for irradiate poultry meat. Furthermore, we acknowledge that knowledge about irradiation processed food is very limited in consumers. The future studies should assess the impact of information on consumers' WTP for irradiate poultry meat.

References

Abbasi, K. (2018). Poultry, meat contain harmful drug residues, NA body told. DAWN News

Akbar, M., Rahman, A., & Mehmood, Z. (2012). The myth of downside risk based CAPM: evidence from Pakistan. *Interdisciplinary Journal of Contemporary Research in Business*, 4(6), 860-869.

Akhtar, S. (1994). Hydropericardium syndrome in broiler chickens in Pakistan. *World's Poultry Science Journal*, 50(2), 177-182

Ali, A., & Anil, A. K. (2013). Prevalence and antibiogram study of Salmonella and Staphylococcus aureus in poultry meat. *Asian Pacific Journal of Tropical Biomedicine*, (2), 163-168.

Buzby, J. C., & Roberts, T. (2009). The economics of enteric infections: human foodborne disease costs. *Gastroenterology*, 136(6), 1851-1862.

Duc, V. M., Nakamoto, Y., Fujiwara, A., Toyofuku, H., Obi, T., & Chuma, T. (2019). Prevalence of Salmonella in broiler chickens in Kagoshima, Japan in 2009 to 2012 and the relationship between serovars changing and antimicrobial resistance. *BMC veterinary research*, 15(1), 108.

Faiza, I. (2016). Chicken meat found contaminated with high levels of arsenic. Dawn News

Frenzen, P. D., Drake, A., Angulo, F. J., & Emerging Infections Program FoodNet Working Group. (2005). Economic cost of illness due to Escherichia coli O157 infections in the United States. *Journal of food protection*, 68(12), 2623-2630.

GALLUP. (2009). Meat Consumption. Islamabad: Gallup Pakistan

Hartl, J., & Fox, J. A. (2004). Estimating the demand for risk reduction from foodborne pathogens through food irradiation. *German Journal of Agricultural Economics*, 53(670-2016-45744), 309-318.

Kume, Tamikazu , Furuta, Masakazu , Todoriki, S., Uenoyama, Naoki & Kobayashi, Yasuhiko. (2009). Quantity and Economic Scale of Food Irradiation in the World. *Radioisotopes*. 58. 25-35.

Nawaz, F., Mukhtar, M., & ur Rahman, A. (2020). A Study of Socioeconomic Determinants of Anemia among Expecting Mothers in Khyber Pakhtunkhwa Pakistan. *Journal of Applied Economics and Business Studies*, 4(3), 113-136.

Nayga Jr, R. M., Aiew, W., & Nichols, J. P. (2005). Information effects on consumers' willingness to purchase irradiated food products. *Review of Agricultural Economics*, 27(1), 37-48.

Ngigi, M. W., Okello, J. J., Lagerkvist, C. L., Karanja, N. K., & Mburu, J. (2011). Urban consumers' willingness to pay for quality of leafy vegetables along the value chain: The case of Nairobi Kale consumers, Kenya.

Rafiullah, A. A., Ali, M. I., Wazir, I., Khan, N., Shah, I. A., Khan, A., & Rashid, A. U. (2018). Antimicrobial resistance of salmonella species isolates from broiler birds in district peshawar. *S. Asian J. Life Sci*, 6(2), 46-53.

Roberts, T. (1989). Human illness costs of foodborne bacteria. American *Journal of Agricultural Economics*, 71(2), 468-474.

Scharff, R. L. (2012). Economic burden from health losses due to foodborne illness in the United States. *Journal of food protection*, 75(1), 123-131.

Yousaf, M. Z., Zia, S., Anjum, K. M., Ashfaq, U. A., Imran, M., Afzal, S., & Iqbal, M. S. (2018). Deadly outbreak of chickenpox at district Faisalabad, Pakistan: possible causes, and preventive way forward. *Molecular biology reports*, 45(6), 2941-2943.