ACM/741

ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

DISCUSSION PAPER

REVIEW OF POSSIBLE MICROBIOLOGICAL HAZARDS THAT MAY BE ASSOCIATED WITH THE ILLEGAL IMPORTATION OF BUSHMEAT

The FSA commissioned Dr Roger Skinner to carry out a review on the possible health implications of the microbiological contamination of bushmeat. A copy of this report is attached.

Dr Skinner will present his review, and Members are invited to comment.

The review has also been sent to the ad hoc group on imported foods and Dr Skinner will address their comments as part of his presentation.

A further report looking at the controls on illegally imported bushmeat has been prepared for the Agency by Mr Ned Kingcott. This report has been commented on by the ad hoc group and is currently with Her Majesty's Customs and Excise for further comment and review. It will be presented to the Committee when the review process has been completed.

Secretariat
June 2005

REVIEW OF POSSIBLE MICROBIOLOGICAL HAZARDS THAT MAY BE ASSOCIATED WITH THE ILLEGAL IMPORTATION OF BUSHMEAT

1. SUMMARY

1.1 A range of possible microbiological hazards that could be associated with bushmeat brought into the UK from Central and West Africa was identified. The possible risk of illness in those handling and consuming bushmeat in the UK was considered. The risk from ingestion of bushmeat cooked in the traditional manner was considered to be extremely low. There may be a very low risk in relation monkeypox virus for those handling bushmeat in preparation for cooking. The greatest risk from microbiological hazards arises from cross-contamination in the kitchen of other foods, particularly those foods that will be eaten with little or no further cooking, with common foodborne disease organisms that may be present on the bushmeat prior to cooking.

1.2 Current prohibition, if properly enforced, on the importation of products of animal origin from third countries outside the EU with the purpose of protecting animal health in the UK would appear to provide appropriate protection to public health in the UK in relation to bushmeat from Central and West Africa and probably worldwide.

2. INTRODUCTION

2.1 This report has been prepared at the request of the Food Standards Agency to examine possible microbiological hazards with respect to illegally imported meat with particular reference to bushmeat. Consideration of the controls in place in the UK to tackle illegally imported meat is the subject of a separate report.

2.2 This report is a scoping study the objective of which is to attempt to identify those microbiological hazards that could be linked to bushmeat. Potential risks in relation to prions were not addressed. Although the report is neither intended nor can it be a risk assessment views have been expressed indicating in a qualitative way the degree of risks that may be associated with the hazards examined.

2.3 Bushmeat is the African term for the meat of wild animals but the hunting of wild animals for meat is not confined to Africa. It is a worldwide phenomenon that has been going on for 100 000 years or more. Imports of bushmeat into the UK for the most part take place from those parts of Africa with which the UK has close historical connections, but particularly from West Africa. For this reason this report focuses on West and Central Africa as being the main source of bushmeat coming into the UK.

2.4 In the preparation of the report meetings and discussions took place with officials from the FSA, DEFRA and HMCE, Local Authority and PHA EHOs, a number of experts in the HPA and academia, as well as ecologists and biologists and others concerned with the broader picture of bushmeat and the hunting of wild animals in the tropics.

3. THE BUSHMEAT TRADE IN CENTRAL AND WEST AFRICA – OVERVIEW

3.1 For many people in Central and West Africa, particularly those living in rural areas, bushmeat is a major source of animal protein. In some parts of Cameroon it provides up to 98% of the animal protein consumed. In addition to its nutritional importance the bushmeat trade is significant in providing economic benefits to different groups of people in the commodity chain. However there is international concern that bushmeat hunting in some areas is threatening some wildlife populations with extinction. The size of the bushmeat trade has been estimated in a number of African countries and ranges per year from $24m in Liberia, where it exceeds the timber trade, to $117m in Ivory Coast (Bowen-Jones et al. 2002).

3.2 Bushmeat is eaten by everybody in Central and West Africa. In remote rural areas bushmeat is a very important and essential part of the diet. In cities bushmeat is a luxury item and usually commands a premium in price and an active market has grown up to supply the needs of urban dwellers (Bowen-Jones et al. 2002). It is not surprising therefore that residents of the UK who have their ethnic and cultural origins in Central and West Africa and who are returning from a visit there would wish to bring bushmeat into the UK for their own use and to share with friends and relatives. In comparison with the domestic market in bushmeat in Central and West Africa the amount of bushmeat coming into the UK represents only a very tiny fraction of the total turnover.

Animals killed for bushmeat

3.3 There is scant information on the species of animal imported as bushmeat from the Illegal Import of Animal Product Seizures (ILAPS) database of the Department of the Environment, Food and Agriculture (DEFRA) or the Detection and Control and Information Service (DCIS) database of Her Majesty's Customs and Excise (HMCE). The entry usually records "bushmeat" with a description such as "dried meat" or "smoked meat". Sometimes the entry records "antelope" or "grasscutter" (cane rat). Many of the entries, particularly from South Africa and Zimbabwe, refer to biltong, a dried meat frequently made from game animals such as kudu, duiker, antelope, impala, wildebeest and similar species. There have been a few occasions at London Heathrow where the animal was clearly identifiable, for example, dried smoked monkey or dried bats, but this is rare. In the absence of specific information from seizures in the UK information from other sources was sought.

3.4 It is possible to glean from a number of publications the types of animal that are consumed as bushmeat. There is no definitive list. Almost any wild animal is potentially a candidate for bushmeat. Local factors will determine the precise mix such as market preferences and availability. The list at Annex 1 is a generic list drawn up from the perusal of a number of documents (Bowen-Jones et al. 2002, Cowlishaw et al. 2004). Annex 2 lists the top 15 consumer preferences in rank order from a survey in 8 urban communities in Liberia (Hoyt 2004). Annex 3 is adapted from a CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) document (CITES 2000). It focuses on endangered species and therefore does not include animals that are not at risk of extinction, such as the cane rat and the sooty mangabey monkey.

3.5 A comprehensive overview of animals hunted in tropical moist forests in Central and West Africa comes from Fa et al. 2005. They compiled hunting data that met particular criteria from 36 sites in 7 West and Central African countries (Cameroon, Equatorial Guinea, Gabon, Congo, Democratic Republic of Congo, Central African Republic and Ghana). A total of 71 mammalian species were recorded:- 22 primates (4 families), 18 ungulates (4 families), 13 rodents (4 families), 12 carnivores (4 families), 3 pangolins, and one species of elephant, hyrax and aardvark. For all sites pooled the most hunted taxonomic groups were ungulates (46.6%) and rodents (37.0%). In terms of weight ungulates constituted 73.2% of all hunted animals, rodents 12.2% and primates 12.0% reflecting differing body sizes. Findings from more urban environments indicate that the relative proportions change towards a reduction in ungulates and an increase in rodents taken. This reflects depletion of larger sized animals and a greater dependence on smaller animals such as cane rats that are able to sustain their numbers in spite of hunting.

3.6 Annex 2, which sets out preferences in urban Liberia (Hoyt 2004), probably provides the best indication of the sort of bushmeat likely to be imported into the UK since returnees and visitors to the UK are most likely to buy their bushmeat in urban markets and are likely to reflect current local preferences. The list supports the findings of Fa et al 2005 comprising ungulates (antelopes, pigs and chevrotain), rodents (grasscutter and porcupines), a primate (sooty mangabey) and 3 pangolins (scaly anteaters).

4. POSSIBLE HAZARDS

4.1 An attempt has been made to identify those microbiological hazards that might be associated with bushmeat obtained in Central and West Africa. The list was drawn up from careful reading of Palmer et al. 1998 and Topley and Wilson (Collier et al. 1997), with additional material where referenced, and from discussions with a number of experts. Short paragraphs summarising key aspects of those organisms that could be considered a hazard in bushmeat are provided in Appendix 4. Environmental contaminants such as Listeria species and organisms where the source is almost exclusively another human being have been excluded.

4.2 The focus of consideration is upon the person or persons handling and consuming the bushmeat in the UK. The implications of possible exposure in the field of the person who hunted and killed the animal for bushmeat are identified where appropriate.

4.3 On the basis of the information set out in Appendix 4 the following can be reasonably excluded as posing a credible risk:-

- Bacteria/rickettsia – leptospires, Yersinia pestis, Francisella tularensis
- Viruses – Ebola, Marburg, Congo-Crimean HF, Hanta, retroviruses
- Parasites – Ascaris suum, toxocara

4.4 Credible hazards, where the burden to public health is very similar to that otherwise found in the UK, include those organisms that have been found to be associated with foodborne illness in UK, namely:-

- Bacteria - salmonella, campylobacter, VTEC, Shigella, TB, C perfringens, and non-plague Yersinia species (Y enterocolitica, Y pseudotuberculosis), brucella.
- Parasites – giardia, cryptococcus, T saginata, T solium, echinococcus, toxoplasma.

The risks from these hazards can be adequately controlled through basic kitchen hygiene, which includes taking steps to avoid cross contamination, and thorough cooking.

4.5 Other foodborne organisms identified are anthrax and trichinella:-

- Anthrax – spores can be present in food but are destroyed by prolonged cooking.

- Trichinella – this should always be considered as a likely hazard where there is inadequate veterinary inspection as is the case with bushmeat. The public health burden from this hazard is increased above the usual UK burden. However thorough cooking of the bushmeat will kill the cysts.

4.6 Non-foodborne hazards

anthrax – there is the possibility of cutaneous anthrax in food handlers from exposure to spores in the bushmeat. However the risk is lower than that associated with an animal skin brought into the UK from a country where anthrax is endemic, for example, a Maasai warrior shield from Kenya, since the bushmeat is eventually cooked and no longer remains a potential hazard.

Brucella – it is possible for brucellosis to be transmitted through cuts and abrasions in the skin. Cases of brucellosis in GB are usually due to consumption of cheese made from unpasteurised milk imported into the country in the personal baggage of visitors to countries where brucellosis is found in domestic food animals (cattle, sheep and goats). Since bushmeat is thoroughly cooked (see later) the risk to public health from brucella organisms would be expected to be lower than the risk from brucella organisms in imported cheese.

Q fever – for infection to occur aerosolisation is needed which is unlikely in the kitchen from normal cooking practices. From seroprevalence studies farmers in the UK have been shown to be frequently exposed but without developing clinical infection. The presence of the organism of Q fever in bushmeat is unlikely to increase the public health burden.

monkeypox - the organism is very robust. There is therefore the possibility of infection of food handlers if the carcase is contaminated. There is person-to-person spread and the disease can have a fatality rate of up to 10%.

4.7 In summary, the hazard that may give rise to a public health risk is the monkeypox virus. Its natural host is the squirrel which could enter the UK from Central and West Africa as bushmeat. Primates can also be infected. None of the other hazards are likely to increase the public health burden significantly above current levels.

5. EXPOSURE ASSESSMENT

5.1 Evidence from urban markets in Ghana indicates that most bushmeat is sold processed, that is, it is dressed and smoked. Smoking extends the shelflife of the meat substantially. Such bushmeat is twice as expensive as meat from domestically reared food animals, and tends to be purchased in small amounts (Cowlishaw et al. 2004). The bushmeat consumed in the UK imported from West Africa is either smoked, dried or salted (Ms Adelagun-Lawal, personal communication).

5.2 By its very nature of being derived from hunted wild animals and dressed in the field without any veterinary inspection, bushmeat needs to considered as possibly being contaminated with a wide range of potential pathogens depending on the species and its provenance. However, because the bushmeat is usually smoked, dried or salted, the initial load of viable organisms on the bushmeat would be expected to be reduced significantly. To preserve the bushmeat it may be frozen on arrival in the UK. This will have the effect of reducing the load of those pathogens in the meat which are susceptible to freezing.

5.3 Bushmeat is cooked as follows (Ms Adelagun-Lawal, personal communication). The meat, which is usually smoked and may be up to one week old, is washed in salted water and scrubbed, often with lemon juice. The meat is always chopped into small pieces and boiled in a stew pot for at least one hour together with spices (curry powder, thyme, white pepper, onions and garlic) until very tender. The vegetables are then added with further cooking (tomatoes, chili pepper, palm oil and more onions). The length of time of cooking is at least 2 hours and often much longer.

5.4 In the preparation of the bushmeat for cooking there is a risk of cross-contamination to other foods in the kitchen. The risk will depend importantly on the level of hygiene observed in the kitchen, the frequency of contamination of the bushmeat and the amount of contamination of the bushmeat. The amount of contamination will depend on, among other things, the skill of the hunter in dressing the animal and the degree of hazard reduction from smoking, drying and salting the carcase.

5.5 The frequency of contamination is likely to have an important bearing on the likelihood of cross-contamination. As bushmeat animals are likely to be contaminated with those organisms commonly found in the gut, such as salmonella, E Coli and campylobacter, the chance of cross contamination of other foods in the kitchen with common foodborne organisms such as these is **moderately high**, depending on the level of food hygiene observed in the kitchen**.**

5.6 The nature of the cooking process (boiling for several hours) is such that **no** pathogens are likely to survive. Contamination of the final bushmeat stew with pathogens is **extremely low**. Neither anthrax spores (Spotts Whitney et al 2003) nor monkeypox virus particles (Hahon and Kozikowski 1961) will survive this treatment.

5.7 However, there remains the possibility that the food handler may be exposed to organisms in handling the bushmeat as part of the preparation for cooking. The organisms that have the ability to give rise to adverse effects are the anthrax bacillus, the organism responsible for brucellosis and the monkeypox virus. The likelihood of the presence of these organisms in the bushmeat prior to cooking is **low to very low.**

6. HAZARD CHARACTERISATION

6.1 In view of the extremely low probability of the presence of pathogens in the bushmeat stew the associated risks from eating the stew are correspondingly extremely low. For this reason, although the whole family eats the bushmeat stew, possible differences in susceptibility to pathogens between different consumers, for example, on the basis of age, sex or immunocompetence, were not considered.

6.2 Even though the risk of eating the bushmeat stew is extremely low a much greater risk arises from cross-contamination in the kitchen by hazards that may be present on the bushmeat of foods that will receive little or no further cooking such as salads. The most likely to happen for the common foodborne disease organisms such as salmonella, E Coli and campylobacter.

6.3 The three hazards identified that may give rise to infection through the non-foodborne route are the anthrax bacillus, the organism of brucellosis and the monkeypox virus.

6.4 Cutaneous anthrax could occur from handling contaminated bushmeat with only up to 10 organisms as an infectious dose. It gives rise to a skin lesion that develops into an ulcer with a typical black eschar. Untreated it can be fatal but with appropriate antibiotic treatment is rarely fatal.

6.5 Brucellosis can occur following innoculation of organisms into the skin. The usual route of infection now is from consumption of infected dairy products. It is a disease of protean manifestations the key features of which are pyrexia, anorexia, weakness and loss of weight. The organisms may ultimately localise to a particular organ eg heart, skeletal, respiratory, genitourinary, central nervous system giving rise to associated signs and symptoms. The disease can be difficult to diagnose and treat and may give rise to significant long-term morbidity and sometimes death.

6.6 Monkeypox can occur from innoculation into abraded skin of virus particles. The disease gives rise to a generalised poxvirus rash that visibly resembles smallpox. Previous vaccination against smallpox provides some protection against the monkeypox virus. Fatality rates can be up to 10%. The fatality rate in recent outbreaks in Democratic Republic of Congo have been lower than in earlier outbreaks but with a greater degree of person-to-person transmission. Infants show greater susceptibility.

7. RISK CHARACTERISATION

7.1 There is a **moderate risk** of illness occurring from consumption of foods that have been cross-contaminated in the kitchen by common foodborne disease organisms such as salmonella and campylobacter. The uncertainty of this assessment depends on:-

- The probability that the animal is harbouring common foodborne disease organisms in its gut or elsewhere as appropriate
- The degree of contamination of the carcase when it is dressed
- The susceptibility of the organisms to processing (smoking, drying and salting)
- The change in the number of viable organisms on the carcase before it is cooked (increase, decrease or no change)
- The level of kitchen hygiene observed in the kitchen by the foodhandler
- Host susceptibility

7.2 There is a **very low** risk of cutaneous anthrax. The uncertainty of this assessment depends on:-

- Probability of an animal dying of anthrax entering the bushmeat food chain
- The degree of contamination of the carcase with anthrax spores
- The susceptibility of the spores to processing (smoking, drying and salting)
- The likelihood of innoculation into abraded skin of the foodhandler
- Host susceptibility

7.3 There is a **very low** risk of brucellosis through the cutaneous route. The uncertainty of this assessment depends on:-

- Probability of an infected animal entering the bushmeat food chain
- Degree of contamination of the carcase with brucella organisms

- The susceptibility of the organisms to processing (smoking, drying and salting)
- The likelihood of innoculation into the skin of the foodhandler
- Host susceptibility

7.4 There is a **very low** risk of a food handler acquiring monkeypox. The uncertainty surrounding this assessment is as follows:-

- The probability of an infected reservoir animal (eg squirrel) or infected animal (eg monkey) entering the bushmeat food chain
- The load of virus particles on the carcase
- The susceptibility of virus particles to processing (smoking, drying and salting)
- The likelihood of innoculation into abraded skin of the foodhandler
- Whether the foodhandler has received smallpox vaccination in the past

7.5 The nature of the risk of illness from common foodborne organisms arising from cross-contamination is broadly comparable to the risk of illness occurring in relation to hazards that may be present in foods obtained from retail outlets in UK.

7.6 Cutaneous anthrax and brucellosis acquired cutaneously are not likely to increase the public health burden above current levels.

7.7 Monkeypox represents a new hazard but with a very low risk.

8. INFORMATION FROM NATIONAL SURVEILLANCE

8.1 The Food Hygiene Laboratory at the HPA has received no samples of bushmeat for analysis. There is therefore no direct information available on microbiological hazards that may be present in or on bushmeat imported into the UK. There have been no cases of illness reported to CDSC that have been linked to bushmeat. There may be sporadic cases but these would be lost in the relatively large numbers of other cases reported, particularly in respect of commonly reported organisms. It may be possible to identify cases of salmonellosis due to organisms that are typically found in Central and West Africa but it would be difficult to distinguish between cases that may have picked up the organism from visiting Africa, cases that may have consumed or otherwise been exposed to bushmeat and person to person spread. Cutaneous anthrax occurs from time to time, the last case being a leatherworker in the Midlands in 2002. There have been cases of brucellosis but they have been mostly linked to the consumption of soft cheeses imported from countries where brucellosis is endemic in the domestic herds. There have been no cases of monkeypox reported in the UK.

8.2 In order to show the relative reporting rates for many of the organisms discussed in this report Annex 5 sets out laboratory reports from the CDR Weekly for a range of organisms for 2003 and 2004 (provisional). Annex 5 includes :- reports of common gastrointestinal infections, reports of less common gastrointestinal infections, reports of common animal associated infections, and reports of imported infections. The latter was included as this was the only table that listed the majority of the organisms considered in this report. For many of the other less common organisms the numbers of reports are very low compared with the common gastrointestinal infections, many being in single or double digits. The table also gives an indication of the proportion of reports linked to travel. Depending on the organism between 3% and 20% of the common gastrointestinal infections are travel related. For completeness these tables were copied together with footnotes with no editing.

9. CONCLUSIONS

9.1 A wide range of possible hazards that could be linked with bushmeat was identified. The risk of someone becoming ill from any of these hazards from the consumption of bushmeat stew made in the traditional way is extremely low. However the risk of illness occurring as a result of cross-contamination from the raw bushmeat to other foods in the kitchen is considered much more likely and comparable to risks from cooking foods obtained from retail outlets in the UK. Possible risks in relation to anthrax, brucellosis and monkeypox were identified as arising from handling bushmeat in preparation for cooking. Of these, only monkeypox was considered to represent a risk to public health above current levels albeit at a very low level.

9.2 The current legislative controls, if properly enforced, prohibiting the importation of all products of animal origin from third countries outside the EU on the grounds of protecting animal health within the UK would appear to provide appropriate protection in respect of hazards in bushmeat that may represent a risk to public health.

Acknowledgments – I am grateful to a number of people for their assistance to me in the preparation of this report. In particular I would like to thank the following for the time they gave me in discussion and providing information:- Stephen Giles-Medhurst of HMCE; Dr Yunes Teinaz of LB of Hackney, Ms Tokunboh Adelagun-Lawal of LB Newham, Ms Beryl Morgan of LB of Southwark, Ms Sandra Westacott and Ms Rosemary Zambra of Southampton PHA, Mr Shabeg Nagra and Ms Carla Millman of Heathrow PHA; Dr David Brown of Overseas Development

Institute and Dr Guy Cowlishaw of the Zoological Society of London; Drs David Brown, Bob Adak, Roland Salmon and Rob Smith of the Health Protection Agency; and Professor Peter Chiodini of UCL Medical School.

Roger Skinner
April 4 2005

ANNEX 1

LIST OF ANIMALS INVOLVED IN BUSHMEAT TRADE IN WEST AFRICA

UNGULATES

Duikers (so-called forest antelopes) – there are many species (see Annex 3) eg black duiker, Maxwell's duiker,
Hogs eg red river hog
Water chevrotain (even toed ungulate that is like a little deer the size of a rabbit and physiologically is between a pig and a deer – it is a primitive ruminant)

RODENTS

Cane rat (grasscutter)
great rat
Squirrels
Flying squirrels eg Pell's flying squirrel
Porcupines eg brush-tailed porcupine

PRIMATES

Gorillas, chimpanzees, bonobos

Crowned monkeys, greater white-nosed monkey, moustached monkey, drills, red colobus monkey (see Annex 3)

LARGE MAMMALS

Elephant, buffalo
Pigmy hippopotamus

REPTILES

Crocodiles eg slender-snouted crocodile
Snakes eg python

BIRDS

Hornbill, guinea fowl, turucao

OTHER

Frogs
Turtles
Snails including giant African land snails

ANNEX 2

LIST IN RANK ORDER OF 15 MOST PREFERRED ANIMALS FOR TASTE FROM 8 URBAN COMMUNITIES IN WEST AFRICA (Hoyt R 2004)

Rank	Species	% of Respondents
1	Cane rat (grasscutter)	18.1
2	Water chevrotain *	12.6
3	Giant pangolin *	9.3
4	Black duiker	8.1
5	Brush-tailed porcupine	7.8
6	Bushbuck	6.9
7	Forest hog *	4.7
8	Long tailed pangolin	4.5
9	Maxwell’s duiker	3.2
10	Red river hog	3.1
11	Ogilby’s duiker *	2.0
12	Tree pangolin	1.9
13	Sooty mangabey	1.7
14	Royal antelope *	0.5
15	Crested porcupine	0.3

**Denotes Protected Species*

ANNEX 3

TAKEN FROM ANNEX 1 FROM PAPER 44 OF THE 11th CONFERENCE OF THE PARTIES OF CITES held in Gigiri (Kenya) in 2000

Primary mammalian species identified in the commercial African bushmeat trade

Jentink's duiker *C. jentinki*
Diana guenon / monkey *C. diana*
Gorilla *Gorilla gorilla*
Elephant *Loxodonta africana*
Drill *Mandrillus leucophaeus*
Mandrill *M. sphinx*
Bonobo *Pan paniscus*
Chimpanzee *P. troglodytes*
Guinea Leopard *Panthera pardus*
Bay duiker *C. dorsalis*
Blue duiker *C.*
Ogilby's duiker *C. ogilbyi*
Yellow-backed duiker *C. sylvicultor*
Zebra antelope / banded duiker *C. zebra*
Moustached monkey *Cercopithecus cephus*
Red-bellied guenon, white-throated Monkey *C. erythrogaster*
Red-eared guenon / monkey *C. erythrotis*
Owl faced monkey *C. hamlyni*
De Brazza's monkey *C. neglectus*
Greater white-nosed monkey *C. nictitans*
Crowned guenon *C.*
Preuss's guenon / monkey *C. preussi*
Sclater's guenon / monkey *C. sclateri*
Sun tailed guenon / monkey *C. solatus*
Black colobus *Colobus satanas*
King colobus *C. polykomos* (in*c. C. vellerosu*s)
Grey-cheeked mangabey *Lophocebus albigena*
Giant pangolin *Manis gigantea*
Red colobus *Procolobus badius*
Golden cat *Profelis*
African civet *Civettictis civetta*
Water chevrotain *Hyemoschus aquaticus*
Bongo *Tragelaphus euryceros*
Sitatunga *T. spekei*
Brush-tailed porcupine *Atherurus africanus*
Peter's duiker *Cephalophus callipygus*
White-bellied duiker *C. leucogaster*
Black duiker *C. niger*

Black-fronted duiker *C. nigrifrons*
Giant hog *Hylochoerus meinertzhageni*
Red river hog *Potamochoerus porcus*
African buffalo *Syncerus caffer*

Sources

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APPENDIX 4

BACTERIA

Anthrax

Anthrax is a disease of herbivores particularly affecting cattle, sheep and goats. It is a major cause of death in wild herbivores in Africa but potentially any animal can be infected with different degrees of susceptibility. Anthrax is unlikely in an animal killed by a hunter but it is possible that an animal that has died of anthrax may enter the food chain. The prepared carcase could be contaminated with spores and hence anyone handling the carcase in preparation for cooking or anyone eating the meat subsequently cooked could be exposed. However, susceptibility of humans to anthrax is low. Human consumption, without ill effect, of animals dying of anthrax has been frequently documented.

Brucella

Brucella antibodies have been detected in sera from African Bovidae including eland, impala, gazelle, topi and wildebeeste. The infecting strains are likely to be the same as those infecting nearby domestic animals such as goats, cattle and sheep. B.abortus and B.melitensis infections in humans are widespread in many African countries. On this basis it is reasonable to assume that duikers and related animals could be infected with Brucella species. In preparation of the carcase internal organs and lymphoid tissue are removed hence reducing the load of Brucella organisms but contamination of the carcase could occur. Infection is known to occur through skin abrasions. The hunter and the foodhandler could be is exposed to the organisms which are highly infectious, certainly in respect of organisms isolated in the laboratory. Most non-occupational brucellosis, which is usually acquired from consumption of dairy and other animal products, could be eliminated by adequate heat treatment of milk and thorough cooking of meat.

Campylobacter

C.jejuni and C.coli are widely distributed in animals particularly in birds. Campylobacter infection in developing countries is very common. It is therefore likely for an animal hunted for bushmeat to carry the campylobacter organism or to be subsequently contaminated after the carcase has been dressed. Subsequent drying and smoking of the carcase would reduce the numbers of organisms on the carcase although the organisms can grow at temperatures above 30^0 C, as may occur in West and Central Africa. However there remains a risk (the infectious dose of campylobacter can be as low as 500 organisms) either through cross-contamination with other foods or undercooking. This risk is probably little different from risks from cooking non-bushmeat products of animal origin obtained in the UK.

Clostridium perfringens

Clostridium perfringens is widely distributed in soil and commonly found in the faeces of man and animals and hence may contaminate the carcase of a bushmeat animal following dressing. The organism can give rise to gastroenteritis.

Leptospirosis

Leptospirosis is a worldwide zoonosis in which humans are infected through contact with infected animals. Almost all animals can be infected with various strains of leptospires and include rodents, which are particularly susceptible, cattle, pigs, dogs and horses. While the disease is infrequent in developed countries in developing countries it can be very high. For example, seroprevalence in those living in rural Nigeria is 18%, and in rice growing areas of the Philippines it is 48%. This reflects the close contact with rodents and with leptospires maintained in domestic animals particularly where there are water associated occupations. The infectious dose can be very low (1-10 organisms). The disease can be transmitted through exposure to the tissues of infected animals. The hunter is therefore potentially at risk. However the organisms do not survive dessication and subsequent treatment of the carcase , for example through smoking, will reduce the load of organisms substantially. The risk from subsequent handling and cooking is likely to be very low.

Mycobacterium

Tuberculosis is widespread throughout animals and in mammals is usually caused by M.bovis. The range of animals in which M.bovis has been described include primates, ungulates, hogs, rodents and cats, all of which are hunted for bushmeat. Transmission is mostly through aerosol. The hunter is therefore at low risk even when dressing the carcase. The risk from subsequent handling of the carcase is low also. The risk can be virtually eliminated by ensuring the meat has been thoroughly cooked.

Q fever

Q fever has been reported worldwide including Africa. Domestic animals are the usual reservoir of infection but cats have been shown to be a reservoir and other animals are suspected. The organism is very robust, is highly infectious, and can be disseminated through contaminated dust and manure. It is an occupational disease for abattoir workers and farmers. An infected animal represents a risk to the hunter and dresser. In view of the organism's stability under adverse environmental conditions it is a potential risk to subsequent handlers of the carcase. Aerosolisation of the organism is usually required for infection to occur.

Salmonella

All animals can be colonised or infected with salmonellae. Salmonellae will therefore be found in the intestines of animals hunted for bushmeat. Following dressing of the animal the carcase may be contaminated faecally. Salmonellae can increase in number at room temperature. In preparation for cooking there is a risk of cross contamination in the kitchen to other foods and the meat will need to be cooked sufficiently to kill any organisms present.

Tularaemia

Tularaemia (caused by bacteria from the genus Francisella) is a disease of wild animals living in the temperate zone in the northern hemisphere between latitudes 30^0 and 71^0. It is transmitted by blood sucking insects. Man is an accidental host. It can also be transmitted through consumption of contaminated food and water. In view of its geographical distribution it is not a hazard associated with bushmeat from Central and West Africa.

VTEC

While it is possible that VTEC organisms may be carried by wild animals in Central and West Africa there are no reports in the literature of human illness there due to VTEC. If VTEC organisms were present then the risk to the hunter, dresser and chef is no greater than for a potentially contaminated piece of meat obtained in the UK. Basic hygiene in the kitchen to avoid cross contamination to other foods and appropriate cooking to kill any VTEC bacteria present in or on the meat provide adequate protection.

There were some cases recently of illness in England due to VTEC linked to the consumption of biltong made from antelope carcases imported from South Africa. It was not clear whether the VTEC organisms were on the carcase prior to import or whether the biltong became contaminated in England during production.

Yersinia enterocolitica and Y pseudotuberculosis

These organisms are widespread in the gastrointestinal tract of domestic and wild animals including pigs, rodents rabbits, deer, cats, birds and in soil and water. Carcases could be contaminated following dressing. These organisms can give rise to an enterocolitis in humans.

Yersinia pestis

The multimammate rat is an important host for plague in Africa. Other wild rodents can also be hosts. Infection of humans is almost always through bites of infected fleas or person-to-person spread, and only rarely through handling of infected tissues. The hunter is therefore at risk albeit a low risk. There is evidence of long term survival of Y. pestis in soil contaminated by animal carcases killed by plague. However Yersinia is susceptible to dessication indicating that viability in an unprotected environment is limited. The risk from subsequent handling and cooking in the UK is therefore likely to be extremely low.

VIRUSES

Arenaviruses

Lassa Fever is endemic in parts of West Africa. The Lassa fever virus causes chronic symptomless infection in its natural host, the multimammate rat (Mastomys natalensis), with viral excretion in its urine. The animal lives close to human habitation and is a common domestic species in Sierra Leone and Nigeria. It is possible therefore that this animal may be killed for human consumption, sold as bushmeat and hence reach the UK. The routes of infection for Lassa Fever are through contamination of broken skin or mucous membranes either through direct contact with the urine of infected rats or through indirect contact with materials, dust or food contaminated with rat urine. A person directly exposed to the animal in west Africa in killing and dressing it for consumption is at particular risk of being infected. In view of the fragile nature of the virus, which will rapidly die off in aging and maturing meat, the risk of infection for someone handling the carcase in the UK is likely to be extremely small.

Bunyaviridae

All the viruses in this family are maintained in nature in a complex lifecycle involving an arthropod vector and vertebrate host. (Hanta viruses can be maintained by direct rodent to rodent spread without a vector.) Man is an accidental host. The diseases that occur in Central and West Africa due to these viruses include Crimean-Congo Haemorrhagic Fever and Rift Valley Fever. These diseases are transmitted to humans by ticks and mosquitoes respectively. However it is possible for humans to acquire infection through contact with blood and tissue of infected animals. However no outbreaks have been observed in urban consumer populations in Africa. It is likely that a fall in pH with maturation or aging of the meat leads to virus death. Although there is a risk to the hunter and dresser locally the risk from meat brought to the UK is extremely small.

The Hanta viruses are maintained in rodent populations. Humans are infected by direct contact with rodents through infectious excreta, saliva or bites. The specific virus that has worldwide distribution is the Seoul virus that is linked to the brown rat (rattus norvegicus) and gives rise to Haemorrhagic Fever with Renal Syndrome. While most human infection comes directly from ticks it is possible for humans with broken skin to be infected by viraemic fresh blood when butchering an infected rodent. However infectivity is destroyed by a fall in pH that occurs in tissues after death. The risk therefore from Bunyaviridae for those handling matured meat is extremely small.

Filoviridae

Marburg disease was first identified in 1967 following human cases of the disease in Marburg, West Germany, due to exposure to the virus in African green monkeys imported from Uganda. There have been a few sporadic cases since then in Zimbabwe and Kenya and small outbreaks in the Democratic Republic of Congo and Angola.

The first outbreak of Ebola fever occurred in 1976 in the Democratic Republic of Congo, since when there have been further outbreaks in Sudan and in West Africa and in the Democratic Republic of Congo in 1995. The virus was found in cynomolgus monkeys imported to USA and Italy from the Philippines between 1989 and 1996.

Both Marburg disease and Ebola fever are suspected of being zoonotic in origin but the reservoir for the viruses is unknown, although clearly monkeys are possible candidates. The viruses responsible for these diseases are fragile and easily destroyed. The risk from bushmeat from possible reservoir animals imported to the UK is therefore considered extremely small. The viruses are destroyed in 30 minutes at 60^0 C and by commonly used disinfectants.

Poxviruses

The organism of relevance is the monkeypox virus which is found only in Africa particularly in the Democratic Republic of Congo. The reservoir host is the squirrel. Transmission requires contact with infected animals or contaminated fomites usually through skin abrasions. The virus is particularly robust and hence hunting of squirrels for bushmeat is an important risk factor. Monkeypox is a serious human infection with a fatality rate of up to 10%. The largest outbreak occurred in the Democratic Republic of Congo involving over 500 cases. Person to person spread continued over a period of 18 months (MMWR1997). In 2003 there was an outbreak of 11 cases of monkeypox in Wisconsin which was linked to contact with prairie dogs who had been infected by Gambian giant rats imported from Ghana (Reed et al 2004).

Retroviruses

Both human immunodeficiency virus type 1 (HIV-1) or type 2 (HIV-2) are considered to be of zoonotic origin and closely related simian immunodeficiency viruses (SIV) found in chimpanzees (SIVcpz) and sooty mangabey monkeys (SIVsm). There is evidence that both these simian lentiviruses have been transmitted to humans (Peeters et al 2000). Peeters et al found antibodies cross reacting with HIV antigens in about 20% of 573 monkeys hunted for bushmeat in the rain forest of Cameroon. Their findings bring to 30 the number of African non-human primate species known or strongly suspected to harbour primate lentiviruses. Those who hunt and field dress primates are likely to be exposed to both known and hitherto unknown SIVs with the potential to cross species to humans (Hahn et al 2000).

Whatever might be the basis for the AIDS epidemic in humans and the potential for exposure to new SIVs from hunting, the lentiviruses are very fragile and will die off rapidly in aging meat, particularly if the meat receives a treatment such as smoking. The risk therefore for those handling and cooking the meat further down the line from the hunter is considered to be extremely small.

PARASITES

Worms

Angiostrongylus (rat lung worm)

Human infection is due to A cantonensis and A costaricensis. They both occur in Africa. The definitive host are rats (rattus species and in the Americas the cane rat and other rodents). The adult worm lives in the pulmonary arteries of the definitive host (rodents). Man is infected by ingesting larvae (L3) in the intermediate host which are snails and slugs. The giant African land snail is an important intermediate host. On ingestion by humans the larvae develop into worms that lodge in the subarachnoid space around the brain, giving rise to meningoencephalitis (A cantonensis), or in the mesenteric arteries, giving rise to abdominal signs and symptoms (A costaricensis). Most humans are infected by ingesting L3 larvae in either raw or undercooked snails and slugs, contaminated water or through hands contaminated with larvae released from molluscs. Larvae are killed by freezing at $< -15^0$C for more that 12 hours, or by boiling for 2 – 3 minutes. There is evidence that the L3 larvae can infect rats through skin abrasions. There is the possibility therefore that humans could acquire infection from snails and slugs through abrasions but this has not been documented. Most cases of eosinophilic meningitis have been reported in SE Asia and the

Pacific Basin although infection is spreading to many other areas of the world including Africa and the Caribbean.

Ascaris suum

A theoretical risk from pigs, the worm is similar to Ascaris Lumbricoides. The eggs are extremely robust and can survive in 10% formalin. There is no indication that it causes infection in humans outside the laboratory.

Echinococcus granulosus (dog tapeworm)

The definitive host is the dog but can also be foxes, jackals and hyenas. Intermediate hosts are parasitised by the larval stage by ingesting eggs excreted by the definitive host. This gives rise to the hydatid cyst in the liver. Intermediate hosts include cattle, goats, sheep, buffalo, wild pigs, gazelle, giraffe and impala. If an intermediate animal host is killed, dressing of the animal will remove the hydatid cyst. Even if a human ingested protoscolices from the hydatid cyst they would be destroyed in the human gut. They do not develop into tapeworms. However, if a primary host, such as a fox, hyena or jackal, is killed then there is the possibility of contamination of the carcase with tapeworm eggs and consequent risk of developing a hydatid cyst. Protection is achieved through basic hygiene in the kitchen and thorough cooking of the meat. Hydatid disease of humans is reported infrequently in the UK but it is almost exclusively associated with sheep farming on the Welsh borders.

Hymenolepis nana – rat tape worm

The adult tapeworm is found in rodents, particularly rats. It has a cosmopolitan distribution including Africa. It is the only tapeworm that does not require an intermediate host. Man can be infected by ingesting the eggs of the tapeworm usually through contaminated food and water. Infection is usually human to human. A bushmeat rodent could be a source of tapeworm eggs from faecal contamination of the carcase following dressing.

Taenia saginata (beef tapeworm)

Human acquired infection from eating raw or undercooked meat from intermediate host animals containing the cysticercus stage of the tapeworm. Cysticerci have been reported in the meat and livers of wild ruminants in Africa. Freezing kills the cysticerci. Protection is provided by ensuring the meat is adequately cooked.

Taenia solium (pig tapeworm)

Humans, as well as being the final host, can also be the intermediate host. Humans acquire the tapeworm by ingesting undercooked meat,most commonly pork, containing the intermediate stage metacestodes (cysts). Intermediate hosts include both domestic and wild pigs and occasionally other mammals who have eaten eggs excreted in human faeces. Protection is provided by ensuring the meat is adequately cooked.

Toxocara

Toxocara canis and toxocara cati are round worms whose definitive hosts are dogs and cats respectively. Eggs are passed with faeces into the environment and incubate in the soil. The parasite may be found in the fox, jackal and hyena. Man is an accidental host. The eggs contain infectious larvae which if ingested by humans are unable to complete their life cycle. The larvae wander around the body causing varying degrees of morbidity including fever and eosinophilia (visceral larva migrans) and in serious cases can cause damage to the retina (visceral larva migrans). Eggs are hardy but require 10 days or more to embryonate in soil before they are infectious. It is unlikely that eggs represent a hazard for bushmeat as any faecal contamination on dressing would not give rise to infectious eggs in the time available and the environment of the carcase, not being soil, is not appropriate for the eggs to mature. Risks are greater from UK domestic environments such as gardens and parks.

Trichinella

Man becomes infected by consuming undercooked meat containing encysted larvae in the muscle. The ingested larvae develop into adult worms which in turn give rise to larvae in the intestine which penetrate into almost any tissue in the body possibly giving rise to a wide range of clinical problems. In equatorial Africa the responsible organism is T nelsoni for which hyenas and large cats are reservoir hosts. The warthog and bush pig are known to be sources of human infection. Bushmeat can represent a risk for trichinella. Freezing at -20^0 C for 3 days kills the cysts. It is important that the meat is thoroughly cooked.

Protozoa

Balantidium coli

This is a common parasite of pigs which like E histolytica lives in the lumen of the large gut and may invade the gut wall and cause ulcers. Man has been infected with this parasite but infrequently.

Cryptosporidia

A very large number of different host species from around the world can be infected with cryptosporidia. It has been found in wild animals including brown rats and housemice. It is therefore possible for a bushmeat carcase to harbour oocysts following faecal contamination. The oocysts are extremely resistant to adverse circumstances and can survive for long periods after excretion in faeces. Viability is lost by heating at 65^0 C for 5 to 10 minutes, and by boiling and drying. Smoking of the carcase will therefore be expected to reduce possible oocyst load. Basic hygiene precautions in the kitchen and thorough cooking will provide adequate protection.

Entamoeba histolytica

Although the main reservoir are other humans morphologically similar amoebae are found in primates. There is therefore a possible risk from monkeys hunted for bushmeat as a result of faecal contamination of the carcase.

Giardia

A number of animals can be infected with giardia and therefore be a zoonotic source (beaver, muskrat, dog, cat, cattle, sheep, pig, goat, gerbil and rat). It is possible therefore that a bushmeat carcase could be contaminated following dressing and therefore be a source of cross-contamination in the kitchen. The cysts will be reduced by the smoking and drying of the carcase and killed by cooking.

Toxoplasma

Toxoplasmosis is the most common parasitic infection of humans. Infection with the protozoan parasite Toxoplasma gondii is common throughout the world in many animals used for food such as sheep, pigs and rabbits. The parasite is also found in wildlife animals such as deer. These are intermediate hosts and harbour cysts in tissues such as the brain, myocardium and skeletal muscle. These animals are infected by eating oocysts shed by the primary host the cat, either domestic or wild. Humans are infected through ingestion of either oocysts, excreted by the cat, that have contaminated food through various vectors such as flies, cockroaches, dungbeetles or earthworms, or by consumption of uncooked or undercooked meat containing cysts. Cysts in bushmeat may represent a risk . If the animal killed for bushmeat is a member of the cat family it could be directly contaminated by oocysts in the faeces when the carcase is dressed. Oocysts can survive for long periods under most ordinary environmental conditions. Infection can be prevented by attention to good hygiene in the kitchen including washing hands and utensils after contact with raw meat, and ensuring meat is fully cooked. Freezing $< -13^0$C kills tissue cysts.

ANNEX 5

Tables taken from CDR Weekly

Common gastrointestinal infections, England and Wales, laboratory reports: weeks 49-52/04

Laboratory reports	Number of reports received				Total reports	Cumulative total to	
	49/04	50/04	51/04	52/04	49-52/04	49/04	52/03
Campylobacter spp.	552	459	306	186	1503	39,746	44,797
Escherichia coli O157*	1	3	6	8	18	624	422
Salmonella spp.†	155	123	92	64	434	12,423	14,901
Shigella sonnei	2	11	4	2	19	689	579
Rotavirus	74	76	82	43	275	13,452	14,694
Norovirus	88	70	68	44	279	2517	2078
Cryptosporidium spp.	46	31	22	16	115	3300	5792
Giardia spp.	40	32	26	19	117	2823	3306

* Vero cytotoxin producing isolates (data from Health Protection Agency's Laboratory of Enteric Pathogens (LEP).
† Data from Health Protection Agency's Laboratory of Enteric Pathogens.

Less common gastrointestinal infections, England and Wales : laboratory reports, weeks 40-52/04

Laboratory reports	Total reports	Cumulative total to	Cumulative total to
	40-52/04	52/2004	52/2003
Astrovirus	39	174	143
Calicivirus	16	48	33
Shigella boydii	–	–	94
Shigella dysenteriae	–	–	50
Shigella flexneri	64	229	261
Aeromonas spp.	37	164	159
Plesiomonas spp.	4	32	26
Vibrio spp.	5	28	19
Yersinia spp.	3	14	32
Entamoeba histolytica	19	101	130
Blastocystis hominis	46	308	331
Dientamoeba fragilis	20	178	267

Above Tables taken from CDR 13 January 2005

Common animal associated infections, England and Wales laboratory reports: weeks 49-52/04

	Total reports for weeks 49-52		Cumulative totals for weeks 49-52	
	2004*	2003	2004*	2003
*Borrelia burgdorferi**‡	–	3	245	284
Leptospira hardjo†§	–	–	3	–
Leptospira icterohaemorrhagiae†§	1	3	10	11
Leptospira other†§	4	1	24	9
Pasteurella haemolytica	–	–	9	3
Pasteurella multocida	25	5	289	268
Pastaurella pneumotropica	–	–	6	8
Pasteurella spp	5	8	78	86
Toxocara spp	–	–	3	4
Toxoplasma gondii	2	–	25	30
Toxoplasma spp	4	5	55	57
Capnocytphaga spp	–	–	5	11
Echinococcus granulosus	–	–	4	10
Coxiella burnettii	–	1	31	36
Chlamydia psittaci	2	9	67	96
Brucella spp	–	2	16	5
Orf-paravaccinia virus	–	2	1	5

* provisional data; † by specimen date; ‡ Lyme Disease Reference Laboratory and CDSC.
§ Leptospira Reference Laboratory and CDSC. NA = Not available.

Comment

Leptospirosis

Leptospira icterohaemorrhagiae: M 57y, no clinical or epidemiological information
***Leptospira* spp**: M 32y, Territorial Army, swimming and capsizing in freshwater pools; M 36y canoeing. M 52y; F 53y, no clinical information.

Pasteurellosis

Pasteurella multocida: Ten females aged between 15 and 85 years with no clinical or epidemiological history

Four females aged between 10 and 75 years with dog bites; one female aged 84y with infected cat scratch.

***Pasteurella* spp**: Eight males aged between 28 and 84 years with no clinical history; two males aged between 25 and 58 years with dog bites.

Toxoplasmosis

Toxoplasma gondii: M 47y, cat died two weeks before onset of symptoms; M 42y.
***Toxoplasma* spp**: F 18y, F 26y, F 31y, M 47y

Psittacosis

Chlamydia psittaci: F 63y, M 71y, no clinical information.

Above Table and Footnotes taken from CDR 7 January 2005

Following Table and Footnotes taken from CDR 3 February 2005

Imported infections, England and Wales: October to December 2004

This fourth quarter report on imported infections in England and Wales covers the period from October to December 2004 inclusive. The data should be interpreted in conjunction with the report *Illness in England, Wales, and Northern Ireland associated with foreign travel – a baseline report to 2002* (1), especially the content under the section 'Sources of data on travel-associated illness and their limitations for analysis'. All data presented are provisional and subject to change; the confirmed final data will be presented annually.

In general, there were fewer infections reported in England and Wales via LabBase* in the final quarter of 2004 (11,867)† compared with the same period in 2003 (15,229) (Table). This may be as a result of current data loading problems within Co-Surv‡, and is currently being addressed. Travel history reporting, however, has improved significantly in the fourth quarter of 2004, from 12.6% reports stating any information about recent travel abroad in the third quarter of 2004 to 19.4% in the same period ($\chi 2 = 234.79$, 1df, $p<0.01$). This is consistent with the second and third quarters (2,3) and may represent an overall improvement of travel history reporting in 2004 compared with 2003. The overall proportion of travel history reporting, however, is still low and limits the interpretation of the following data (Table).

Table Imported infections in England and Wales: October to December 2004

Organism	Total reports for Oct to Dec				Cumulative totals for Oct to Dec			
	2004*		2003		2004*		2003	
	Travel-related	All reports	Travel-related	All reports	Travel-related	All reports	Travel-related	All reports
Gastrointestinal Infections								
Bacterial								
Salmonella spp	458	2521	509	3205	1967	11404	2759	15057
Campylobacter spp	228	7447	320	9214	1050	35939	1404	44688
Shigella flexneri	10	67	6	52	35	204	32	258
Shigella dysenterae†	12	15	9	19	49	223	31	50

Shigella sonnei	36	185	15	97	100	609	83	578
Shigella boydii†	14	31	21	30	64	113	52	94
Shigella unknown spp	1	17	1	17	6	101	3	68
Salmonella Typhi	31	43	26	37	116	193	118	201
Salmonella Paratyphi (A,B,C)	37	58	15	27	136	213	107	199
Vibrio cholerae (Type O1)†	2	2	4	4	8	10	10	11
Protozoal								
Entamoeba histolytica	4	29	15	72	20	149	58	264
Entamoeba coli	1	15	1	17	8	68	6	66
Giardia lamblia	64	616	67	890	229	2453	283	3332
Cryptosporidium spp	18	797	58	1430	96	3046	405	5778
Cyclospora spp	5	9	2	7	16	43	13	40
Endolimax nana	–	5	–	7	5	23	5	50
Helminths								
Strongyloides stercoralis	1	3	4	6	1	18	7	25
Strongyloides spp	–	1	–	1	–	5	–	7
Ancylostoma duodenale	–	–	–	–	–	1	1	1
Necator americanus	–	–	–	–	–	–	–	–
Hookworm unspecified	–	3	5	15	3	18	10	73
Ascaris lumbricoides (round worm)	1	8	9	29	8	64	18	105
Trichuris trichiura (whip worm)	2	5	1	11	9	39	5	77
Hymenolepis diminuta	–	–	–	–	–	–	–	–
Hymenolepis nana	–	–	–	3	1	5	1	16
Hymenolepis spp	–	–	–	–	–	–	–	–
Taenia saginata	2	8	5	28	5	38	6	49
Taenia spp	–	7	1	13	2	27	2	45
Gnathostoma spp	–	–	–	1	–	2	–	2
Diphyllobothrium latum (fish tape worm)	–	2	–	2	–	2	–	2
Arthropod borne infections								
Arboviruses								
Dengue virus	–	3	3	9	2	15	6	21
Chikungunya virus	–	–	–	–	–	–	–	–
Ross river virus	–	–	–	–	–	1	–	1
Sandfly fever virus	–	–	–	–	–	–	1	1
Unspecified	–	2	–	–	1	6	–	1
Leishmaniases								
Cutaneous	–	–	7	7	8	9	23	28
Visceral	–	–	–	–	–	1	1	1

Unspecified	–	–	1	3	5	6	1	6
Filariases								
Loa loa	–	–	–	–	–	2	–	1
Wuchereria bancrofti	–	–	–	1	–	–	–	2
Mansonella perstans	–	–	1	2	–	–	1	4
Onchocerca volvulus	–	–	–	–	–	–	–	–
Unspecified	–	–	–	–	–	–	2	3
Lyme borreliosis‡	22	100	5	31	54	323	24	315
Miscellaneous								
Schistosome infections								
Schistosoma mansoni	–	–	3	5	5	12	5	13
Schistosoma haematobium	–	5	2	8	3	21	16	43
Schistosoma intercalatum	–	–	–	–	–	–	–	–
Schistosoma unknown spp	1	5	–	6	4	21	–	10
Other infections								
Leptospirosis‡	3	11	2	8	6	30	7	30
Legionnaires' disease§	42	68	33	92	137	273	143	310
Coxiella burnetii (Q fever)	–	5	1	7	1	28	3	46
Rickettsia spp	–	–	–	–	–	1	1	1

*All data for 2004 is provisional and subject to change.
† Data on cholera, *S.boydii* and *S.dysenteriae* supplied by the SMRD Laboratory of Enteric Pathogens
‡ The Zoonoses Surveillance Reference Unit, CDSC Wales, supplied data for Lyme borreliosis and leptospirosis on behalf of the Leptospira Reference Unit, Hereford and the Lyme Disease Reference Unit, Southampton.
§ Data on legionnaires' disease were supplied by the Legionella Section of the Respiratory Diseases Department of CDSC and represent cases of legionnaires' disease reported to the National Surveillance Scheme in residents of England and Wales. Travel-related cases are those who have spent all or part of the incubation period of between two and ten days abroad prior to onset of symptoms.

Gastro data extracted from Labbase 10 January 2005, enteric fever and other infections 19 January 2005 Table compiled by the Health Protection Agency's Travel Health Surveillance Section at the Centre for Infections, Communicable Disease Surveillance Centre (CDSC), London.

Gastrointestinal infections
Bacterial infections

Gastrointestinal infections are the most frequently reported type of infection in England and Wales and, although under reported, are the most common infection in travellers. In the fourth quarter of 2004, *Salmonella* spp (non-typhoidal) were the most frequently reported infection associated with recent travel abroad (458/2521) even though more campylobacter infections are reported in England and Wales in general (7447 in total of which 228 reported recent travel abroad). Travel history reporting was slightly better for the fourth quarter compared with the third quarter of 2004, and more complete for *Salmonella* spp than for campylobacter, with 68.3% of *Salmonella* spp reports having any information about foreign travel compared with only 4.6% for *Campylobacter* spp. Travel history reporting for campylobacter is historically under- estimated in routine surveillance systems (3).

Of the *Salmonella* spp reports that stated recent travel abroad, 33% (151/458) reported recent travel abroad to Europe and 22% (101/458) travelled to north Africa and the middle east. The travel destinations most frequently reported were Spain, including the resort islands of the Canaries and Balearics, (17.9%, 82/458), Egypt (8.1%, 37/458), Greece and India (both 7% (32/458), Thailand (4.8%, 22/458), Turkey (4.4%, 20/458), and Tunisia (4.1%, 19/458). Fifty-eight (12.7%) reports had no country of travel stated.

Thirty-two per cent (73/228) of the *Campylobacter* spp reports showing a recent history of foreign travel reported recent travel to mainland Europe, 25.9% (59/228) to the Indian sub continent, and 15.6% (35/228) to north Africa and the middle east. The most frequently reported countries of travel were Spain (21.5%, 49/228) and India (20.2%, 46/228). Twenty-two reports (9.6%) had no country of travel stated.

In the fourth quarter of 2004, there were 315 reports of shigella infection, 31 due to *Shigella. boydii* and 15 due to *Shigella. dysenteriae*, the organisms that cause dysentery-like (bloody diarrhoea) illness. There was information about recent travel abroad for 24.4% (77/315) of reports, of which 73 (95%) specified recent travel abroad. The countries of travel most frequently reported were Egypt (20/73) and India (13/73).

There were two reports of *Vibrio cholerae*, both serotype O1, biotype El Tor Ogawa; one was imported from Cameroon and the other from India.

The geographical distribution of gastrointestinal infections, in particular salmonella and campylobacter, tends to reflect the travelling patterns of British travellers, as they are common worldwide. As the winter months approach, travellers tend to travel further afield for winter sun holidays, *eg*, northern Africa, the middle east, and to tropical countries; this is also reflected by the countries of travel that have been reported in the above data.

Protozoal infections

During the fourth quarter, there were 797 reports of cryptosporidiosis in England and Wales, of which 18 reported recent travel abroad. Of those, the Indian sub-continent (ISC), Europe and the Caribbean were stated regions of travel. There were 616 reports of *Giardia lamblia*, of which 64 reports stated recent travel abroad. The most frequently reported regions of travel were the ISC (20), sub-Saharan and southern Africa (nine), north Africa, the middle east, and Europe (eight each). Only 3.4% of Cryptosporidium reports had any information about travel history stated, but travel history reporting for *Giardia lamblia* was significantly better at 11.2% ($\chi2$ = 33.5, 1df, p<0.01). Other infections reported in this category included *Entamoeba histolytica* and *Entamoeba coli*, *Cyclospora* spp, and *Endolimax nana*; those that reported recent travel abroad were mainly associated with travel to the Tropics, particularly to the ISC, south east Asia, and the far east. There were two cases with dual infections, one with *Giardia lamblia* and *Ent. coli*, who had travelled to Angola, and one with *Giardia lamblia* and cryptosporidium, whohad travelled to Pakistan.

Enteric fever

In the fourth quarter of 2004, there were 43 reports of *Salmonella* Typhi, of which 31 reported recent travel abroad. Twenty-six reports stated recent travel to the ISC (India 13, Pakistan 9, Bangladesh 3, and Nepal 1), two with no country stated, and one each stated travel to Nigeria, Niger, and Cameroon. There were 58 reports of *S*. Paratyphi (53 *S*. Paratyphi A, 4 *S*. Paratyphi B, and one *S*. Paratyphi C), of which 37 stated recent travel abroad (35 Paratyphi A and two Paratyphi B). Thirty-three reports stated travel to the ISC (India 18, Pakistan 7, Bangladesh 7, Nepal 1), two to South America, one to Indonesia, and one with no country stated. On average, for each quarter in 2004, 74% of all enteric fever reports have some information about their history, which is 13% higher than in 2003 ($\chi2$ = 13.8, 1df, p<0.01). Travel history reporting, therefore, has improved for enteric fever over 2004.

Gastrointestinal incidents

In the fourth quarter of 2004, there were 50 incidents § of gastrointestinal illness reported to be associated with foreign travel with onset dates between October and December 2004. Of those, 19 were due to salmonella, 19 to campylobacter, and five to *Shigella* spp, although these events/outbreaks were not typed any further. Forty-two per cent of gastrointestinal events reported, specified travel to Europe (16 to Spain), and ten specified travel to north Africa and the middle east.

Helminths

In the fourth quarter of 2004, there were 38 reports of helminth infection, six of which stated recent travel abroad. There were eight reports each of *Taenia saginata* (of which two stated recent travel abroad to South Africa and Thailand) and *Ascaris lumbricoide*s (of which one stated recent foreign travel but country unknown). There were seven reports of *Taenia* spp, five *Trichuris trichiura* (of which two stated recent travel abroad to Bangladesh and Nigeria).

Arthropod borne infections

Dengue

Only three cases of dengue fever were reported through the routine laboratory reporting system, none of which had any information about travel history. This is probably an underestimate.

Lyme borreliosis

CDR Weekly, Vol 15 no 5: Travel Health One hundred reports of Lyme borreliosis were received during the fourth quarter of 2004 of which, 22 were known to have been acquired overseas. Eight infections were acquired in Scandinavian countries (Sweden and Norway); five infections were acquired in the United States (New England and other eastern seaboard states); five were acquired in France, two in Germany (one of whom was in the British Army), and one each in Belgium and Portugal. All, apart from the soldier, are believed to have acquired their infections during recreational activities. The proportion of overseas-acquired infections (22%) is comparable with previous experience.

Other infections

Legionnaires' disease

As of 19 January 2005, there were 68 legionnaires' disease cases reported for the fourth quarter of 2004, of which, 42 were travel-related. Nine of the travel-related cases were associated with five different outbreaks in Bulgaria, Malta, Turkey, and the United Arab Emirates.

Schistosomiasis

Only ten cases of schistosomiasis were reported for the final quarter of 2004, compared to 19 in 2003. Only one report of schistosomiasis (unspeciated) had a reported travel history, with travel to Africa (country not stated).

Leptospirosis

Eleven cases of leptospirosis were reported during the fourth quarter of 2004 compared with eight in the same quarter of 2003. Three cases, all males, were reported to have been acquired overseas. One had been canoeing in France, one had been fishing in Thailand, and the epidemiological history remains unavailable for one.

Footnotes

*Labbase is the database that collects laboratory reports of all microorganisms isolated at nearly 400 NHS and other laboratories throughout England and Wales . The database is managed and accessed at CDSC.
†Note that these figures refer to data extracted from Labbase only, and do not include cholera, malaria, Legionnaires' disease, Lyme borreliosis or leptospirosis where data has been obtained from other sources.
‡Co-Surv is an electronic reporting system, and is managed at the HPA's Centre for Infections.
§Gastrointestinal illness incidents are reported to the Environmental and Enteric Diseases Department of CDSC by CCDCs and Environmental Health officers and each event may be one or more cases. It is a passive database and can only give a broad idea as to what sort of infections travellers are returning to England and Wales with. It cannot be matched to the laboratory reporting system.

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