

Antibiotic Resistance of *Salmonella* isolates recovered from beef cattle from Honduras, Mexico and the United States of America

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Introduction

Antibiotic resistance is defined as the capacity of a microorganism to oppose the antibiotics effects, thus reducing the effectiveness of the antibiotics to prevent infections (1). Multidrug-resistance is defined as the resistance of a microorganism to 3 or more antibiotic classes (MDR) (3). There are many possible factors contributing to antibiotic resistance in microorganisms. Approximately 50% of all antibiotic use occurs in animal production (7). This use is one of the contributing factors to the development of antibiotic resistance and to the transmission of this to animals and humans (6). *Salmonella* species are known contaminants of food and animal products and they are also known to develop resistance to antibiotics and cause illness in humans (5). Antibiotic resistance has impacted public health because it can lead to higher mortality rates, higher medical costs, and an increase in the duration of illnesses, causing limited options for the treatment of illnesses (4). Good agriculture practices, good manufacturing practices, consumer behavior, and microbiological inspections are some of the factors that can prevent the development of resistant *Salmonella* infections (8).

Objectives

➤ To determine the antibiotic susceptibility profiles of *Salmonella* isolates from Honduras, Mexico, and United States and to compare resistance patterns within sample type and among countries.

Materials and Methods

✓ Samples and Countries

- Honduras: Hides (n= 7) and retail beef (n=28)
- Mexico: Hides (n=30) and retail beef (n=45)
- United States: Hides (n=28) and carcass (n=28)

✓ Microbial Analysis

- *Salmonella* isolates were collected and confirmed in a previous study.
- *Salmonella* isolates were streaked on blood agar plates and incubated at 37 °C for 18-20 h.
- Three well-isolated colonies were transferred into a sterile water tube to obtain a desired cell density.
- An aliquot of 10 µl of the cell suspension was transferred into Mueller-Hinton broth and mixed.
- Sensititre® Standard plates CMV2AGNF (Trek Diagnostic System) were inoculated with 50 µl of the cell suspension, and incubated at 35°C for 18 to 24 h.
- Susceptibility patterns were evaluated using SWIN ® software(Thermo Fisher Scientific version 3.3)

✓ Statistical Analysis

- To allow for a binary classification of data epidemiological breakpoints following CLSI guidelines were used.
- Prevalence and susceptibility were descriptively analyzed using pro freq SAS (SAS version 9.3; The SAS Institute, Cary, NC)

✓ Antibiotics tested:

FOX	Cefoxitin	GEN	Gentamicin
AZI	Azithromycin	NAL	Nalidixic acid
CHL	Chloramphenicol	XNL	Ceftiofur
TET	Tetracycline	FIS	Sulfisoxazole
AXO	Ceftriaxone	KAN	Kanamycin
CIP	Ciprofloxacin	AMP	Ampicillin
AUG2	Amoxicillin/clavulinic acid 2:1	STR	Streptomycin
SXT	Trimethoprim/ sulfamethoxazole		

Results

Figure 1. Frequency of pansusceptible *Salmonella* isolates by sample type and country

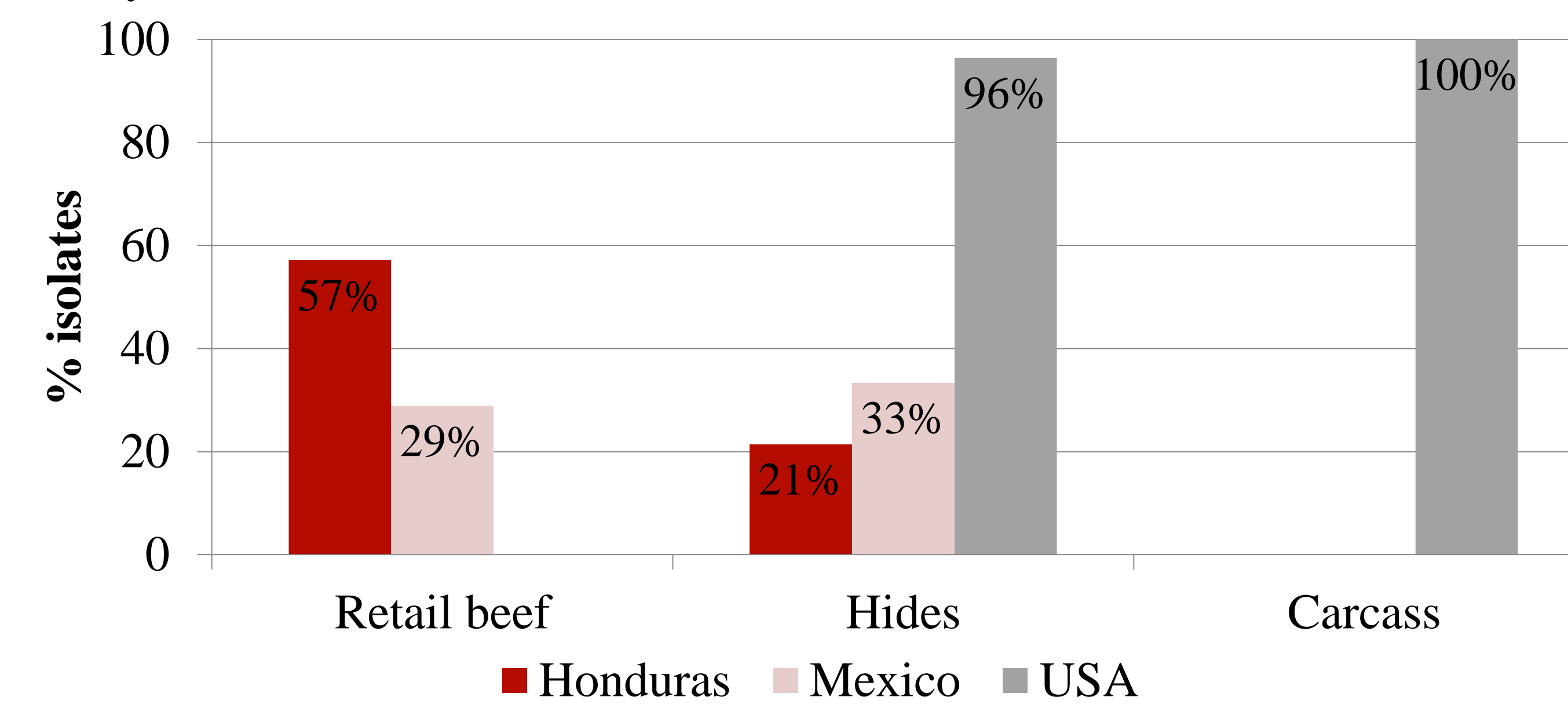


Figure 2. Resistance phenotypes profiles in Honduras, Mexico and United States

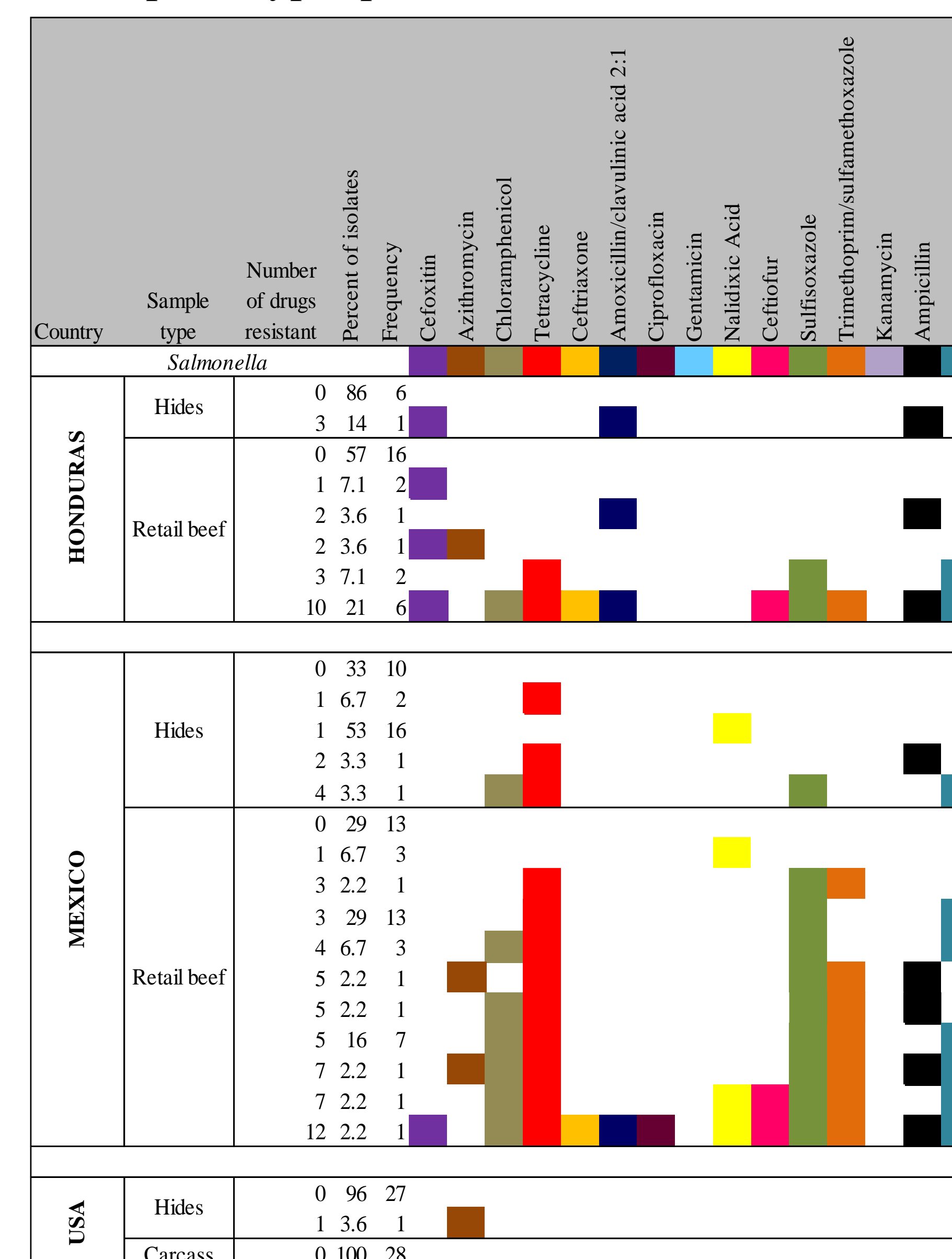
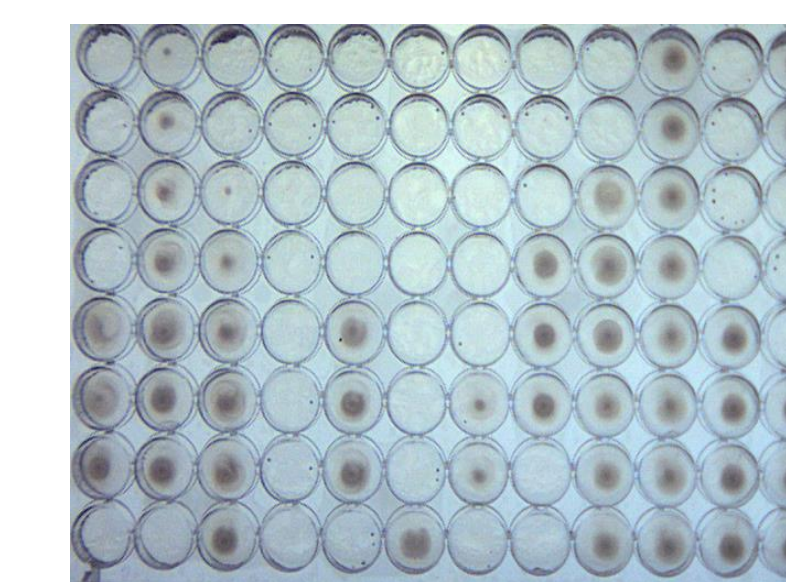


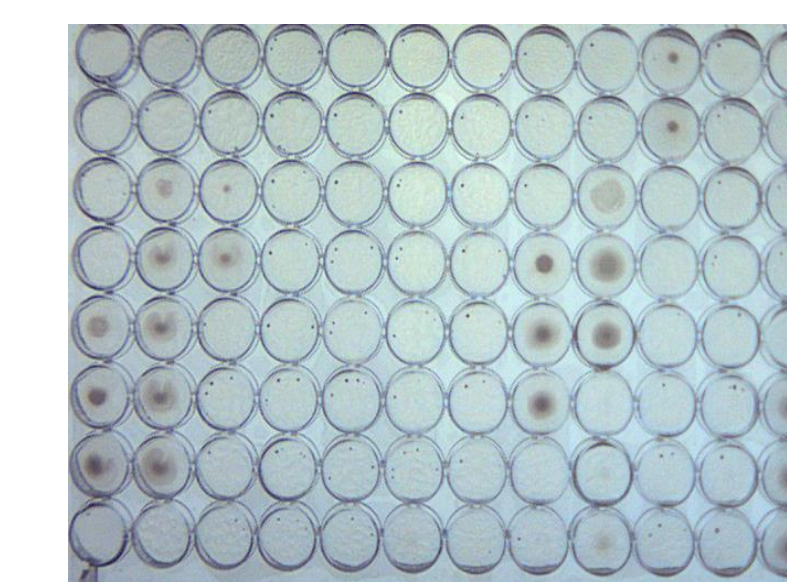
Table 1. Frequency of resistance in Honduras, Mexico and United States

Country	Type	n	Resistance to ≥ 3 antibiotics	ACSSuT* (only)	MDR-AmpC**
HN	Hides	7	Yes (1)	No	No
	Retail beef	28	Yes (8)	Yes (6)	Yes (6)
MX	Hides	30	Yes (1)	No	No
	Retail beef	45	Yes (29)	Yes (2)	Yes (1)
USA	Hides	28	No	No	No
	Carcass	27	No	No	No

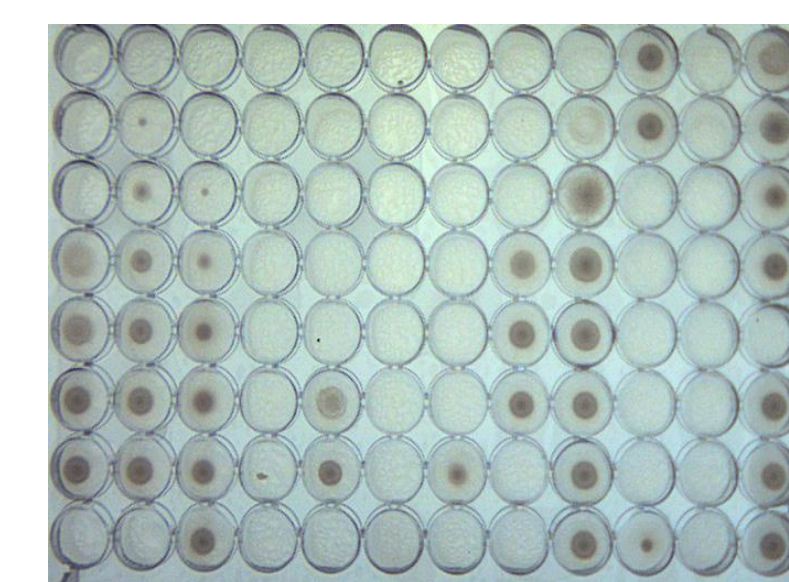
*ampicillin+chloramphenicol+streptomycin+sulfamethoxazole+tetracycline ; **ACSSuT+ceftiofur+augmentin.



Mexico: Retail beef



USA: Carcass



Honduras: Retail beef

Relevance

In Honduras and Mexico, *Salmonella* on the hides and carcasses of cattle can potentially lead to contamination of retail meat products. Monitoring antibiotic resistance, particularly, multidrug-resistance in samples of cattle origin is an important public health concern due to the incidence of multi-drug resistant *Salmonella* infections in these countries(5). Pre- and post-harvest intervention strategies in addition to inspection standards need to be implemented to avoid meat product contamination and the spread of antibiotic resistance within and between countries.

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