

WILLINGNESS TO PAY FOR PORK MEAT WITHOUT ANTIBIOTICS IN THE STATE OF MEXICO

Miriam Susana **Hernández-Valdivia**¹, Ramón **Valdivia-Alcalá**^{1*}, Enrique **Melo-Guerrero**², Juan **Hernández-Ortíz**¹, Luis Manuel **Valenzuela-Núñez**³, Miguel Ángel **Martínez-Damián**⁴

¹Universidad Autónoma Chapingo.

²Universidad Autónoma del Estado de Hidalgo.

³Universidad Juárez del Estado de Durango, Facultad en Ciencias Biológicas.

⁴Colegio de Postgraduados.

*Corresponding author: ramvaldi@gmail.com

ABSTRACT

Pork represents the second source of protein in Mexico due to the multiple benefits of its consumption. However, several studies link the indiscriminate use of antibiotics with public health problems. This study aimed to know the willingness to pay for antibiotic-free pork with the contingent valuation method (CV). Questionnaires were applied to 156 consumers in eastern State of Mexico and the data were analyzed with a binomial logit model. It was found on average, a willingness to pay a premium of 16.34% (\$17.81 MXN kg⁻¹) as a markup price. The most representative variables were premium amount, age, number of dependents in household, income and frequency of consumption. The results indicated that there is a potential market for differentiated antibiotic-free pork meat, so that consumers are willing to pay a premium per kg of 16.34% over the price of conventional meat.

Keywords: consumer welfare, logit model, consumer preferences.

INTRODUCTION

Pork is a basic source of protein in many countries, in 2020 a global production of 109.8 million tons (Megagrams, Mg) was reported. China, the main producer (and consumer) contributed 41.2% of total pork, the second producer was the United States of America and the third place was occupied by Germany (FAOSTAT, 2022). In Mexico, pork represents the second largest source of protein, after poultry (Hernández, 2021). In 2020, pork production was 1.6 million Mg, an annual increase of 4.5% (the highest in the national record). The main producing states were Jalisco with 22% (359 thousand Mg), Sonora with 19% (322 thousand Mg) and Puebla with 11% (176 thousand Mg) according to the Mexico's Agri-Food and Fisheries Information System (SIAP, 2021). The main destination of Mexican exports is Japan with 43.9% (118 thousand Mg), followed by China with 40.5% (109 thousand Mg), then the United States with 11.4% (31 thousand Mg) and finally South Korea with 2.5%. While imports mostly come from the United States and Canada, 926 thousand Mg (87.8%) and 123 thousand Mg (11.7%), respectively, according to the Mexican Meat Council (CMC, 2021).

Demand in 2020 reached 2.05 million Mg, which is explained by affordable prices, as well as the recent dissemination of the benefits of consumption of this meat (Barrios, 2020). Studies indicate, for example, some nutritional advantages of consuming pork meat, such

Citation: Hernández-Valdivia MS, Valdivia-Alcalá R, Melo-Guerrero E, Hernández-Ortíz J, Valenzuela-Núñez LM, Martínez-Damián MÁ. 2023. Willingness to pay for pork meat without antibiotics in the State of Mexico. *Agricultura, Sociedad y Desarrollo* <https://doi.org/10.22231/asyd.v20i1.1509>

ASyD 20(1): 41-51

Editor in Chief:
Dr. Benito Ramírez Valverde

Received: October 31, 2021.
Approved: August 26, 2022.

Estimated publication date:
March 18, 2023.

This work is licensed under a Creative Commons Attribution-Non-Commercial 4.0 International license.



as the high protein, vitamin and mineral content (Aguilar, 2006; Barrios, 2020). However, it is also stated that pork can cause effects on human health if proper sanitary management is not implemented (Vega-Sánchez *et al.*, 2020). It is even shown that microbial resistance can be traced from the production process due to the indiscriminate use of broad-spectrum antibiotics in livestock (Cartelle *et al.*, 2014; Haro, 2020).

The practices of including antibiotics as growth promoters have been developed in the world since the 70s (Lusk *et al.*, 2006), but due to the findings of abuse in their use, some countries have already regulated the use of antibiotics in pigs production. For example, in Europe since 2006 the use of antibiotics as growth promoters has been prohibited (Redacción Interempresas, 2020); in the United States a Veterinary Food Directive came into force in 2017 that limits the use of antibiotics in animal production (Doyle, 2020). In Mexico, progress on antimicrobial regulation issues is slow. In 2010, the regulation of the sale of antibiotics with a prescription to the population came into force, according to Mexico's Official Federal Gazette (DOF, 2010), and in 2018 the agreement of the National Strategy for Action against Antimicrobial Resistance (DOF, 2018) was published, in which a series of objectives, strategies and lines of action for the evaluation and minimization of microbial resistance are granted. This strategy includes the development of a national policy on the rational use of antimicrobials in veterinary practice and animal production. However, there is no clarity regarding the dates or modes of implementation; nor has progress been made in matters of awareness, education and training for the population and producers regarding antimicrobial resistance (AMR).

Organic livestock farming (named for the way cattle are fed and because meat and derivatives are free of toxic chemicals, pesticides, etc.) prohibits the use of hormones, and antibiotics as growth precursors, as well as chemical synthesis drugs. Antibiotics are allowed in necessary cases and only those allowed by the Mexico's National Service of Health, Safety and Quality (Servicio Nacional de Sanidad, Inocuidad y Calidad–SENASICA). The main producers of organic cattle in Mexico are Guanajuato, Chiapas, Veracruz, Sinaloa and Yucatan. Although the production of organic meat results in a higher cost, in the world there is a demand for this type of premium-priced products compared to those conventional due to the utility they report to consumers, related to the consumption of more natural, healthy and higher quality products.

Economists have developed techniques to value goods that lack a market, they do so based on the observed behavior of consumers in front of a good, drawing a connection between a good that does have a market and that which does not, and is also a subject to public policy interest. Such is the case of contingent valuation (CV), which allows calculating the value of goods without a market or alternatives of shares or projects (Osorio and Correa, 2009). The main objective of this research was to calculate the willingness to pay (WTP) for antibiotic-free pork in the eastern zone of the State of Mexico through the CV method, to infer whether this type of meat would have demand and acceptance in that zone therefore encouraging commercialization. The hypothesis states that there is a positive willingness to pay for antibiotic-free pork, since the population is already aware of its benefits.

METHODOLOGY

Texcoco de Mora is one of the 125 municipalities of the State of Mexico; between the geographical coordinates: 19°23'41.28" N, 99°01'44.04" W and 19°33'25.20" N, 98°38'04.92" W (Figure 1) at 2247 m of altitude (Mexico's National Institute of Statistics and Geography–INEGI, 2020). In 2020, its population was 797 562 inhabitants, of which 51.4% were women; the average age was 30 years and the average schooling for the population aged 15 and over is 10.5 grades (as a reference, the national average is 9.7, while for the State of Mexico it is 10.1 grades) (*ibid.*).

The CV method is part of the direct valuation methods; it formulates questions regarding a hypothetical market in which individuals declare by their answers, the monetary valuation of the good in question (Labandeira *et al.*, 2007). As part of the assumptions in this method are the following: a) the individual maximizes his utility according to his budgetary constraint, which is represented by his disposable income, b) the individual behaves in the same way both in the hypothetical and in the real market, and c) the subject knows the information about the benefits of the good, which is included in the WTP question (Vásquez *et al.*, 2007).

The application of CV has focused on environmental assessment studies (Mendieta, 2000); however, other studies have applied the method in the valuation of differentiated products such as *Tilapia* derivatives (Antonio-Estrada *et al.*, 2021), artisanal aged mezcal (Cervantes *et al.*, 2020), various organic products (Hernández *et al.*, 2019a), cultural attributes in homemade chocolates (Jaramillo-Villanueva *et al.*, 2018), organic maize tortilla (Jaramillo, 2016), organic apples (Cerdeña *et al.*, 2014), among others, with positive results.

The application of the method included three stages: design of the questionnaire, application of the survey and, finally, capture the data in Excel and data processing with



Source: Mexico's National Institute of Statistics and Geography (INEGI, 2020).

Figura 1. Location of Texcoco de Mora, State of Mexico, Mexico (national and within the state scales).

NLogit 4.0. For the application of the questionnaires, Simple Random Sampling (SRS) was used, assuming a normal distribution in the estimator of interest, with the following formula (Álvarez *et al.*, 1989). For this study, the following sample size was obtained:

$$n = \frac{pq}{\left(\frac{d}{Z}\right)^2 + \frac{pq}{N}} = 150$$

In which N : population size for Texcoco (797 562); Z : value of Z for the 95% confidence interval (1.96 in this case); p : proportion with approximate maximum variance of people who would be willing to pay a premium (0.5 for this case); $q=1-p=0.5$; d : accuracy of the interest estimator, 8%, resulting in a sample size of 150 consumers.

The questionnaire consisted of five sections: 1) introduction, 2) description of the product, 3) socioeconomic information questions, 4) valuation questions, which asked about the willingness to pay for pork meat with the following characteristics: red color, 10% less fat, antibiotics-free and with a premium cost. The premium was set at three amounts: 10%, 15% and 20%, so each one was included in 50 questionnaires; and 5) appreciation for participating in the survey. Google Forms tool was used to apply the questionnaire and finally worked with 156 responses. The application of the questionnaires was to individuals of legal age residents of the municipality of Texcoco who decide to buy meat for their home in various places such as butchers and shopping centers located in the study area.

The multiple linear model that represents the expected utility of consumers is:

$$RESP = \beta_0 + \beta_1 PRIM + \beta_2 EDAD + \beta_3 GEN + \beta_4 EDUC + \beta_5 INTEF + \beta_6 DEP + \beta_7 ING + \beta_8 LUGAR + \beta_9 CONSU + E$$

where $RESP$ represents the probability of answering “yes=1” or “no=0” to the WTP question; $PRIM$ = premium amount; $EDAD$ = age of the interviewee (in years); GEN : male or female; $EDUC$: schooling level; $INTEF$: number of members in their family; DEP : number of economic dependents; ING : monthly family income; $LUGAR$: place where meat is frequently acquired; $CONSU$: frequency of pork consumption per week; β_0 : the intercept; $\beta_1 \dots \beta_9$: coefficients of variables; E : indicates the error.

To obtain the WTP , the formula used by Valdivia-Alacalá *et al.* (2011) was followed:

$$DAP = \frac{\alpha}{-\beta_i}$$

where α is the sum of the multiplication of the coefficients of each variable by their respective value for each individual (including the intercept); and β_i is the coefficient of the variable $PRIM$, but with negative sign.

RESULTS AND DISCUSSION

First, the characteristics of the profile of the interviewees are presented and analyzed; in order to analyze then the model used to know the WTP of consumers by antibiotic-free pork in economic and econometric terms.

The average age of the interviewees was 36 years, 51% were men and 49% women, all of them involved in making decisions about buying food for the family. Regarding the education level, the highest proportion (46%) corresponded to a University degree, but if we add the interviewees with postgraduate studies, as master (21%) and doctorate (15%) degrees, this percentage reaches 82% Overall, an average of 16.49 years of schooling was obtained, which shows a level of training higher than the national average; Jaramillo *et al.* (2015) reported an average of 8 years of schooling for Mexico City. A possible explanation for this contrast in averages is that in the eastern State of Mexico there are several centers dedicated to higher education and research. Regarding household structure, families on average consist of four members, two of them, as income dependents (Table 1).

Table 1. Socioeconomic characteristics of respondents.

Variable	Description	Percentage
Age	18-35 years old	61%
	36-50 years	29%
	> 51 years	10%
Gender	Woman	49%
	Man	51%
Education	Secondary	3%
	High School	15%
	University	46%
	Master's Degree	21%
Family members	PhD	15%
	1-2	21%
	3-4	57%
Dependents	> 4	22%
	0-2	78%
	3-4	19%
Income	5 or more	3%
	\$0-\$12,000	48%
	\$12,001-\$19,000	29%
	\$19,001-\$55,000	22%
Location	> \$55,001	1%
	Butcher's shop	90%
	Supermarket	7%
Consumption	Tianguis	3%
	Less than 1 time	37%
	1- 2 veces	54%
	More than 3 times	9%

Source: own elaboration.

The average monthly income was reported between \$10,000–\$15,000 MXN, and nearly half of respondents (48%) had as household income less than \$12,000 MXN. These figures also varied drastically compared to other studies valuating meat, where lower average income was found (*ibid*; Jaramillo *et al.*, 2018). More than half of respondents (52%) reported incomes above \$12,000 MXN, which is related to level of schooling. Regarding the purchase, 90% of the participants bought their meat in butcher shops, 7% in supermarkets and 3% in *tianguis* (a traditionally local market). Jaramillo *et al.* (2018) also found that beef is bought mainly in butchers, secondly in *tianguis*, and finally in supermarkets. On average, participants consume pork twice a week, and 37% consume less than once per week.

The values of the coefficients obtained with the model, as well as the value of the goodness of fit and test parameters of the model were calculated (Table 2). In general, it is observed that the pseudo R-square resulted in the value 0.2492; the Chi square 53.58 and the logarithm of likelihood (log likelihood) –107.5019, values usually accepted for this type of models (Cabrer *et al.*, 2001; Gujarati and Porter, 2010; Train, 2014; Tudela and Leos, 2017).

The most significant variables were *ING*, *CONSU* and *DEP*; whereas the variables *EDAD* and *PRIM* were not significant, but they did contribute to the validity of the model. The *EDUC* variable was expected to be significant and positive since it would be expected that people with a higher degree of education would be willing to pay for healthier products; however, its sign was negative, a situation that coincides with Antonio-Estrada *et al.* (2021) and Berges and Casellas (2008) who justified such a response by mentioning that it could be due to the fact that with lower education grades, the perception of risk is more exaggerated. Another possible explanation is that, overall, there is no awareness regarding the use of antibiotics in pig production or its implications.

With the coefficients and signs of the variables, the model is represented as:

$$RESP = -0.08619927 - 0.08619927PRIM + 0.02730860EDAD - 0.27788113DEP + 0.53952413ING - 0.51584778CONSU$$

Table 2. Logit Model Results.

Variable	Coefficient	Standard error	P [Zú > z]
Constant	-0.84386077	1.06742455	0.4292
PRIM	-0.08619927	0.05171109	0.0955
EDAD	0.02730860	0.02026068	0.1777
DEP	-0.27788113	0.15479653	0.0726
ING	0.53952413	0.09626136	0.0000
CONSU	-0.51584778	0.20421957	0.0115
Log likelihood		-107.5019	
Chi-square		53.58091	
Pseudo R-squared		0.2492091	
Number of observations		156	

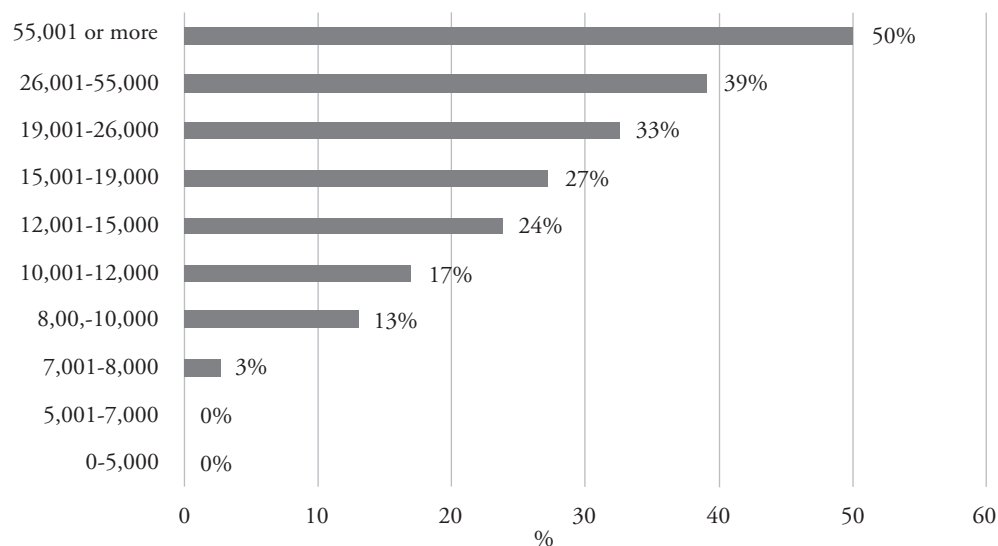
Source: own elaboration based on NLogit results.

On the negative sign of *PRIM* is interpreted that the higher the amount of the premium, the less willingness to pay there is. Whereas the positive sign of *EDAD* means that the older the age, the greater the willingness to pay for a premium cost. This is a contrasting fact with Cervantes *et al.* (2020), who found a negative relationship in the *WTP* for artisanal aged mezcal. The negative sign in *DEP* means that the greater the number of dependents in the family, the lower the willingness to pay; this information coincides with González and Valdivia (2009) and Valdivia-Alcalá *et al.* (2011).

The positive sign in *ING* indicates that, the higher the income, the greater the willingness to pay; the fact that *CONSU* is negative may indicate that the higher the frequency of consumption, the less willing one is to pay a premium. Other authors include a variable that represents knowledge of the product or situation assessed (Jaramillo *et al.*, 2015; Sandorf *et al.*, 2017; Valdés-Castro *et al.*, 2021), whose value may be significant. Such a variable was omitted in this study, but it could be relevant given the experience.

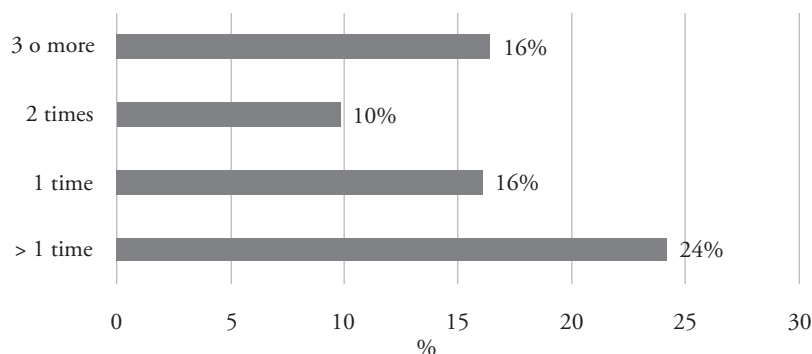
Average *WTP* values were obtained by income level (Figure 2) and by frequency of consumption (Figure 3). Figure 3 shows that there is agreement with the findings of other authors (Jaramillo, 2016; Tudela and Leos, 2017; Jaramillo-Villanueva *et al.*, 2018; Hernández *et al.*, 2019b; Cervantes *et al.*, 2020; Lugo *et al.*, 2020) and it confirms the theory about the positive relationship between income level and *WTP* a premium for healthier products. In this case, when there is an income of \$10,000 MXN or less, participants would only be willing to pay an average premium of 13% at a maximum, but consumers earning more than \$26,000 MXN would pay a minimum premium of 39% and up to 50% at maximum.

Figure 3 shows that the fewer times a week pork is consumed, the more willingness to pay a premium for antibiotic-free meat. In this case, there would be an average *WTP*



Source: elaborated by the authors.

Figure 2. Average willingness to pay (*WTP*) according to income level.



Source: elaborated by the authors.

Figure 3. Average willingness to pay (WTP) according to the number of times pork meat is consumed per week in the household.

of 24% when pork meat is consumed less than once a week. This inverse relationship may be explained based on respondents who consume pork meat more frequently would spend more money per week than those who consume it only once. This means that the consumer level of satisfaction does not compensate the premium cost.

The value of the WTP was also calculated in the NLogit program, the results of which are shown in Table 3. Where it is perceived that the average value of the premium that the surveyed consumers of Texcoco, State of Mexico are willing to pay was 16.3%, with a maximum value of 29% and a minimum of 1.2%. If it is considered that on average 1 kg of steak costs \$109.00 MXN according to Mexico's Food and Agriculture Association for Certification (ACSAA, 2021), the average value of the premium would be \$17.81 MXN per kilogram.

In order to interpret the magnitude of the effect of a change in each variable, marginal effects were calculated in percentage terms, for this, antilogarithm was applied to the marginal effect, subtracted one and the result was multiplied by one hundred (Dunteman and Ho, 2004; Gujarati and Porter, 2010; Hardin and Hilbe, 2018). Table 4 integrates these three values. It is highlighted that income has the greatest effect and it is interpreted that for each Mexican peso that income increases, consumers would be 14.2% more willing to pay a premium for antibiotic-free pork meat. The behavior of the variable *CONSU* implies that, if the frequency of pork consumption increases one more time per week, participants would be 11.9 % less willing to pay a premium cost.

Table 3. WTP (percentage of price premium).

Variable	Media	Standard deviation	Minimal	Maximum
DAPR	16.34	8.40	1.16	29.07

Source: own elaboration based on NLogit results.

Table 4. Marginal effect of variables.

Variable	Marginal effect	Marginal effect in percent
PRIM	-0.02126419	-2.10%
EDAD	0.00673666	0.67%
DEP	-0.06854950	-6.62%
ING	0.13309328	14.23%
CONSU	-0.12725265	-11.94%

Source: own elaboration with NLogit results.

The *DEP* variable determined that, for each additional dependent in the household, the probability of paying more for differentiated pork meat decreases by 6.6%. The -2.1% of the *PRIM* variable indicates that, if the amount of the premium cost increases by 1%, the probability of paying it decreases by 2.10%. Finally, in the variable *EDAD*, for each year that the age of consumers increases, participants would be 0.7% more willing to pay a premium for antibiotic-free pork meat.

CONCLUSIONS

This study allowed us to know the preferences of pork consumers in the eastern State of Mexico, as well as the variables that most influence their decision-making when purchasing their meat. It was found that there would be a willingness to pay a premium for antibiotic-free pork meat.

Results allow us to assert that antibiotic-free pork meat would be in demand in the eastern State of Mexico. However, with the findings it is not possible to infer that pork producers or traders would have sufficient incentives to start production.

Other additional studies are needed to delve into issues of production costs to be able to make more solid statements. In addition, the incentive on the part of the demand is not enough to start with antibiotic-free meat production processes, since there is an overall ignorance on the part of consumers about the characteristics of the product they consume.

REFERENCES

- ACSAA (Asociación de Certificación de Sector Agropecuario Alimentario). 2021. La carne de cerdo alcanzó un precio por kilo de hasta 117 pesos al consumidor. ACSAA. <https://acsaa.com.mx/2021/06/25/la-carne-de-cerdo-alcanzo-un-precio-por-kilo-de-hasta-117-pesos-al-consumidor/>
- Aguilar JA. 2006. Carne de cerdo ¿es buena o mala? Revista del Consumidor. Entrevista con Cecilia Sommer, Confederación de Porcicultura Mexicana. Alimentación y Nutrición pp: 60–63. <http://www.ciap.org.ar/Sitio/Archivos/carne%20cerdo%20buena%20o%20mala.pdf>.
- Álvarez V, Rendón G, González V, Gómez J, Castillo A. 1989. Tamaño de muestra: procedimientos usuales para su determinación. Monografías y Manuales en Estadística y Cómputo 8 (2).
- Antonio-Estrada C, Kido-Cruz MT, Borrás-Enríquez OA, Alcántar-Vázquez JP. 2021. Disposición a pagar del consumidor de derivados de tilapia del Nilo (*Oreochromis niloticus*) en el estado de Oaxaca. Estudios Sociales 31 (58): 1–22. <https://doi.org/10.24836/es.v31i58.1127>
- Barrios MP. 2020. El consumo de carne de cerdo y sus beneficios nutricionales. *Porcicultura.com* Boletín digital (05 de octubre 2020). <https://www.porcicultura.com/destacado/El-consumo-de-carne-de-cerdo-y-sus-beneficios-nutricionales>

- Berges M, Casellas K. 2008. Disposición a pagar por atributos de calidad. Un estudio aplicado al agregado de nutrientes en la leche fluida. Comunicación presentada en XLIII Reunión Anual de la Asociación Argentina de Economía Política. <http://nulan.mdp.edu.ar/id/eprint/1030>
- Cabrer Borrás B, Sancho Pérez A, Serrano Domingo G. 2001. Microeconometría y decisión. Ediciones Pirámide: Madrid, España.
- Cartelle GM, Villacís JE, Alulema MJ, Chico P. 2014. De la granja a la mesa. Implicaciones del uso de antibióticos en la crianza de animales para la resistencia microbiana y la salud. *Revista Cubana de Alimentación y Nutrición* 24 (1): 129–139. <https://www.medigraphic.com/pdfs/revcubalnut/can-2014/can141k.pdf>
- Cerda A, García L, Tolosa F, García V. 2014. Preferencias y disposición a pagar por manzanas orgánicas en la Región Metropolitana de Santiago de Chile. *Revista de la Facultad de Agronomía de la Universidad del Zulia* 31 (2): 274–289. <https://produccioncientificaluz.org/index.php/agronomia/article/view/27160>.
- Cervantes LJO, Melo GE, Hernández OJ, Valdivia AR, Sandoval RF, González JA. 2020. Disposición a pagar por mezcal añejo en San Felipe, Guanajuato, México. *Acta Universitaria* 30: 1–11. <https://doi.org/10.15174/au.2020.2887>
- CMC (Consejo Mexicano de la Carne). 2021. Compendio estadístico 2021. <https://comecarne.org/wp-content/uploads/2021/05/Presentacio%CC%81n-pu%CC%81blica-Compendio.pdf>
- DOF (Diario Oficial de la Federación). 2010. Acuerdo por el que se determinan los lineamientos a los que estará sujeta la venta y dispensación de antibióticos. Secretaría de Salud (27 de mayo de 2010). https://dof.gob.mx/nota_detalle.php?codigo=5144336&fecha=27/05/2010#gsc.tab=0
- DOF (Diario Oficial de la Federación). 2018. Acuerdo por el que se declara la obligatoriedad de la Estrategia Nacional de Acción contra la Resistencia a los Antimicrobianos. Consejo de Salubridad General (05 de junio de 2018). https://dof.gob.mx/nota_detalle.php?codigo=5525043&fecha=05/06/2018#gsc.tab=0
- Doyle L. 2020. El camino hacia una producción de cerdos libre de antibióticos. BM Editores. Boletín digital (14 de agosto de 2020). <https://bmeditores.mx/porcicultura/el-camino-hacia-una-produccion-de-cerdos-libre-de-antibioticos/>
- Dunteman G, Ho M. 2004. An introduction to generalized linear models. Series: Quantitative Applications in the Social Sciences Num. 145. Sage Publications Inc. 88 p.
- FAO (Organización de las Naciones Unidas para la Alimentación y la Agricultura). 2022. Producción/Rendimiento de Carne, cerdo, fresca o refrigerada en mundo. <https://www.fao.org/faostat/es/#data/QCL/visualize>
- González GP, Valdivia AR. 2009. Valoración económica de servicios ambientales percibidos en Guanajuato y Silao. *Revista Mexicana de Economía agrícola y de los Recursos naturales* 2 (3): 163–178.
- Gujarati DN, Porter DC. 2010. *Econometría*. 5ª Edición. McGraw-Hill Educación/ Interamericana Editores: México, DF. 921 p.
- Hardin JW, Hilbe JM. 2018. *Generalized Linear Models and Extensions*. 4th Edition. Stata Press: College Station, TX, USA. 598 p.
- Haro L. 2020. Estudia IPN resistencia a los antibióticos por el consumo de carne. Debate. Entrevista a Dra. Ana Verónica Martínez Vázquez (23 de febrero de 2020). <https://www.debate.com.mx/salud/Estudia-IPN-resistencia-a-los-antibioticos-por-el-consumo-de-carne-20200223-0178.html>
- Hernández OJ, Trujillo MJ, Martínez DMA. 2019a. Disposición a pagar por productos orgánicos en Texcoco, Estado de México. *Revista Mexicana de Ciencias Agrícolas* 10 (7): 1685–1691. <https://doi.org/10.29312/remexca.v10i7.926>
- Hernández VMS, Valdivia AR, Hernández OJ. 2019b. Valoración de servicios ambientales y recreativos del Bosque de San Juan de Aragón, Ciudad de México. *Revista Mexicana de Ciencias Forestales* 10 (54): 100–117. <https://doi.org/10.29298/rmcf.v10i54.557>
- Hernández VMS. 2021. Disposición a pagar por atributos de la carne de cerdo con dos métodos de valoración. Tesis Profesional. Universidad Autónoma Chapingo DICEA-Economía Agrícola. <https://repositorio.chapingo.edu.mx/handle/123456789/1594>
- INEGI (Instituto Nacional de Estadística y Geografía). 2020. Población total, México, Texcoco (05 de octubre de 2020). <https://gaia.inegi.org.mx/scince2020/>
- Jaramillo VJ, Vargas LS, Guerrero RJD. 2015. Preferencias de consumidores y disponibilidad a pagar por atributos de la calidad en carne de conejo orgánico. *Revista Mexicana de Ciencias Pecuarias* 6 (2): 221–232. https://www.scielo.org.mx/scielo.php?pid=S2007-11242015000200007&script=sci_abstract#:-:text=El%20sobrepeso%20que%20los%20consumidores,Carne%20de%20conejo%3B%20Productos%20org%C3%A1nicos

- Jaramillo J. 2016. Preferencias del consumidor y disposición a pagar por el consumo de tortilla de maíz orgánico. Estudios Sociales. Revista de Alimentación Contemporánea y Desarrollo Regional. 25 (47): 145–161. <https://www.redalyc.org/articulo.oa?id=41744004006>
- Jaramillo VJL, Vargas LS, Rojas JLA. 2018. Valoración contingente y disponibilidad a pagar por atributos intangibles en carne de bovino. Revista Mexicana de Ciencias Pecuarias 9 (1): 14–31. <https://doi.org/10.22319/rmcp.v9i1.4376>
- Jaramillo-Villanueva JL, Córdova-Lázaro CE y Cordoba-Ávalos V. 2018. Willingness to pay for cultural attributes in handmade chocolates from the Chontalpa región, Tabasco, México. EARN–Economía Agraria y Recursos Naturales 18 (2): 53–73. <https://doi.org/10.7201/earn.2018.02.03>
- Labandeira X, León CJ, Vázquez MX. 2007. Economía Ambiental. Pearson Educación: Madrid, España. 376 p.
- Lugo SM, Valdivia AR, Monroy HR, Hernández OJ, Sandoval RF, Contreras CJM. 2020. Valoración económica de los servicios ambientales del Monte Tláloc, Texcoco, Estado de México. Revista Mexicana de Ciencias Forestales 11 (61): 176–195.
- Lusk JL, Norwood FB, Pruitt JR. 2006. Consumer demand for a ban on antibiotic drug use in pork production. American Journal of Agricultural Economics 88 (4): 1015–1033. <https://www.jstor.org/stable/4123543>
- Mendieta JC. 2000. Economía ambiental. Economía del Medio Ambiente–39404 VP. Facultad de Economía, Universidad de Los Andes: Bogotá, Colombia. 294 p.
- Osorio MJD, Correa RFJ. 2009. Un análisis de la aplicación empírica del método de valoración contingente. Semestre Económico 12 (25): 11–30. <https://www.redalyc.org/articulo.oa?id=165013651001>
- Redacción Interempresas. 2020. La carne de cerdo está libre de antibióticos. Canales Sectoriales (18 de noviembre de 2020). <https://www.interempresas.net/Industria-Carnica/Articulos/319259-carne-cerdo-esta-libre-antibioticos-cumple-controles-seguridad-alimentaria-mas-exigentes.html>
- Sandorf ED, Campbell D, Hanley N. 2017. Disentangling the influence of knowledge on attribute non-attendance. Journal of Choice Modelling 24: 36–50. <https://doi.org/10.1016/j.jocm.2016.09.003>
- SIAP (Sistema de Información Agroalimentaria y Pesquera). 2021. Carne en canal de porcino. http://infosiap.siap.gob.mx/repoAvance_siap_gb/pecAvanceProd.jsp
- Train KE. 2014. Métodos de elección discreta con simulación. Cambridge University Press, 2a Edición. Trad: Carlos Ochoa. OL 320 p.
- Tudela J, Leos J. 2017. Herramientas metodológicas para aplicaciones del método de valoración contingente. Universidad Autónoma Chapingo: México. CIESTAAM Serie: Metodologías y herramientas para la investigación No. 3. 122 p. <https://ciestaam.edu.mx/publicacion/herramientas-metodologicas-aplicaciones-del-metodo-valoracion-contingente/>
- Vega-Sánchez V, Barba-León J, González-Aguilar DG, Cabrera-Díaz E, Pacheco-Gallardo C, Orozco-García AG. 2020. Resistencia antimicrobiana de *Salmonella* spp aisladas de canales de cerdo obtenidas de dos tipos de rastros en Jalisco, México. Revista Mexicana de Ciencias Pecuarias 11 (4): 1004–1015. <https://doi.org/10.22319/rmcp.v11i4.5386>
- Valdés-Castro YR, Valdivia-Alcalá R, Pérez-Armendáriz B, Mayett-Moreno Y. 2021. Experimentos de elección: preferencias declaradas de alimentos orgánicos para una política de inocuidad alimentaria. Agricultura Sociedad y Desarrollo 18 (1): 1–24. <https://dialnet.unirioja.es/servlet/articulo?codigo=7956238>
- Valdivia-Alcalá R, García-Ávalos E, López-Santiago M, Hernández-Ortiz J, Rojano-Aguilar A. 2011. Valoración económica por la rehabilitación del río Axtla, S.L.P. Revista Chapingo Serie Ciencias Forestales y del Ambiente 17 (3): 333–342. <https://doi.org/10.5154/r.rchsc/ fa2010.07.045>
- Vásquez LF, Cerda UA, Orrego SS. 2007. Valoración económica del ambiente. Fundamentos económicos, econométricos y aplicaciones. Thomson Learning Inc: Buenos Aires, Argentina. 368 p.