



Federal Office of
Consumer Protection
and Food Safety



 **BfR**
Bundesinstitut für Risikobewertung

Zoonoses Monitoring 2015

Summary of Findings and Conclusions



***Salmonella* spp.**

There were no findings of *Salmonella* spp. in samples of oil seeds taken from central oil mills, while samples of extraction meals, which by sample-taking provisions, were to originate from the same seed lots, had 1.1% of findings. This shows that feeding extraction meals to food-producing animals may be a path for *Salmonella* spp. entering the food chain. It makes clear that a high degree of diligence is due in the processing of feed, as contamination or re-contamination of extraction meals with *Salmonella* spp. cannot be precluded, in spite of the hot pressing procedure applied in central oil mills.

Young pigs from piglet farms carried *Salmonella* spp. more often than breeding sows, with 10.3% of the young pigs' faecal samples found positive with *Salmonella* spp., while only 5.6% of the sow faecal samples were positive. This shows that *Salmonella* spp. colonisation of porcines starts as early as in the breeding farms, and that it is important to try and control *Salmonella* spp. there, in order to prevent their entry in fattening farms through infected piglets. In caecal samples taken of fattened pigs at the slaughterhouse, *Salmonella* spp. was detected in 6.1%. The portion of positive samples was lower in pigs from category-I fattening farms (3.5% positives in caecal samples) than in pigs from category-II fattening farms (12.2% positives). This supports the serological categorisation of fattening farms under the Regulations to reduce the spread of *Salmonella* spp. through slaughter pigs (abbreviation: SchwSalmoV), showing that it is in relation with the bacteriological findings in slaughter pigs from these farms. At the same time it shows that even pigs of category-I farms bring a certain risk of contamination of the meat during slaughter, because here, too, occurrence of *Salmonella* spp. infections must be expected. Comparable findings were already made in the 2011 Zoonoses Monitoring. The findings in pig carcasses in 2015 (4.5% positive samples) and fresh pork (0.4% positive samples) are in the same range as in the 2011 monitoring programme. In spite of the relatively low rate of contamination with *Salmonella* spp., porcine meat is an important source of human infection with *Salmonella* spp., because of quite common raw consumption, such as in the form of minced seasoned pork.

No *Salmonella* spp. was found in bulk milk of sheep and goat sampled at dairy farms. Raw milk cheese of sheep and goat, in contrast, was positive with *Salmonella* spp. in 0.3% of the samples. These findings corresponded with the test results in bulk milk and raw milk cheese of cows obtained in previous years' zoonoses monitoring programmes, confirming that raw milk cheese is a possible source of human infection with *Salmonella* spp.

In fresh beef, the detection rate of *Salmonella* spp. was 0.4%. Previous monitoring programmes had no *Salmonella* spp. findings in fresh beef at all. Although the contamination rate is fairly low, raw consumption as, for instance, minced meat or steak tartare, is a possible source of human infection with *Salmonella* spp.

Raw shrimps are also a possible source of human infection with *Salmonella* spp., with 0.5% of the samples taken at retail level found positive. The cooking time of shrimps being usually very short, one cannot readily assume that the temperature reached is sufficient to kill all pathogens. People with limited immune competence (infants and small children, elderly and immunosuppressed people as well as pregnant women) should abstain from eating raw shrimps.

One sample of cut, ready-packed salad vegetables (corresponding to 0.3% of all salad vegetable samples) was contaminated with *Salmonella* spp. Cut and ready-packed lettuce which is contaminated with *Salmonella* spp. is rated as harmful to health by law, and must not be placed on the market.

The *Salmonella* isolates obtained from the pork meat chain showed the lowest rates of resistance in breeding sows (43.5%). This is linked with the frequent findings of S. Derby in breeding sows, that serovar being less frequently resistant or multi-resistant than S. Thyphimurium, which accounted for the majority of findings in young and fattened pigs. 86.2% of the isolates obtained from young pigs and 82.6% of isolates obtained from the ceaca of fattened pigs at the slaughterhouse were resistant towards at least one of the tested anti-biotic substances. The resistance rate was thus roughly the same as the rate found in fattening pig stocks in the 2011 Zoonoses Monitoring (88.1%). *Salmonella* isolates obtained from pig carcasses, in contrast, were found with a higher resistance rate in the 2015 Zoonoses Monitoring (75%) than in the 2011 monitoring (45.5%). A positive aspect was that none of the tested isolates was resistant towards 3rd-generation cephalosporins or colistin.

***Campylobacter* spp.**

Campylobacter spp. was found in 1.0% of bulk milk samples of sheep and goat drawn on farm level. This was roughly the same rate of findings as with bulk milk of cows in previous years' zoonoses monitoring programmes, when 1% to 2% of samples had been positive. It makes clear that raw milk is a potential source of *Campylobacter* infections in humans.

Both fattened pigs and fattened calves/young bovines, sampled at the slaughterhouse, were very frequently found colonised with *Campylobacter* spp., with 73.2% and 64.2% positive caecal samples. In fresh pork meat, in contrast, *Campylobacter* spp. was detected only in one single sample (0.2%), and fresh beef had no finding at all. The zoonoses monitoring programmes of the previous few years also produced only very rare findings of *Campylobacter* spp. in pork and beef (0.2% to 0.5% of samples). The findings have confirmed that, though fattened pigs and fattened calves/young bovines are a reservoir of *Campylobacter* spp., these pathogens are not carried into meat production to a considerable extent. So, fresh pork and beef are of minor importance as transmitters of *Campylobacter* spp.

None of the raw shrimps samples at retail level was found positive with *Campylobacter* spp., so that raw shrimps may be assumed to pose a fairly low risk of human infection with this pathogen.

As in previous years, isolates of *Campylobacter coli* displayed higher resistance rates throughout than isolates of *Campylobacter jejuni*. Porcine isolates of *Campylobacter coli* had lower resistance (42.8%) than isolates obtained from fattening calves (87.0%), in particular against the fluoroquinolone substance ciprofloxacin. This is probably attributable to the more frequent use of fluoroquinolones in bovines, compared to porcines. The resistance rate in *C. jejuni* isolates obtained from fattening calves and young bovines (83.9%) corresponds to that found in the 2012 Zoonoses Monitoring (83.6%).

Listeria monocytogenes

Bulk milk of sheep and goat sampled at dairy farms was found positive with *Listeria monocytogenes* in 1.9% of the samples. In previous years' programmes, cow bulk milk sampled was found positive with *Listeria monocytogenes* in 3.5% to 4.6% of samples. A quantifiable finding of *Listeria monocytogenes* was made in one sample (0.3%) of raw milk cheese of sheep and goat. With 570 cfu/g, that finding was rated as posing a potential health risk to humans. In the 2011 Zoonoses Monitoring, there was even one much higher finding of *Listeria monocytogenes* in soft and semi-hard cheese, which at that time was 6.2×10^3 cfu/g. These findings suggest that non-heat-treated raw milk and raw milk cheese should not be consumed by sensitive consumer groups, such as small children, elderly and immunodeficient people, or pregnant women.

In raw shrimps sampled at retail level, *Listeria monocytogenes* was detected in 2.2% of the samples. This shows how important it is to sufficiently heat shrimps, in order to kill pathogenic germs before consumption.

One sample (2.0%) of cut and packaged salad vegetables on retail was contaminated with *Listeria monocytogenes*. In the 2012 Zoonoses Monitoring, too, 3.4% of the salad vegetables sampled at primary farms, and 2.6% of the samples taken at retail, were contaminated with *Listeria monocytogenes*. However, the actual quantitative contamination levels were fairly low, being a maximum 20 or 60 cfu/g, respectively, which is normally not a health hazard with humans. Still, the humid environment of film bags of mixed, cut lettuce promotes the growth of present *Listeria*, rendering this food unsuitable for sensitive consumers, such as small children, elderly and immunodeficient people, and pregnant women.

Verotoxin-forming *Escherichia coli* (VTEC)

Bulk milk of sheep and goat sampled at dairy farms was contaminated with VTEC in 7.3% of cases, which was significantly more than cow bulk milk sampled under previous zoonoses monitoring programmes. On these previous occasions, cow milk had VTEC contamination rates between 1.5% and 3.6%. The VTEC detection rate of raw milk cheese of sheep and goat was 0.7% and so corresponded to the rates found in cheeses of raw cow milk, which was 0.6%, both in firm slicing cheese and in soft and semi-hard cheeses of raw cow milk. The findings confirm that non-heat-treated, raw milk and raw milk products of sheep and goat also pose a risk of human infection with VTEC. This all the more as some of the VTEC isolates were found with O-groups known to be frequent causes of EHEC infections and the haemolytic uraemic syndrome.

The results of tests in the fattening calves/young bovines food chain for VTEC presence ranged at about the same level as in previous years' zoonosis monitoring programmes. VTEC was found in 25.7% of the ceacal samples taken of fattening calves and young bovines at the slaughter house, and in 0.9% of fresh beef sampled at retail level. The results confirm that fattening calves and young bovines are frequent hosts of VTEC, and a potential source of VTEC contamination of fresh meat.

Samples of cut leaf lettuces were not found with VTEC. In contrast to that, leaf and head lettuces (not cut) sampled at primary farms in the framework of the 2012 Zoonoses Monitoring was found contaminated with VTEC in 1.3% of the samples.

VTEC isolated from tank milk samples of sheep and goat milk showed a low rate of resistance only of 5.9%. The VTEC isolated from fresh beef all were sensitive to the anti-biotic substances tested. In contrast to that, more than half of the VTEC isolates obtained from fattening calves and young bovines were resistant to at least one of the anti-biotic substances tested, which reflects the frequent use of antibiotics in these animals.

Methicillin-resistant *Staphylococcus aureus* (MRSA)

MRSA occurs frequently in the fattening pig food chain. 26.3% of the sock samples taken in the sows' FE were positive with MRSA. The MRSA detection rate in sock samples taken in the young pigs raising area even were significantly higher, namely 41.3%. This shows that young pigs sold-on pose a risk of MRSA being transferred onto the fattening farms. Pig carcasses and fresh meat were contaminated with MRSA to 20.2% and 13.1%, respectively. The results of tests in fresh pig meat correspond with the results obtained in the 2009 Zoonoses Monitoring, when 11.7% of the fresh pig meat samples were positive with MRSA.

Consumption or handling of food contaminated with MRSA is not linked to a higher risk of being colonised or infected with these bacteria, according to the current state of knowledge (<http://www.efsa.europa.eu/de>). Humans with frequent contact with animal stocks, such as farmers or veterinarians, however, have an increased risk of being colonised with the bacteria. Only in very rare cases, however, hosting farm animal-associated MRSA seems to result in serious disease symptoms.

As it was expected, all isolates were resistant to beta-lactam antibiotics. In addition, nearly all of the isolates showed resistance towards tetracycline, which is typical of farm animal-associated MRSA strains. It was striking that the rate of resistance of MRSA isolates towards ciprofloxacin, which is an important substance in human medicine, had increased in comparison with earlier zoonoses monitoring findings. This phenomenon was already observed with MRSA isolates obtained from the turkey and milk cow food chains under earlier monitoring programmes. It is particularly problematic that MRSA isolates from the fattening pigs food chain have developed resistances also towards other important antibiotics which may complicate therapy in case of human infections.

Coagulase-positive staphylococci

Coagulase-positive staphylococci were detected by a quantitative method in 9.3% of samples of sheep and goat raw milk cheese. In 1.9% of the samples of raw milk cheese the bacterial count exceeded the critical level of 10,000 cfu/g, which is, under European law, the threshold level for the food business operator to initiate measures to improve production hygiene and choice of raw materials. 1.2% of the samples harboured staphylococci by even more than 100,000 cfu/g. In such case, the cheese may only be placed on the market if a laboratory analysis has delivered proof that it is free of staphylococcal enterotoxin. The findings make clear that utmost attention must be paid to udder health of the milk-delivering animals, and to personal and production hygiene, as staphylococci present in raw milk may develop into alarmingly high colony numbers during the cheese ripening process.

Raw shrimps contained coagulase-positive staphylococci in quantifiable amounts in 3.7% of samples. The highest bacterial count was 1,300 cfu/g. This means that in rare cases, samples of raw shrimps contained coagulase-positive staphylococci at levels exceeding the ICMFS's (International Commission on Microbiological Specifications for Foods) recommended limit of 1,000 cfu/g.

***Alaria alata* mesocercariae**

Alaria alata mesocercariae were detected in 4.7% of all samples obtained from wild boar. The Laender with higher sample numbers had *A. alata* mesocercariae finding rates between 0.8% and 8.4%. The findings confirmed the fact that wild boar meat is a potential source of human infection with *Alaria alata* mesocercariae. However, only few cases of human disease have been reported so far in Northern America. These occurred after consumption of inadequately cooked game meat containing *A. alata* mesocercariae and were symptomized by, among others, disorders of the respiratory tract. The findings strengthen the recommendation to thoroughly cook wild boar meat before consumption.

Commensal *Escherichia coli*

Commensal *E. coli* were detected and quantitated in 14 samples (3.9%) of cut salad vegetables. Two samples (0.6%) contained commensal *E. coli* in numbers higher than the limit of 1,000 cfu/g holding for the manufacture of pre-cut, ready-to-eat vegetables. This indicates hygienic deficiencies during the manufacturing process. The highest bacterial count detected was 1.3×10^5 cfu/g. While commensal *E. coli* mostly do not have pathogenic effect, they in fact indicate possible faecal contamination of the product. Findings – though rare – of high bacterial counts in fact indicate that pre-cut salad vegetables sometimes lack hygienic quality. It shows that it is very important to thoroughly rinse salad vegetables with water before consumption, and keep prepared salads refrigerated in order to slow bacterial growth.

The results of antibiotics resistance tests of *E. coli* isolates confirmed the differences noted in previous years with regard to resistance rates depending on the origination isolates. *E. coli* isolates obtained from the pork food chain were between 50% and 70% resistant towards at least one of the tested antibiotics. Compared to that, the *E. coli* isolates obtained from fattening pigs under the 2011 Zoonoses Monitoring displayed an even higher resistance rate of 77%. *E. coli* isolates from young pigs had the highest resistance rates towards a number of antibiotic substances, which is probably to be linked with frequent applications of antibiotic substances in this animal group. The *E. coli* isolates from fresh pork had, with 50%, the lowest rate of resistance, which was also the case in the 2011 Zoonoses Monitoring.

E. coli isolates from caecal samples of fattening calves/young bovines displayed a higher rate of resistance (46.1%) than isolates obtained from beef, where the rate was 11.5% isolates resistant to at least one antibiotic substance. This reflects different frequencies of antibiotic treatment in fattening calves/young bovines on the one hand, and fattened adult bovines – that are usually the source of beef – on the other.

The resistance rate of *E. coli* isolates from raw shrimps was 45%. Here, resistance towards ciprofloxacin, which is considered an antibiotic of particular importance, was frequently noted. *E. coli* isolates obtained from cut salad vegetables were only in few cases resistant.

ESBL/AmpC-forming *E. coli*

ESBL/AmpC-forming *E. coli* were detected by selective methods in about half of all faecal samples taken from breeding sows (53.9% positive samples) and young pigs (47.6% positive samples) in piglet primary farms. Ceacal samples taken from fattening pigs in slaughterhouses produced roughly the same detection rate (46.3% positive samples), while the contamination rate of fresh pork with ESBL/AmpC-forming *E. coli* was 5.7%.

The contamination rate with ESBL/AmpC-forming *E. coli* in ceecal samples of young bovines was found still markedly higher than that in caecal samples of fattening pigs, with 60.6% of the samples being positive. Fresh beef was found contaminated with ESBL/AmpC-forming *E. coli* to a portion of 4.0%.

Raw shrimps had a 3.1% portion of samples positive for ESBL/AmpC-forming *E. coli*.

The contamination rate in samples of cut salad vegetables was 2.4%. Fresh herbs which had been tested for ESBL/AmpC-forming *E. coli* under the zoonoses monitoring programme of the previous year had displayed a similar contamination rate with 2.2%. The finding of ESBL/AmpC-forming *E. coli* in cut salad vegetables is of particular importance with regard to preventive health protection of consumers in so far as these vegetables are normally consumed raw, which means consumers may directly ingest resistant bacteria. The findings add importance to the recommendation that pre-cut salad vegetables, too, should be rinsed again with water thoroughly before consumption.

Round-up

The Zoonoses Monitoring Programme serves to raise relevant and comparable data on the occurrence of the most important zoonotic agents at any level of the food chain that allow drawing conclusions on the infection risk to consumers through consumption of foods. Continuous testing in the framework of the Zoonoses Monitoring allows monitoring trends in the spread of zoonotic agents in animals and in foodstuffs. Resistance testing contributes to essential improvement of the data basis in this field and helps to better be able to analyse links between use of antibiotics and development of resistance.

The results of tests in breeding sows and young pigs confirm that pigs are infected with *Salmonella* spp. as early as in primary breeding farms. This fact must be paid attention to when taking *Salmonella* control measures in pigs.

Testing at slaughterhouse level has shown that there is much less transfer of entry contamination to carcasses while slaughtering pigs and bovines than while slaughtering poultry. Still, beef and pork are important potential sources of human infection with zoonotic agents because of customary raw meat consumption. Raw minced meat and raw sausages are therefore not suitable as foods for susceptible consumer groups, such as young children, elderly and immune-deficient people, or pregnant women.

Tests of bulk milk and of raw milk cheese have shown that raw milk, including of sheep and goat, is a source of entry zoonotic agents. As milk ready for consumption is generally heat-treated before being put on sale in Germany, zoonotic agents in (raw) tank milk do not pose a direct risk to consumers. Raw milk does pose a risk, however, if there is no heat treatment step, such as in the manufacture of raw milk cheese or other raw milk products. Consumers should therefore be careful to follow the recommendation to fully cook milk bought directly on farms (“farm milk”). The recommendation to susceptible consumer groups, such as small children, elderly and immuno-deficient people and pregnant women, should be to abstain from consuming non-heat-treated raw milk and raw milk products.

The finding of potential pathogens in raw shrimps makes clear that these should also be cooked before consumption. Food business operators should direct attention to this risk by placing appropriate cooking directions on product labels.

In some single cases, cut and packaged salad vegetables are contaminated with potential pathogens, which is important because these salad vegetables are consumed raw. This food is not suitable for susceptible consumer groups, all the more as the humid atmosphere in the packages may promote growth of germs. The findings of the Zoonoses Monitoring show that hygienic rules must be followed also when handling vegetal foodstuffs. The findings confirm the recommendations to thoroughly rinse pre-cut salad vegetables again before consumption.

MRSA and ESBL/AmpC-forming *E. coli* were very frequently found in the food chains “fattening pigs” and “fattening calves/young bovines”. But food consumption seems to be of subordinate importance in transmitting MRSA to humans. As regards ESBL/AmpC-forming *E. coli*, in contrast, the current state of knowledge is that these resistant bacteria may be transmitted to humans by foodstuffs, among other paths of transmission, while the actual risk of infection in this way cannot yet be accurately assessed.

Examination of wild boar meat in the framework of the Zoonoses Monitoring enhances the data basis on the occurrence of *Alaria alata* mesocercariae and has shown, that their presence in wild boar meat must be reckoned with. Wild boar meat infested with *Alaria alata* mesocercariae should not be placed on the market for reasons of preventive health protection of consumers. Hunters should be trained with regard to that particular risk being connected to wild boar meat. Further studies are needed in order to be able to better assess the influence of processing steps, such as heating, curing, or smoking, on the viability of the mesocercariae in wild boar meat.

Overall, resistance rates found in the 2015 Zoonoses Monitoring programme were rather on the decline, compared to earlier monitoring programmes. A problem was the notable increase in MRSA isolate resistance towards ciprofloxacin, which is an important antibiotic in human medicine, as well as towards other important antibiotics. The high resistance rates found in MRSA isolates obtained from young pigs and young bovines reflect these animal groups’ frequent exposure to antibiotic treatments.

The results of the Zoonoses Monitoring programmes serve to define foci of official surveillance activities, and help government services in taking effective action to reduce the prevalence of zoonotic agents.

With the overarching aim to reduce consumers' exposure to zoonotic agents, the Zoonoses Monitoring programmes greatly contribute to health protection of consumers.

Consumers can protect themselves from certain food-borne infections by thoroughly cooking any meat and following strict kitchen hygiene rules preventing the transmission of pathogens from raw meat to ready-to-eat food, such as salads, during preparation of the food. Fruit and salad vegetables should be thoroughly washed before consumption in order to reduce germs. In order to counteract bacterial growth in meat and certain ready-to-eat foodstuffs, attention should be paid in particular to keeping up a continuous chain of refrigeration, and defining short consumption dates. Raw minced meat and raw meat and milk products, as well as certain ready-to eat foods, are a potential source of risk, and should therefore not be consumed by susceptible consumer groups, such as young children, elderly and immune-deficient people, as well as pregnant women. The Federal Institute of Risk Assessment (BfR) has published a series of recommendations on how to minimise the risks of infection with *Campylobacter*, VTEC, or *Listeria*, as well as on how to generally protect from food-borne infections in private households (www.bfr.bund.de).