

EATING RAW MEAT POSES HEALTH RISKS, BETTER HYGIENE IN MARKETS WILL REDUCE RISKS, BUT CANNOT ELIMINATE THEM

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The meat sold in Peruvian food markets may have the presence of pathogenic microorganisms that represent a risk to people's health. This risk can be reduced with better hygiene practices and investments in the markets. The pandemic showed that improvements can be achieved, but they are expensive to implement and maintain over time. Consumers showed a willingness to pay a higher price for healthy stall meat. However, for market stall certification to be credible, greater vigilance and training by governments and local authorities, and greater involvement of vendor associations, is needed.

1. 1. It is suspected that in Peru the presence of *Salmonella* spp. it could be throughout the meat production and distribution chain.

Salmonella spp is a microorganism in the intestine of animals. The problem arises when people accidentally ingest it with food. Salmonella poses a health hazard. In Latin America, the number of cases of acute diarrhea caused by Salmonella is three times higher than in Europe and Central Asia (GDD, 2017).

Salmonella control represents a challenge because contamination can occur at different stages of the production and supply chain, from the farm to the consumer's plate. At each stage the number of microorganisms can increase, especially due to temperature and humidity. Salmonella can contaminate other meats and food products when there is contact with surfaces, utensils or water contaminated with the bacteria. Therefore, the control of Salmonella requires coordinated action throughout the production and supply chain.

The research carried out within the framework of the GICCAP project (Ho-Palma et al., 2022) in supply markets of three cities showed that there was a high presence of Salmonella in the raw chicken cuts analyzed. The presence of Salmonella in pork was lower, but it is still worrisome.

2. Multiple entry points to increase food safety

One of the entry points to reduce the risks of meat contamination is surveillance during transport and slaughter. SENASA, with the support of the central government, is responsible for monitoring the established norms. Unfortunately, a large part of the country's slaughterhouses are in a suboptimal state and do not have the required infrastructure to prevent the meat from being contaminated with pathogens during or after slaughter. Most of the meat is transported from the slaughterhouse to the points of sale in multi-use vehicles without refrigeration.

Another entry point is to improve hygiene in food markets and warehouses. Local governments and DIGESA (MINSa) are the public institutions responsible for ensuring compliance with basic health standards in the markets. Supported by resources from the Municipal Management Incentive Plan, training activities are organized and a strategy is implemented to achieve healthy markets and stalls. There is a list of measures that markets must comply with in order for municipalities to obtain the transfer of the MEF incentive.

3. The pandemic showed that it is possible to improve hygiene practices in markets

During the pandemic, the market incentive plan was adapted to promote measures for the prevention and containment of COVID-19. Most of the markets and stalls managed to comply with hygiene and social distancing rules. Above all, the markets managed directly by the municipality adopted the regulations for the adaptation of the food environments and the use of masks more quickly. In the absence of a source of financing to pay for these adaptations, in addition to their more complex collective decision-making system, the associative markets had lower compliance than the municipal markets. However, in many places these vendor associations managed to organize themselves and their members contributed to pay for the adaptations (Ton, Espinoza and Fort, 2023).

4. *The challenge is not to go back to the pre-COVID situation*

After the COVID-19 pandemic, most of these protection and hygiene measures were discontinued, such as the use of masks and intensive disinfection of utensils and surfaces. However, the experience of the pandemic has shown that changes in vendor practices are possible. And some of these measures could remain. For example, in several markets the water and drainage system has been improved.

Water is important in cleaning stall surfaces where meat is cut or displayed. However, and contrary to what many think, the installation of water can also increase the risk when the cleaning is suboptimal. In the GICCAP investigation, a relationship existed between the incidence of *Campylobacter* spp. and the stall's access to running water. The data suggest that stalls where cleaning was done using two buckets—one bucket for clean water and another bucket for dirty water—had less *Campylobacter* contamination than stalls where cleaning was done using tap water. For this reason, it is important that vendor training prioritizes good meat handling and cleaning practices.

5. *Two out of three consumers found Salmonella in raw chicken meat bought in the markets, whether this meat is frozen or not.*

The microbiological risks depend on the type of meat purchased in the markets. Chicken meat has a higher risk of *Salmonella* contamination than pork meat. Two out of three consumers found *Salmonella* in chicken meat bought in the markets, whether this meat is frozen or not. *Salmonella* was found in pork in one of every three purchases. The cold chain seems to be effective in reducing the risk in the case of pork. The difference in the presence of pathogens between chicken and pork meat could be associated with the type of slaughterhouse, where the beef and pork went through slaughterhouses, with a minimum of good practices and sanitary control, while the slaughter of chickens was largely done informally. Further research is needed to test this hypothesis. The consumer should be aware of these risks and always cook meat thoroughly. For example, cooking meat for 20 minutes eliminates the risk of *Campylobacter* transmission by 50 to 90% (Martín et al, 2012).

6. *Consumers are more willing to pay for meat from healthy stalls*

The incentive program for municipal management, promoted by the Ministry of Economy and Finance, seeks to certify "healthy stalls" in supply markets. Obviously, to improve their positions and achieve the seal, sellers must incur expenses. With this in mind, the GICCAP project carried out a study to investigate the willingness to pay for meat certified as safe for health in market stalls in three cities in the country.

The study found that consumers were willing to pay an amount between 5 and 7% more per kilo of meat in certified market stalls. This suggests that the certification of healthy jobs could be a mechanism to finance part of the investments for the improvement of jobs.

However, the study also identified that the government and, in particular, the market authorities, must play an active role to improve the governance and health conditions of the supply markets. Without effective control, consumers quickly lose confidence in certifications (Grace, 2015).

7. *Biological analysis of mesophiles can help in surveillance*

Surveillance could focus on the implementation of cleaning practices in the stalls. The training, surveillance and control could be accompanied by biological analysis. Unfortunately, the detection of Salmonella and Campylobacter requires high investments of resources and time and precise procedures that are not within the reach of local governments. Therefore, instead of investing in the detection of these, it is better to use the incidence and load of mesophiles as a risk indicator. Analysis of the presence and load of mesophiles is simpler and less expensive. A high incidence of mesophiles is related to a high probability of Salmonella spp. and Campylobacter spp. in the meats. In the GICCAP research, a difference could be observed between markets with better conditions compared to markets with deficient conditions (Ho-Palma et al., 2022).

Policy Recommendations

1. Guaranteeing the safety of food in general, and of meat in particular, requires a coordinated action plan that goes beyond the closure of stalls or markets, and that addresses the entire food supply chain: from production, slaughter, transportation, marketing and consumption of the product. The presence of pathogenic agents in meats may not be exclusive to markets and may extend to other types of sales establishments.
 2. The results of the study suggest that the training of vendors by DIGESA, SENASA and the municipalities should prioritize meat handling and cleaning practices because it is a low-investment measure and one with a potentially high impact in reducing the risk of contamination of meat in the stall.
 3. The certification of healthy stalls, where merchants can charge a premium price, could be a way to finance part of the investments that vendors must make to continuously improve their stalls and keep their equipment and infrastructure in good condition.
 4. The surveillance and control of markets by municipal authorities is essential to improve the internal governance of markets with respect to food safety. For this, it is critical to strengthen the Sanitary Self-control Committees.
 5. Associative markets present greater challenges to improve market infrastructure and stalls to ensure greater food safety. Their collective and complex decision-making systems, and the absence of financing sources, meant that these markets had less compliance with the measures to prevent and contain COVID-19 than municipal markets. The authorities should provide complementary support for these types of markets.
 6. Although better hygienic handling of meat in markets can reduce the load of microorganisms, this cannot prevent their incidence. The greatest way to reduce the risk is for the consumer to thoroughly cook the meat and avoid using their meat cutting utensils to prepare other foods such as salads.
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ABOUT THE GICCAP INVESTIGATION

Since 2019, a consortium of universities and research institutes, led by the Royal Veterinary College, the Universidad Peruana Cayetano Heredia, the Universidad Nacional Mayor de San Marcos, the Grupo de Análisis del Desarrollo (GRADE) and the Institute of Development Studies, has carried out a multidisciplinary project, supported by funds from the UKRI in the United Kingdom and PROCIENCIA-CONCYTEC in Peru (Newton-Paulet Fund).

As part of this project, "Governance and Safety in the Peruvian Meat Chain" (GICCAP), samples of different cuts of meat from six markets in three provinces of the country (Huancayo, Huaral and Tumbes) have been evaluated. Results of biological research on *Salmonella* and mesophiles used in this summary are in Ho et al. (2022). The results regarding *Campylobacter* are still preliminary. The social research included interviews and surveys of vendors and consumers in the same markets where the microbiological analysis was carried out. In addition, during COVID-19, compliance with hygiene and social distancing measures was monitored in nearly 400 supply markets in the country (See Ton, Espinoza and Fort 2023).

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