

PRESENCE OF *SALMONELLA ENTERITIDIS*, SEROTYPE AGONA, IN PERU¹

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The Isolation of S. enteritidis, serotype Agona, from Peruvian food handlers and fish meal, as reported below, provides information relating to the worldwide propagation of this disease agent. It also clearly demonstrates a need for investigation of how the fish meal contamination occurs.

Introduction

There were no reported isolations of *Salmonella enteritidis*, serotype Agona, in Peru before 1971. Moreover, the serotype appears to have been only rarely isolated elsewhere, from either human or non-human sources, prior to 1969.

However, in 1970 and 1971 the number of reported isolations grew rapidly. In 1970 Austria, Finland, Hungary, Italy, and Yugoslavia all reported isolation of the Agona serotype from man for the first time (1), and in 1971 the organism was found in specimens from over 700 human cases in the United Kingdom alone, making it the second most common *Salmonella* serotype isolated from human cases there (2). The serotype has also become increasingly common in the United States—being found in 27 states by the end of 1972, at which point it was the eighth most commonly isolated *Salmonella* serotype (3). The clinical picture produced by the organism is typical of gastroenteritis.

The first isolations of the Agona serotype from non-human sources were made from fish meal. Peru is the world's largest exporter of this product, supplying roughly 60 per cent of the world market in recent years, and it was in fact from Peruvian fish meal that two importing countries, Israel and the Kingdom of Netherlands, reported making their first isolations of the Agona serotype in 1969 (3).

The purpose of the present paper is to report on our experience with the Agona serotype in Peru, and to provide one more significant illustration of the important role that foodstuffs contaminated with *Salmonella* play in the etiology of human intestinal infections.

Materials and Methods

Since establishment of the National Enterobacteria Reference Laboratory in 1971, we have been engaged in developing a program for serotyping *Salmonella*. This program includes collecting samples of suspected *Salmonella* infections from all hospitals in Lima and from other bacteriologic diagnosis centers. The materials thus received have included *Salmonella* samples obtained from human beings, from food intended for human consumption, and from foodstuffs used to feed animals—samples of fish meal being included among the latter.

The methodology used for primary identification has been in accord with established procedures (4), and the technique followed for serotyping has been that recommended by Edwards and Ewing (5). Through the kind cooperation of Dr. George J. Hermann, the identity of the strains isolated has been confirmed at the Enterobacteriology Section of the United States Center for Disease Control in Atlanta, Georgia.

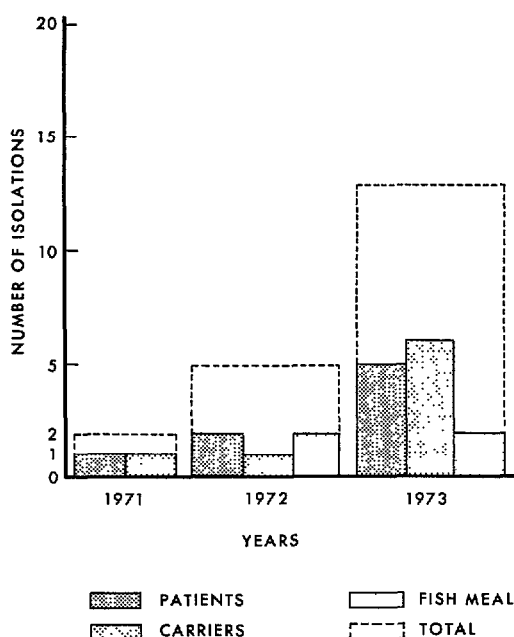
Results

Figure 1 shows the number of cultures found positive for the Agona serotype in 1971, 1972 and 1973. In 1971 two positive cultures were received, one from a case of gastroenteritis in a 15-month-old boy and the other from a

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FIGURE 1—Cultures positive for *S. enteritidis*, serotype Agona, obtained from different sources (1971-1973).



carrier. In 1972 five such cultures were received, one from a pediatric inpatient at Lima's San Bartolomé Hospital, another from an adult inpatient at the Hospital Central del Empleado, the third from a carrier, and the last two from fish meal. The two carriers were persons engaged in food handling.

In 1973 a substantially larger number of serotype Agona isolations, thirteen in all, were obtained. The sources of the positive samples were as follows: five came from sick persons (two of them in Arequipa and three in Lima), six came from carriers (including four from Chosica, one from Chimbote, and another from Chiclayo), and the remaining two were obtained from fish meal. The known distribution of serotype Agona in Peru up to the end of 1973 is shown in Figure 2.

In all, from 1970 through 1973 we confirmed that 52 bacterial cultures obtained from fish meal contained some type of *Salmonella*. Serotyping of these cultures (see Figure 3) indicated that nine (17 per cent) belonged to

serotype Anatum, seven each (13 per cent) belonged to serotypes Oranienburg and Tennessee, six (11.5 per cent) belonged to serotype Derby, five (9.7 per cent) belonged to serotype Havana, four each (7.7 per cent) belonged to serotypes Agona and Thompson, three each (5.8 per cent) belonged to serotypes Infantis and Bredeney, two (3.9 per cent) belonged to serotype Senftenberg, and one each (1.9 per cent) belonged to serotypes Newport and Worthington.

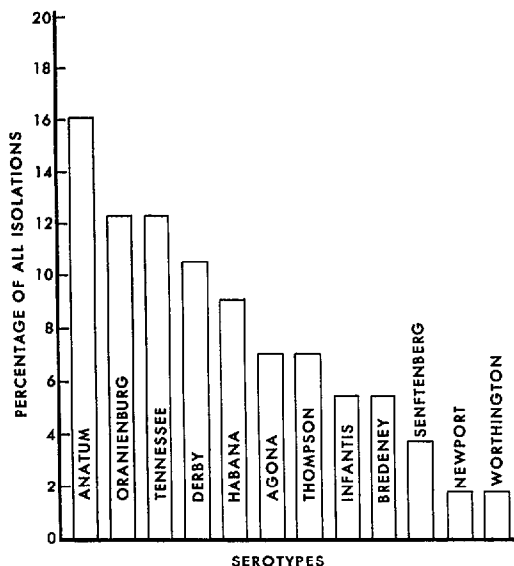
Discussion

To sum up, our experience with serotype Agona in Peru dates from 1971, when two cultures were obtained from human infections. Since then the serotype has been isolated from

FIGURE 2—Geographic distribution of samples taken from fish meal and from humans in Peru that were positive for serotype Agona, 1971-1973.



FIGURE 3—*Salmonella* serotypes isolated from fish meal samples received by the National Enterobacteria Reference Laboratory in 1972 and 1973.



both children and adults suffering from gastroenteritis, but the precise source of the contamination has not yet been established.

Fish meal, which has been positively identified as the general source of serotype Agona infections (6, 7), is used in animal feed because of its high (60-80 per cent) protein content. Animals fed on fish meal do not often provide a direct vehicle for human infection because the temperature at which their flesh is cooked destroys any vegetative form of bacterial life. However, animals which reach the housewife's kitchen in an infected state also contaminate utensils—such as chopping boards, knives, etc.—creating new potential sources of infec-

tion. If proper care is not taken with such utensils, they can pass the organisms to other foods which are eaten raw (e.g. many fruits and vegetables), and these in turn can pass the infection on to man. The chances for infection are enhanced by inadequate refrigeration and by storage of leftovers for later consumption—practices which give the bacteria a better opportunity for multiplication.

Our experience shows that serotype Agona has been isolated not only from fish meal and from sick persons, but also from apparently healthy persons. This strongly suggests that man plays a significant role as a reservoir of the infection. However, the immediate source of most Agona infections are domesticated fowl, which consume the large quantities of fish meal that go into poultry feeds. In the United States, for example, 90 per cent of all fish meal is used for this purpose, most of the remaining 10 per cent being used in making feed for hogs (7).

The discovery of gastrointestinal infections caused by serotype Agona in various countries has served to demonstrate the importance of fish meal as a source of this particular *Salmonella* infection (6,7). Nevertheless, this serotype accounts for only part of the problem. Other *Salmonella* serotypes such as Anatum, Oranienburg, and Derby are quite frequent contaminants of fish meal, and according to our local experience they also occur frequently in human infections.

These considerations make it imperative to conduct an investigation aimed at determining how the fish meal becomes contaminated. This knowledge is required in order to prescribe measures that will help to safeguard both the fish meal industry and public health.

SUMMARY

Since 1971, serotyping of *Salmonella* specimens by the National Enterobacteria Reference Laboratory has enabled us to obtain information about the presence of *S. enteritidis*, serotype Agona, in Peru. This serotype is widely

distributed in the country, isolations having been confirmed in cities as far apart as Chiclayo in the north and Arequipa in the south. It has also gained increasing prominence outside Peru, having become one of the more common

Salmonella serotypes currently isolated from human cases in both the United Kingdom and the United States.

In Peru, serotype Agona has been isolated from patients with symptoms of gastroenteritis, from apparently healthy persons, and from fish

meal. The latter has been identified as a worldwide source of propagation for this serotype, strongly indicating the need for bacteriologic investigation to determine how this fish meal contamination occurs.

ACKNOWLEDGMENTS

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