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MEDITERRANEAN ZOONOSES CONTROL CENTRE CENTRE MEDITERRANEEN DE LUTTE CONTRE LES ZOONOSES

SALMONELLOSIS
AND
FOODBORNE INFECTIONS

Report of a WHO/MZCP Training Course
Anogia, Crete, Greece, 20-22 March 1997

Athens, 1998

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1. INTRODUCTION

Almost half of the world's population suffers from diseases associated with contaminated food and water. Their virtual importance as a public health problem is often overlooked because their true incidence is difficult to be evaluated and the severity of their health and economic impact is often not fully understood. Moreover, there is a scarcity of reliable information on the spread of foodborne zoonotic infections among the human population and the sources of food contamination in most countries of the Mediterranean region (MR). Salmonellosis, zoonotic tuberculosis, campylobacteriosis, enterohaemorrhagic *E.coli* infections and listeriosis are included among the most important.

Salmonellosis remains among the main causes of foodborne illness in developing as well in developed countries. It is known to be an important cause of severe diarrhoea among the children as well as other age groups of a population. Moreover serious economic problems are created in poultry production, which is incriminated to be the main cause of human infection.

Since mid 80s, there has been a market increase in the incidence of human salmonellosis in many countries. This has been associated with *Salmonella* contamination of human food products. Particularly, poultry meat and eggs. This phenomenon is also attributed to the particular development of industrial type of breeding and food processing as well as to the slaughtering methods used. Moreover, many other human foods such as fresh milk, dried milk, chocolate, mayonnaise and fermented meat products are sources of human infection with this pathogen. During the aforementioned period there was a marked increase in *S. enteritidis* serotype involvement in human infection and this still persists.

Another foodborne pathogen of very high public health importance is the Shiga-like toxin producing *E. coli* (SLTEC), also called Verocytoxin producing *E. coli* (VTEC) or Enterohaemorragic *E.coli* (EHEC) especially serotype 0:157:H7. It is the cause of systematic toxaemia complications such as haemolytic uraemic syndrome and its low infectious dose makes it highly transmissible.

The real magnitude and direct or indirect impact of these diseases on public health cannot be assessed properly in most countries. Lack or deficiencies in surveillance and reporting systems do not permit reliable evaluation of prevalence and incidence of zoonotic foodborne infections among the human and animal populations.

In view of these situations the World Health Organization jointly with the Mediterranean Zoonoses Control Programme (MZCP) and its Member States, understanding the need for information, expertise and knowledge exchange, organized the *"Training Course on Salmonellosis and Foodborne Infections"* in the Mediterranean countries. This Training Course was also aimed at further strengthening the collaboration and cooperation between all interested countries in a matter of a major public health importance.

The technical contribution and organizational assistance of the WHO Collaboration Centre on the Research and training in the Mediterranean Zoonoses Medical Faculty, University of Crete, Heraklion and of its director Prof. Y. Tselentis, is deeply acknowledged.

1.1 Opening Session

In the opening session, Dr A. Seimenis, Director of the WHO/Mediterranean Zoonoses Control Centre welcomed the participants on behalf of the Director General of the WHO, Dr. H. Nakajima. Then he conveyed the greetings of Dr. F.X. Meslin, Secretary of the Joint Coordinating Committee of the MZCP, for a successful Meeting.

Dr. A. Seimenis, recalled the purposes and objectives of the Training Course which were as follows:

a) To review the epidemiological situation on human and animal salmonellosis and the foodborne zoonotic infections in the MZCP countries.
b) To study strategies for the control of salmonellosis and foodborne infections in the Mediterranean Region.
c) To emphasise on food safety issues and rules.
d) To stress the importance of public health education, community participation and intersectoral cooperation in the prevention and control of zoonoses in general and foodborne infections in particular.

Dr. Y. Tselentis, Director of WHO/Collaborating Centre in Mediterranean Zoonoses, University of Crete, Heraklion, was elected Chairman. Dr. M. Abdou, WHO/MZCP Temporary Advisor, was elected Vice-Chairman, while Dr. Ch. Vlassiotis, Greece, was elected Rapporteur.

2. THE PROBLEM OF SALMONELLOSIS AND FOODBORNE INFECTIONS IN THE MEDITERRANEAN REGION.

Foodborne and waterborne diseases are, perhaps, the most widespread health problems in the contemporary world and an important cause of law productivity. They range from mild indisposition to life threatening illnesses. Apart from their immediate effects, foodborne diseases are known to cause serious and chronic health problems.

Diarrhoeal diseases caused more than 3 million deaths globally in 1995, of which more than 80% were among children under the age of 5. About 50% of diarrhoeal deaths are due to acute watery diarrhoea, 35% to persistent diarrhoea and 15% to dysentery[1].

The problem of foodborne diseases is very serious in developing countries but is not limited to them. The estimated annually incidence of foodborne diseases in the United States ranges from 6.5 million to 80 million cases. Surveys in several other industrialized countries suggested that annually, up to 10% of the population might be suffering from a foodborne disease[1].

Salmonellosis has increased tremendously in industrialised countries over the past two decades with *S. enteritidis* as prevailing serotype. Poultry meat, eggs and egg products have been identified as predominant sources of this pathogen[1].

Many industrialised countries are experiencing outbreaks of diseases due to recently identified types of foodborne pathogens such as *Campylobacter jejuni, Listeria monocytogenes,* and *E. coli* 0157:H7. Referring to the latter pathogenic agent, the largest outbreak of foodborne infection ever recorded occurred in Japan in 1996, affecting more than 6.300 school children and causing two deaths. In Scotland the same year, an outbreak due to the same pathogen killed 20 and affected almost several hundreds persons[2].

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[1] The World Health Report, 1996, WHO, Geneva, Switzerland.

[2] The World Health Report, 1997, WHO, Geneva, Switzerland

Many species of bacteria, which are pathogenic to humans, have animals as their principal reservoir. Among these, *Salmonella* is probably, the most important as it is responsible for hundred of thousands of various foodborne infections originating from contaminated meat or food products of animal origin.

Taking under consideration that contaminated food plays an important role in the infant diarrhoea and that many families in developing countries have only limited if any, access to facilities to control contamination (e.g. refrigeration), WHO and FAO have jointly published recommendations concerning the use of fermentation as a household technology for improving food safety[2].

The medical and public health importance of foodborne diseases is increasingly realised, especially after the decline of major epidemic diseases. However, their real socio-economic implications are still not well known.

Diarrhoeal diseases are not only a cause of serious morbidity and mortality in infants, elder and debilitated organisms and of gastrointestinal disease in adults, they are also an important cause of absence from work having damaging effects in productivity. As a consequence, diarrhoeal diseases are undermining the nutritional status of the already undernourished populations and cause serious losses to the food trade.

Many developing countries are trying to set up industrial food processing for export and for their growing urban populations but they find it difficult to compete with similar industries in countries with better hygienic conditions and standards.

Prevention and control of foodborne infections implicates the setting up of an efficient surveillance and reporting systems together with efficient laboratory services and consistent health education of the public.

2.2 Role of animals and food of animal origin in the epidemiology of salmonellosis

It is well known that, during the last decade, human cases of salmonellosis are constantly increasing in many countries and *S. enteritidis* is the major pathogen causing foodborne diseases globally. It is also well known that it is very difficult to characterise the serovars of *Salmonella* except for *S. enteritidis.*

Some of the 2,500 different serovars of *Salmonella* are host adapted, like *S. cholerasuis* in pigs or *S. pullorum/gallinarum* in poultry while some others affect all species, for example, the *S. typhimurium,* the most common pathogen for humans. For this reason epidemiological surveys are needed, including the molecular biology of the isolated strains.

Nevertheless, it seems that salmonellosis is more prevalent when various conditions co-exist, as for example, the intensive livestock farming in many countries of the MR.

<u>The chain of transmission in the productive animals</u>

Infected animals excrete the organism and contaminate the environment. The chain of transmission begins with the animals in their natural habitat.

<u>The infection on the farm:</u>

Farm animals are infected by:

- animal to animal transmission (from breeding flocks to newly hatched chicks via infected eggs),
- contaminated animal feed,
- contaminated environment, (dust, infected rodents, insects, water etc.)

<u>The infection in the slaughterhouse:</u>

Live animals are infected:

- during transport due to the exacerbated stress imposed on the animals.

- in the slaughterhouse cross-contamination may occur during scalding and eviscerating due to the faecal contamination of the carcasses (bad hygiene), or even after the slaughter due to bad refrigeration during the storage or at the moment of transportation.[3]

How to keep productive animals free of *Salmonella*

In the majority of cases, salmonellosis in man is derived from foodstuffs of animal origin. The first step to be taken in order to protect the consumer is the attempt to raise animals free of *Salmonella*. It is not easy to rear *Salmonella* -free animals as they can be infected by a number of agents very difficult to control, such as dust, animal feed, water, faecal material and excreta, rodents, insects, wild animals and birds. Moreover in some productive animals (swine and poultry) salmonellosis do not cause clinical symptoms that can lead to economic losses. Therefore, farmers either do not report it or they are unwilling to implement any programmes for the eradication of the disease. However, some countries have reported significant success in raising *salmonella*-free herds (e.g. Sweden, Denmark, the Netherlands and others).

The measures suggested to be taken to achieve *salmonella*-free herds/flocks are reported in ANNEX III.

The role of animals and food of animal origin in the epidemiology of salmonellosis is predominant but very complex. Many questions remain unanswered; i.e. how would the difference of virulence between strains of *Salmonella* on the farm, the processing plants, in the sewage, or rivers be explained.

Many principles to answer these questions need to be developed. Nevertheless, it is actually possible, for hygienists, to use different models to reduce the risk of *Salmonella* contamination. Such models include Good Hygienic Practices (GHP), Hazard Analysis Critical Control Point (HACCP) systems, epidemiological risk assessment and quality risk management procedures. The battle against *Salmonella* is a permanent fight, at each stage of the production chain.

Measures suggested for the prevention of contamination by *Salmonella* and other pathogens are referred to ANNEX IV.

2.3. Epidemiology of meatborne and milkborne infections in the Mediterranean Region

Contaminated meat and milk have been known to be sources of illness in human societies since antiquity. They still remain a serious problem because they continue to cause morbidity, mortality and significant economic losses in both developed and developing countries.

1. The available data show that the main diseases transmitted by meat, milk and their products are: salmonellosis, tuberculosis, anthrax, staphylococcal intoxication, streptococcal infections, and taeniases. The incidence of other diseases such as clostridiasis, or outbreaks by *E. coli* is much lower.
2. Raw milk and fresh milk products are the principle vehicles for the transmission of brucellosis, typhoid, salmonellosis and other enteric and diarrhoeal infections. Milk based pastries such as milk containing sweets, cream filled products etc. are the main cause for the transmission of pathogenic agents in developing countries.
3. The reporting of foodborne diseases is generally very poor, but in some cases of outbreaks the group of persons involved is so large that attract the attention of the mass media. Nevertheless, statistical data concerning the prevalence of the

[3] The World Health Report, 1997, WHO, Geneva, Switzerland

aforementioned infections are usually lacking. This fact makes the control of these infections a very difficult task.

Developing countries show considerable weakness to prevent and control the foodborne diseases. This is due to:

- low standards of living of the majority of the populations
- illiteracy
- low health standards
- malnutrition
- poor water supply hygiene
- inadequate waste disposal systems
- inadequate health care
- absent or inadequate laboratory services
- unfavourable climatic conditions
- outdated food laws and regulations
- lack of financial resources, expertise, specialized technical staff (food inspectors, epidemiologists, etc.).

Epidemiological surveillance programme

In many countries of the MR, there is no system of actual surveillance of foodborne diseases with the result that these countries lack authentic epidemiological data on the incidence of meatborne and milkborne infections. Therefore, the public health and economic significance of these infections is underestimated.

The establishment of an epidemiological surveillance system is to provide information that will contribute to the analysis of causes and associated factors in order to facilitate the planning and the implementation of preventive and control measures taken by governments.

Surveillance is not an isolated activity but a component of an effective control programme, which should be used to formulate and carry out a disease control policy. The principal components of such a system should be.

- ♦ the reporting of the occurrence of the aforementioned diseases including the presence of corresponding pathogens in human beings, animals, food and feed-stuff, the water and the environment in general.
- ♦ the collection and the interpretation of data collected and
- ♦ the dissemination of information to the appropriate authorities in order to achieve quick and efficient action.

An efficient surveillance and reporting system together with adequate laboratory facilities is sure that would contribute to the prevention and control of zoonotic foodborne diseases in humans and animals.

3. COUNTRY REPORTS ON SALMONELLOSIS EPIDEMIOLOGICAL SITUATIONS IN THE MZCP COUNTRIES.

3.1 Cyprus

Salmonellosis in Cyprus is a notifiable disease. It is considered to be one of the main foodborne diseases but there is not enough data concerning its impact on public health and the national economy. Officers of the Ministry of Health investigate all reported cases.

Diagnosis of salmonellosis in humans is carried out by bacteriological and biochemical tests in hospital laboratories. Most of the reported cases represent

family cases and are reported by the practitioners of the government sector, while the private one avoids reporting.

The veterinarians of slaughterhouses submit samples to the Laboratory for the Control of Foods of Animal Origin, Ministry of Agriculture and the results of their examination are submitted back to the veterinarians for action. The table below shows the investigated cases of salmonellosis from 1986 to 1995.

INVESTIGATED CASES OF SALMONELLOSIS FROM 1986 TO 1995

Year	Cases	Year	Cases	Year	Cases
1986	107	1990	56	1994	76
1987	75	1991	56	1995	83
1988	86	1992	97		
1989	74	1993	111		

3.2. Egypt

Salmonella is an important causative agent of diarrhoeal diseases in Egypt. Studies carried out in the '80s showed that *Salmonella* was responsible for 2 - 7% of reported cases of acute gastro-enteritis among children. An investigation for the causes of infantile diarrhoea performed in 1991 in the Governorate of Alexandria showed that this pathogen represented 4.2% of the cases while in the Assuite Governorate the incidence was only 2.9%. Incidence was lower in rural areas than in urban ones.

The serovars detected in the Governorate of El-Fayoum in 1991 were the following: *S. typhimurium* 18.2%, *S. newport* 15.1%, *S. dublin* 6.1% and *S. reading* 3%. However, these figures do not represent the real situation due to under-reporting.

Following a laboratory investigation performed in 1993, the serovars detected from poultry feed were *S. muenster* (27.77%), *S. lexington* (16.66%), *S. cerva* (11.1%), *S. drypool* (11.1%) and *S. uganda* (5.55%)

Egypt imports a considerable amount of bovine meat and frozen chicken meat. A major cause of introduction is attributed to these imports.

New legislation for food hygiene has been issued during the past five years including accurate specification for all food items. Regular inspection together with laboratory tests according to a double sample system is implemented to assure food safety.

3.3 Greece

Zoonotic salmonellosis in Greece was rather rare until 1987. A remarkable increase of cases has been recorded since 1988. The table below shows the cases officially notified during the last four years:

NOTIFIED SALMONELLOSIS CASES FROM 1992 TO 1995

Year	Cases	Year	Cases
1992	974	1994	1082
1993	895	1995	906

*Most of the above cases occurred during July and August.

During the recent years the predominant serotype has been *S. enteritidis* accounting for 65% and 82% of all human isolates in 1990 and 1991, respectively. More than 50% of isolates were from children.

There is under-reporting or no reporting mainly from the private sector. As in all countries the epidemiological situation indicates that foodborne infections could be prevented and controlled through appropriate hygiene practices at animal and poultry productuion level as well as during the processing and storing of food.

The disease has exceptional occurrence in sheep and goats and in general is infrequent in food animals. It is calculated that only 0.1 - 0.2 % of the food animals are infected every year but the available data do not cover all the geographical regions and the total of the animal population.

Salmonellosis control in Greece is focused mainly on poultry and poultry products which appear to be the commonest cause of human salmonellosis cases. The control strategies are based on the European Union 92/117 Directive.

3.4 Italy

A considerable increase of human cases of salmonellosis in humans was notified in Italy during the last years.

Salmonellosis in humans and domestic animals is a notifiable disease. The state veterinary laboratories are the responsible institutions for the isolation of *Salmonella* in animals, food of animal origin and feed. Sources of information on *Salmonella* infection in humans are the Local Health Units. The table below shows the cases of salmonellosis officially reported.

NOTIFIED SALMONELLOSIS CASES FROM 1984 TO 1995

Year	Cases	Year	Cases	Year	Cases	Year	Cases
1984	9.474	1987	11.411	1990	19.684	1993	20.722
1985	11.025	1988	11.580	1991	20.511	1994	21.109
1986	12.299	1989	13.034	1992	23.488	1995	14.783

*Over 60% of the outbreaks are principally due to *S. enteritidis* but also to other group D Salmonellae.

There is an increased frequency of Salmonellae isolations from poultry meat and eggs. *S. enteritidis* is by far the most frequently isolated serotype in these products.

3.5 Lebanon

Salmonellosis is a serious problem in this country creating severe socio-economic consequences.

Contamination of water sources, damage of sewage system in the cities and increase of bottomless wells used for human wastes are listed among the basic problems that this country faces.

Although it is known that salmonellosis presents a serious problem to human health there are no figures accurately representing the epidemiological situation due to underreporting especially by the private sector.

Efforts are being made for information collection improvement and information exchange among Ministries and agencies involved.

In a study performed in 1995 by the Veterinary Laboratory in Fanar, from different samples taken from poultry and large animals as well as from local and imported animal feed, the following serotypes were isolated: *S. pomona, S. binza, S. montevideo, S. blegdam, S. typhimurium, S. infantis, S. paratyphi, S. essan, S. galinarum, S. enteritidis, S. lockley, S. shiogere, S. nissen.*

3.6. Saudi Arabia

Salmonellosis is included among the zoonotic diseases, which create important public health problems in Saudi Arabia. A countrywide surveillance system established is based on weekly reports issued by Primary Health Care Centres.

There is evidence of contamination in cooked food (beef, lamb or chicken meat) and raw milk. The table below shows the recorded cases in humans from 1989 to 1994.

NOTIFIED SALMONELLOSIS CASES FROM 1989 TO 1994

Year	Cases	Year	Cases
1989	1600	1992	1226
1990	1536	1993	1394
1991	973	1994	1723

Salmonella infection has been identified in several poultry farms. The serovars that have been detected are the following: *S. enteritidis, S. java, S. virchow, S. livingstone, S. infantis* and *S. eppendorf.*

S. enteritidis has been isolated from eggs, hatcheries, broiler carcasses and feed.

The following measures have been adopted in order to reduce the incidence of salmonellosis in the livestock:

- poultry infected with *S. enteritidis* are condemned while those infected by non-motile organisms are treated;
- frequent bacteriological surveys from hatcheries, slaughter houses and feed mills are performed;
- random blood testing for poultry parent stocks are carried out every six months;
- prevention of contamination during processing of food of animal origin;
- strict rules have been adopted for the release of poultry meat and poultry products to human consumption.

3.7. Spain

Salmonella is most frequent in family outbreaks. Foods prepared with eggs and egg products, pastry and poultry, are the most reported vehicle in outbreaks of foodborne diseases. Other foods involved such as shellfish, milk products, meat products and hamburger patties, account for lower frequencies. Outbreaks due to contaminated or infected food handlers are steadily decreasing because the autonomous regions are educating and training the handlers. Since 1983 food handlers undergo training before receiving their handlers card. The table below shows the outbreaks of foodborne diseases from 1991 to 1995.

FOODBORNE DISEASE OUTBREAKS FROM 1991 TO 1995

OUTBREAKS	1991	1992	1993	1994	1995
Outbreaks with causative agent known	560	602	607	516	568
Various serotypes of salmonellae	473	482	471	379	433
S. enteritidis	244	210	195	141	153
Total outbreaks	918	988	944	969	904

Salmonella spp. is responsible for about 78% of the foodborne cases. The most frequent serotypes identified in food are: *S. enteritidis* (41%), *S. typhimurium* and *S. virchow* .

The same serotypes as above are usually isolated in human cases. Cases due to *S. enteritidis* have had a downward trend during the recent years. This is

attributed to the setting up of regulations since 1991. These regulations concern the elaboration and presentation of high-risk food, which is uncooked and low heat processed i.e. salads, mayonnaise, preparations containing raw egg, ice cream, pastry, meat, etc. These regulations provide that, only pasteurised egg products should be used. The use of raw egg is prohibited except in cases when the temperatures are not less than 75^{o}C.

3.8. Syria

Salmonellosis is not a notifiable disease in Syria except cases of diarrhoea in children under 5 years of age. Foodborne diseases of various aetiology, are among the important public health problems especially during the summer. The most important bacterial foodborne diseases in Syria are due to *Shigella, Salmonella* and *Cholera.*

Out of 409 children hospitalised during 1994 for acute gastro-enteritis, diarrhoea was diagnosed for 124 cases (30.3%). Among them 42% were due to *Salmonella* while 42.7% were due to *E. coli*. In another investigation, among 823 cases, 14.2% were due to *Salmonella*. Serotyping detected that 69.23% of the isolates were due to *S. typhimurium* and 9.4% to *S. enteritidis*.

Reporting from the private sector is poor and State surveillance on private poultry farms encounters difficulties.

National control activities against foodborne infections consist mainly of:

- salmonellosis surveillance in food animals, especially poultry;
- periodic examination of drinking water and food of animal origin;
- health status surveillance of food handlers;
- provision of laboratory equipment and diagnosis material;
- training of scientific and technical staff;
- preparation of guidelines directed to health staff involved in salmonellosis control;
- issuance of appropriate specialised legislation.

3.9. Turkey

Salmonellosis due to *S. pullorum* and *S. gallinarum* is a notifiable disease. Most *Salmonella* isolated strains in poultry and other animals are: S. *typhimurium, S. enteritidis, S. thompson* and *S. infantis*. A control programme involving hatcheries and parent stocks is under application. In the case when any serotype is identified in flocks, they are slaughtered.

Typhoid and paratyphoid fever are also notifiable diseases in Turkey. Reported data include only clinical diagnosed cases so data of isolations are not available at central level. The reporting system involves collection of data on human cases and outbreaks, monitoring of the incidence of foodborne infections, identification of problems and prevention of target disease.

Analysis of data collected during the recent years shows a decreasing trend in mortality and increasing trend in morbidity. The latter is probably due to a most efficient surveillance system.

4. FOOD SAFETY

4.1 Tourism and food safety

Tourism has become one of the most important industries in many countries both developed and developing. The countries of the Mediterranean region are beneficiaries of a significant proportion of the tourist business among the tourist countries globally and it seems that the future of tourism will be brighter. Indeed, there are indications that in the coming years the tourist industry will grow, as the economies of the industrialized countries improve providing this way higher standards of living to more people. Moreover, it is a fact that modern life is more complicated and more stressful and the need for relaxation becomes greater year by year.

Although food is not a major factor in choosing a destination, the success of a vacation to a great extent depends on the quality, variety and most important the safety of food.

Developing countries, most in tropical and subtropical zones attract more than 20% of international tourists. Therefore millions of tourists are at risk of becoming ill by a large variety of infectious agents that lurk in food and water.

The most frequent complaint of tourists is diarrhoea caused by pathogens not normally prevalent in their home countries. A joint FAO/WHO Expert Committee has estimated that up to 50% of all travellers are victims of diarrhoea and undoubtedly, most of the cases occur in developing countries with low standards of hygiene.

The most common pathogens seriously affecting the tourist industry are the following:

Viruses: Viral hepatitis A, is one of the most serious public health problems. Tourists from developed countries with no previous exposure to the virus are extremely vulnerable to this disease.

Bacteria: are the most important agents of foodborne gastrointestinal infections.

- *E. coli* pathogenic strains are common causes of diarrhoea among tourists in tropical countries where it may be responsible for 70 % of the cases among the tourists.
- *Salmonella* infections are endemic in many countries both developed and developing practically throughout the year.
- *Shigella* is another cause of diarrhoea and dysentery affecting tourists.
- *Yersinia* infections may occur all over the world but they are more common in Europe and Canada.
- *Campylobacter* is as common as *Salmonella* and *Shigella*.
- *Vibrio cholera* has a long history of epidemics and it remains a problem in many parts of the world.

Protozoa: Among protozoan pathogens, *Entamoeba histolytica* and *Giardia lamblia* are responsible for a number of food and waterborne gastrointestinal abnormalities among tourists.

Parasites: The liverfluke *Fasciola hepatica,* a parasite of herbivorous animals, can accidentally infest human by eating vegetables.
Trichinella spiralis contracted by eating raw pork or pork products containing encysted larvae. It may create serious cardiac or cerebral complications.

Chemicals: Chemical contaminants and toxicants in food and water still pose another threat to the tourists. It is well known that many chemicals are added to food in order to improve the taste or to extend its life. Chemicals can also pass into the food chain or the water supplies

through pesticides, fertilisers, and growth stimulants, veterinary drugs or even directly from the environment. Local people are somehow accustomed to these hazardous factors and they consume their products without serious health adverse effects while tourists from countries with higher sanitary standards are likely to develop mild or even clear intoxication symptoms.

Tourists are likely to become sick after eating in low budget food establishments. However, gastrointestinal problems may also arise in expensive restaurants.

Water and beverages are still other hazards to tourists in some countries. Piped water is not always safe to drink and bottled water or beverages may also be contaminated if maintained in high temperatures, which is a common practice in tropical and subtropical countries.

It is obvious that the international average tourist cannot be aware of the potential risk hazards in the country of destination, so health authorities and travel agents have a responsibility to inform and provide guidelines to the tourists in order to make their trip as safe as possible.

Developing countries should realise that they loose a good share of tourism, as the fear of sickness is a strong deterrent among international travellers.

4.2. Hazard Analysis Critical Control Points (HACCP)

Hazards are defined as *any biological, chemical or physical property of a food that may cause an unacceptable consumer health risk*. The biological hazards include pathogenic bacteria, viruses and parasites. The chemical ones include natural occurring chemicals (such as alkaloids from the fungus *Claviceps purpurea* causing ergotism) and added chemicals (such as insecticides). Physical hazards include extraneous materials or objects such as glass, wood, bone, stones, metals, etc.

The objective of HACCP is to prevent contamination, inhibit growth and destroy, eliminate or reduce hazardous agents. This can be accomplished by sanitation, good hygiene, decontamination, appropriate refrigeration or freezing and various processing procedures such as heat, irradiation, drying off and water activity control, preservatives and packaging.

Before 1950 the traditional quality control techniques were unable to provide an assurance that the products would not contain pathogens, toxins and other chemical or physical hazards and they relied on traditional finished product testing to assure product safety.

In trying to develop a better system, the scientists concluded that the only approach to assure safety would be through development of a preventive system exercising control over all stages of production from raw materials to product storage and consumption.

Development of HACCP systems for food assurance was initiated in the 1960s in the USA through the United States National Aeronautics, the USA Army and Pillsbury Company. The HACCP systems have been implemented in the company's plants since the 1970s and 1980s.

Steps in the application of HACCP

The HACCP system is an effective and rational approach of assuring food safety and it is relevant to all stages involved in food production, from the field to consumption, including growing, harvesting, processing, manufacturing, distributing, marketing, retailing and preparation for consumption.

The steps needed in the development and implementation of the HACCP programme are:

1. Assurance of full support from the company. The benefits of HACCP should be clarified.
2. The assembling the HACCP team. Because the HACCP team will develop the HACCP plan, it should be multidisciplinary, including experts from fields relating to specific products, such as production, processing, engineering, microbiology, sanitation and quality assurance. The team may consist of both company personnel as well as outside experts to bring needed expertise and to foster a sense of ownership to those who will implement HACCP.
3. The training of the HACCP team and the production line persons. One or more members of the HACCP team should be trained on the HACCP application. The trained persons will be used as trainers in the future. Production line personnel will be trained and understand on how they will apply the HACCP programme. Training should be applied, focused on production practices and product safety. The trainees should be able to distinguish the difference between problems of safety from those of quality and low requirements.
4. The product description and its intended use. The following are recorded:

Product name, composition, intended uses and consumers of the food, type of packaging, label instructions, ingredients list, shelf life, describing the food and its distribution and handling requirements.

5. Development of a flow diagram describing product processing. The diagram will describe all phases of production starting for the ingredients up to delivery of the product to consumers.
6. Verification of the flow diagram. This will be done by going through the actual production practices in the plant.
7. The other steps in the development of HACCP will be discussed with application of its principles.

<u>The principles of HACCP</u>

The HACCP system is an effective and rational approach of assuring food safety and it is relevant to all stages involved in food production, from the field to consumption, including growing, harvesting, processing, manufacturing, distributing, marketing, retailing and preparation for consumption. As practised today the development of HACCP includes a number of stages as follows:

1. *Conduct a hazard analysis by:*
   - identifying and listing in the process where significant hazards can occur, listing all identified hazards with each step, and adopting preventive measures to control the hazards.
   - assembling an appropriate HACCP team of experts for the product and its process
   - describing the food and its distribution
   - identifying intended uses and consumers of the food
   - developing a flow diagram of food production
   - verifying the flow diagram
2. *Identify Critical Control Points*

   Critical control points (CCP) are defined as *points, steps or procedures at which controls can be applied to prevent, avoid, eliminate or reduce the severity of food safety hazards to acceptable levels*. The CCP are also defined as *any point in the chain of food production and processing, from raw materials to finished product (from the field to the table), at which loss of*

control can result in an unacceptable food safety risk. All hazards identified by the hazard analysis step must be controlled at the appropriate CCP. Common examples of CCP include time-temperature processes for destruction of specific pathogens, and refrigeration or a low pH and water activity to control microbial growth. In general, CCPs should only deal with product safety and may apply to sanitation, formulation and control of cross-contamination, cooking, chilling and employee hygiene.

3. *Establish Target Level and Critical Limits (CL) for CCPs*.

These CLs are actually one or more criteria or tolerances that need to be met at each CCP, and serve as boundaries of safety for each CCP. Each CCP may have more than one critical limit, and if control is lost in even one of them, then a potential hazard may develop in the product. Parameters of criteria for which critical limits may be set include temperature, time, pH, water activity, acidity, salt and preservative concentration, humidity, moisture content, product and equipment dimensions, sanitizer concentration, viscosity as well as sensory properties such as appearance, texture and aroma.

For example, critical limits for cooking of ready-to-eat ground meat patties to destroy vegetative pathogenic bacteria would be minimum internal patty temperature, oven temperature, and time of heating, which would be affected by factors such as belt speed, patty thickness, and composition and oven humidity. Similar to hazard analysis and critical control points information, needed to select and define critical limits, is derived from scientific literature searches, supplier records and recommendations, laboratory testing, regulatory and scientific guidelines, and expert opinion. Since microbiological testing is time consuming, use of chemical and physical variables is better and more effective than microbiological analyses for monitoring of CCP.

4. *Establish a Monitoring System for each CCP*.

This is a planned sequence of observation and measurements to assess whether CCPs are under control, and to produce an accurate record for future verification. Monitoring involves scheduled, continuous testing or observation of CCP and their critical limits, which must be documented, because failure to monitor and to control a CCP is defined as a critical defect (i.e., leads to a hazard).

The three main points of verification are: (a) Help management to follow the operation of the HACCP system and to take action when monitoring indicates that loss of control may occur. (b) Determine when loss of control has occurred so that corrective action is taken and (c) Provide written documentation for use in verification of the HACCP plan. Thus, monitoring detects or prevents critical defects.

5. *Establish corrective actions when deviations occur*.

This principle provides the HACCP plan with documented corrective action steps to be taken where there is a deviation from the critical limits at some CCP. The actions recommended to be taken, should eliminate or control the potential hazard that was generated by deviation from the HACCP plan. It also assures safe disposition of faulty or suspect products, and that the CCP has been brought under control. When a serious deviation occurs, the product involved should be put on hold until corrective actions are applied and the results of analyses are evaluated. If the deviation generates no

safety concerns, then the company should decide the fate of the product. However if the safety of the product has been compromised, then, the government must approve its final disposition.

Records relating to an incidence of deviation should be maintained at least until the shelf life of the product has well expired. Thus, the corrective action activities should be as follows:

- adjust the process to meet established CCP and critical limits;
- deal with suspect product manufactured when deviation has occurred;
- provide short-term correction and compliance;
- find cause of problem or deviation and make corrections for future control; and
- maintain records of corrective actions taken, as indicated in the next principle of HACCP.

6. *Establish effective record-keeping and documentation procedures. Records to be maintained include*:
   - list of the HACCP team and individual responsibilities
   - a decision of each product and its intended use
   - a flow diagramme indicating the process and its CCP
   - the hazards that may develop at each CCP
   - preventive measures and critical limits to control the hazards
   - the monitoring system
   - the plans for corrective action
   - procedures for record-keeping and verification of the HACCP system and
   - a record generated during application of the HACCP plan.

   Record keeping is useful because it: (a) provides evidence of product safety; (b) provides documentation of compliance with regulations; (c) enhance review of plant procedures; and (d) assists in tracing product lots or batches when necessary. Retention of records should take into account regulatory requirements and product shelf life. Review of records is daily as part of the HACCP monitoring process and investigative to verify that HACCP is working properly.
7. *Establish procedures for verification that the HACCP system is working properly. Processes involved in verification include:*
   - scientific or technical procedures to verify that the critical limits at each CCP are satisfactory, based on knowledge of highly skilled professionals from the appropriate disciplines;
   - procedures ensuring that the HACCP plan is working effectively based on frequent reviews and verification;
   - documented periodic validations to ensure accuracy of the plan, and
   - regulatory responsibilities and actions to ensure that the HACCP system is working properly.

In general verification involves methods, procedures and tests used to determine that the HACCP system is working properly and is in compliance with the approved HACCP plan and should be done by the company as well as the regulatory authority.

Verification measures may include chemical, physical and sensory methods to determine that the established criteria are met. Its activities may include:

- inspection schedules;
- review of HACCP plan;
- review of monitoring CCP and critical limit records.

- review of deviations and actions taken;
- visual inspection of the operation;
- random sample analysis;
- maintenance of verification inspection records.

Verification inspection may be done (a) routinely; (b) unannounced; (c) when health problems related to similar products develop. In addition to the above, verification is needed when a product or its processing is modified such as: (1) new ingredients are used; (2) process controls and operations are changed; (3) new pathogens or hazards are recognized; and (4) product packaging changes.

In general, HACCP, as a food safety assurance programme, requires continuous monitoring of established critical limits at CCP, and verification to evaluate compliance with the approved HACCP plan. Moreover, HACCP is a preventive system of food safety assurance, which, if applied properly, can control points or steps in the food chain that could lead to a hazardous situation. As such, then it serves as a tool for prevention rather than after-the-fact detection of problems. For its success, however, there is a need for continuous commitment by management and employees and it is important to train people and make them feel as part of an important team, with someone responsible for the overall implementation of the programme.

Implementation of HACCP programmes should be useful in the world trade. The Codex Alimentarious Commission has developed and adopted a HACCP document virtually the same as that of the United States NACMCF. The European Union has adopted two Directives that refer to the HACCP system (Directive 93/43/EEC and Directive 92/5/EEC). The recent proposal by the USDA/FSIS “Mega Regulation” indicates that companies exporting meat and poultry products to the United States must establish HACCP programmes.

HACCP implementation

In order for the HACCP concept of food safety assurance to be implemented, there is a need first for the management of the company to believe in the value of HACCP and to support its implementation. Without the support of management, any attempt to apply its principles will be incomplete and will fail. Regulatory authorities should convince management of the need to support development and implementation of HACCP programmes.

A HACCP plan should be developed for a specific product manufacturer in a specific establishment or plant. In doing so, however, food processors may consult and use as a basis HACCP plan models developed by specialized organizations or individual scientists working in this field.

Bibliography for farther reading on HACCP rules and applications can be found in ANNEX V.

4.3. Application of food safety in developing countries: Practical criteria - safety of street food

The task of ensuring an adequate and safe food supply is an important target for both the government and the private sector. The incredible complexity of the food production system today, is a cause of various serious concerns such as:

- the need for adequate food supplies in order to meet the nutritional requirements of the populations, and
- the need to prevent contamination of food supplies.

Food safety programmes aim at ensuring that all food is fit for human consumption and remain so during storage, processing and distribution.

WHO identified food safety as an important area of emphasis and as one of priority areas of action. Consequently, food safety has been integrated into the regional strategy for health and environment in the Mediterranean region (MR).

While industrialized countries have in many instances updated and revised their food control systems, many developing countries, as previously referred, have been left with an outdated and inadequate set of laws and tools to implement them. Many countries in the MR have encountered numerous and specific problems in implementing their food safety programmes and foodborne diseases have been recognized as the most widespread public health problem. This is also an important cause of reduced productivity and economic losses for many developing countries. Moreover, environmental contamination of food is on the increase in the aforementioned countries where beyond the large number of humans, debilitated by foodborne diseases, the national economy is dramatically impaired through the tremendous food losses.

Most countries in the region have an urgent need to strengthen their food safety activities, especially in the area of food legislation, including food standards, to enable them to face their new responsibilities. This is particularly important in rural areas, where most of the population lives and where a formal approach to food safety by legislation and its enforcement is unsuitable.

The main objective of food safety programmes is to protect and promote human health through national, community, family and personal measures for the prevention and control of conditions and factors in the environment that adversely affect health.

Safety of street foods

Street foods have been defined as "*ready-to-eat*" foods and beverages prepared and/or sold by vendors in streets and public places. Street-vended foods have a long tradition in most countries of the MR. They are essential to some communities especially in developing countries.

Although important as these foods are in the food supply, however, street-vended foods are also recognized as potential hazards to health. A FAO/WHO expert committee on food safety identified both the importance and potential hazards of street-vended foods because a number of cases of foodborne bacterial infections and intoxications have been traced to street-food. Cholera, hepatitis A, typhoid and other diseases can be transmitted in food establishments. In some cases hazardous chemicals and additives, as well as unauthorised colorants and preservatives, have been found in street foods.

It is right to regulate this trade in the interest of safety and quality, but not to eliminate this vital sector of food supply or substantially reduce its capacity to provide a variety of nutritious foods at affordable prices. Thus, an applicable code of legislation should be drawn up, including education and training in the field. Education in food hygiene is absolutely crucial for the persons involved in street-food-vending.

Vendors of street foods tend to buy raw materials at lower prices and may sometimes use lower grade materials. Care should be taken that they do not utilize contaminated or hazardous raw materials and ingredients. Preparation and sale of food should be carried out in clean well-lit places protected from strong sun, dust, rain and wind. Equipment and surfaces in the place of preparation should be such that they can be cleaned easily and preferably made or covered with impervious materials. Utensils, pots, pans and other containers should be clean and in good

condition and made of materials which do not release toxic or hazardous substances into food and beverages.

One of the most critical problems in street-food vending is the supply of water of acceptable quality and in sufficient quantities for drinking, washing, cleaning and other operations. Water used for washing utensils, food and hands should be safe and should not be re-used. All waste should be handled and disposed of in such a manner as to avoid contamination of food, water and the environment. In particular, access to food waste by insects, rodents, dogs, cats etc. should be avoided. Solid waste should be kept in covered containers and removed at least once daily. The containers should be cleaned daily.

Street-food vendors should be officially recognized as a part of the food supply system and, where possible, included in urban development programmes. Training of food handlers in personal hygiene and safe handling and preparation of food, as practicable as can be under local street-vending conditions, is an essential part of any strategy to improve the safety and quality of street vended food. A complementary education programme for the consumer and the community is also strongly encouraged as it would help to assure compliance by vendors under pressure of customer demands.

Public health implications of consumption of raw food of animal origin

Among the foods intended for humans, the consumption of raw food of animal origin tends to be most hazardous unless the principles of food hygiene are employed.

Livestock are naturally exposed to various pathogenic microorganisms, part of, which are pathogenic to humans.

Cases of foodborne diseases can be caused by the consumption of raw food of animal origin and can be a serious threat to public health. Especially meat and meat products play an important role in the epidemiology of these diseases since the habit of eating raw meat exists in some countries of the MR e.g. Syria, Lebanon, etc. Thus, livestock producers not only in this region but globally, should realise that they are not producing animals but food. This is the starting point to control the pathogens in the environment, at the farm level, the slaughterhouses, the factories etc.

During the last decades, traditional methods of food production, once thought to be safe, are now being questioned e.g. dry-fermented sausages and salami (*E. coli* survives the process). Therefore if a product is marketed as a ready-to-eat item, the process should include a pathogen-killing step.

For the aforementioned reasons, developing countries should initiate a food strategy that begins at the farm and continues through the food chain to the consumer. Animal production practices need to embrace innovative and collaborative strategies for enhancing food safety. In the slaughter and processing plants every effort must be made to reduce pathogens in raw meat and poultry, thus to produce pathogen-free, ready-to-eat products.

Food law regulations

The food laws existing in developing countries should be re-examined and, if possible, brought together under a single code.

Administration

In order to be effective in protecting all the consumers and the food supplies in a country, a food control service should operate at the national, provincial and local levels.

Personnel

Since most countries in MR have an insufficient number of highly qualified scientific personnel they should obtain benefit from the work of specialists by utilising the recommendations of the FAO/WHO Codex Alimentarious Commission and the FAO/WHO Expert Committees on Food Additives and Pesticides Residues. They may also use the specialised publications issued at the end of specific meetings held by the WHO and the MZCP.

Field inspection staff

In most developing countries either the number of trained food inspectors or their basic qualifications are at a considerably low level, so it is gratifying to mention that a FAO/WHO manual for food inspectors is now available.

Food control laboratories

In some MR countries, facilities hardly exist and food control is minimal.

Epidemiological surveillance

This is another crucial activity urgently required to improve understanding of the severity of the problem of foodborne diseases and facilitate their prevention and control.

4.4 Public health education - community participation in food safety

Health education of the public has been recognized as potentially the most effective or among the most effective preventive devices. However, it was not until the beginning of this century that the governments included health education among Public Health actions. Winslow, one of the pioneers in this field, in his definition of Public Health defined health education "*as one of the most important actions to promote and protect people's health*".

After some decades of experience it has been shown that health education of the public is quite a difficult and complex task. On the other hand it has been proven that programmes based on scientifically sound techniques frequently flounder and fail because of ignorance or lack of complete understanding on the part of the recipient public.

Need for health education is limitless. Every stage of life, every type of person or social group, all occupations and professions are appropriate targets of programmes for the prevention of illness and disability, the control of disease, and the promotion of health. Since the need is omnipresent, health education must be provided in a wide variety of settings that ideally blanket a community or society: homes, schools, community agencies, voluntary and private organizations, governmental agencies, hospitals, professional schools, group practices, planning agencies, communications media, unions, business and industry.

Health education goals

Health education must aim not only at specific measures, but also at improving the responsibility towards ones health and the community health. Therefore the goals of health education are the prevention of diseases and the maintenance of health. The major objectives are to enable people to define their problems and needs; to understand what they can do for these problems with their own resources combined with outside support; to decide on the most appropriate related actions. These can be achieved through a deep knowledge of the social and environmental frame, in which people work and live.

Health education leads to a set of activities such as:

- informing people about health, illness, disability and ways in which they can improve and protect their own health
- motivating the population to want to change their practices and habits by healthier ones
- helping them to learn the necessary skill in order to adopt and maintain healthful practices and lifestyles
- encouraging teaching and communication skills in all educators of consumers about health
- advocating changes in the environment that facilitate healthy conditions and behaviour
- adding knowledge through research and evaluation concerning the most effective ways of achieving the above objectives.

Health education field of action

The whole community is the spectrum of action for health education. Every stage of life, type of person or social group, occupations and professions are appropriate targets for the prevention of illness and disability, the control of disease and the promotion of health.

a) *Health Education in School*

The school represents the most important learning situation for a large and significant group of the population. What is learned, as a child tends to have a deep and lasting influence throughout life. A child is reached and influenced primarily through two channels: parents and teachers. This points to the importance of a carefully designed, comprehensive sequential programme of health education for all students aiming at the development of healthy life-styles and the acquisition of healthy habits.

It has to be remembered that many school-age children and young people in endemic areas do not attend school. Health education should therefore, extend beyond the school in order to reach educationally deprived children.

Since parents serve as models for the establishment of good practices, they should be assisted in fulfilling their role.

b) *Health Education in the Work Place (Education of the Food Handler and Consumer in Food Hygiene)*

The public and food workers need to be informed of the dangers of bad hygiene and to be motivated to avoid them. It is essential that good hygienic practice becomes a habit. It will never be possible to guarantee that any food, even free of *Salmonella*, will not cause other types of foodborne diseases if handled unhygienically.

It is essential for the manager of a food establishment to understand the hazard of poor hygiene and not to respond only to immediate commercial pressures.

Hygienic measures taken by food handlers and by consumers to control salmonellosis will be equally effective in the prevention of other types of foodborne diseases of bacterial origin.

The most important products handled, and for which health education is necessary, are foods of animal origin e.g. meat (both raw and processed), milk (raw and processed), fish and other sea products (raw and processed), eggs and honey.

Food handlers must be educated on occupational risks and on risks concerning consumers.

With regard to protection of consumers the role of food handlers is fundamental. Therefore their education in this field should be stressed in food hygiene

programmes. The principle items on which this education should be based are as follows:

- *Awareness of risk*
- *Legal information.*
- *Cooperation with the food inspection authority*
- *Proper technologies for food processing and preservation*
- *Proper methods for serving food.*
- *Measures of personal hygiene.*

c) *Health education in the community*

Healthy population should be protected from health risks through appropriate education. This education when well planned and implemented could become the appropriate tool for the gradual elimination of unhealthy attitudes and habits and adoption of healthy practices.

For example, health education programmes should inform the public about the risks connected with consuming raw food of animal origin. They should also demonstrate that eating raw meat exposes one to salmonellosis, trichinellosis, taeniasis, etc; or that drinking raw milk and eating freshly prepared cheese, exposes one to brucellosis and other infections. Moreover, health education programmes should inform people on early symptoms of the most important zoonoses or of specific zoonoses under control. They should also motivate them to undergo regular medical examinations.

Community participation - target groups

Community participation has been identified and adopted as one of the fundamental strategies for accomplishing the priority objectives of Primary Health Care (PHC). According to the Declaration of the International Conference in PHC (Alma-Ata, ex-USSR, 1978), "*Community participation is the process by which individuals and families assume responsibility for their own health and welfare and for those of the community, and develop the capacity to contribute to their and the communities development*".

By the process of education and by acquiring experience and knowledge, individuals and communities learn to understand their own situation and are motivated to solve their problems. Community participation in PHC enables individuals and communities to become agents of their own development, rather than passive receivers of information and assistance. Community participation generates in individuals a sense of responsibility for their own health and welfare. To be successful, they have to acquire the capacity to evaluate situations, choose options and determine their contributions. In other words, individuals and families, and the community as a whole, are not obliged to accept otherwise conventional solutions that may be imposed, but are not suitable.

Moreover, the individual and the community must be willing to acquire new knowledge, and to translate it into wholesome habits and constructive behavioural patterns. Human and animal health systems are responsible for providing clear information and explaining the favourable and adverse consequences of the various intervention measures being proposed, as well as their relative costs.

Health programmes are unlikely to succeed if community participation is not an integral part of the structure and these programmes not executed at local level. Laws, regulations and veterinary policy measures alone will not bring the desired results.

The higher the level of self-reliance and social awareness, the more the individuals and families will accept responsibility for protecting their animals and

themselves from zoonotic diseases. The relevant community education programmes should concentrate on what people can do in order to build their own health.

The population should be involved as participants in the implementation of health programmes in their communities. They have the advantages of speaking the local dialect, knowing how to reach people and being socially accepted. They know local situations and local needs.

The following groups, which are to be found in most communities, are important:

- *Local medical and veterinary services*
- *Local health committees and community health workers*
- *Local religious bodies*
- *Local civic groups*
- *Local school and adult education groups*.
- *Local practitioners of traditional medicine, birth attendants and midwifes*
- *Local police or local military units*

In the early phases of a control programme, the general public, especially communities in endemic areas, has to be made aware of the danger to health as well as the economic importance of zoonoses and foodborne diseases. As far as possible, full use should be made of the mass media. All available means of informing each community should be used, but an effective method has been found to be discussions in small groups. In such discussions, the health worker (educator) suggests some kind of concrete action, for example, formation of working committees, which may be formed soon after the discussions. Such committees have proved to be extremely useful in the early phases of several control programmes.

The most common teaching aids and media are posters, documents, pictures, slides, films, radio and television programmes. Communicating the health message is very important, and the different methods and techniques have to be combined to accomplish the educational purpose e.g. health talks with posters, mass media, etc. However, the information should be correct, complete and acceptable to the people. The language of the messages should be understandable.

Other considerations

It is important that health education should be included in a zoonosis control project or food hygiene programme from the initiation and should be closely linked to and coordinated with all changes to it. Continuing evaluation of the impact and the limitations of health education should be undertaken and modifications should be made as and when indicated. The control programme should be technically sound, realistic and achievable. The educational material should be based on local problems in order to be effective and have the impact needed on governmental officials, managers, farmers, health professionals, etc. It should take into full consideration the *beliefs, perceptions, behaviour, expectations and needs* of the people. In other words, education of the public should not be a passive procedure but dynamic and progressive one, adjusted to the changing demands and progress of the campaign.

4.5. Intersectoral cooperation in prevention and control of foodborne diseases

Intersectoral cooperation for achieving health goals has been accepted as one of the guiding principles for a health strategy. Health is multi-dimensional, therefore health policy and practice should be interdisciplinary and intersectoral. The Alma-Ata[4] declaration on primary health care (PHC) stressed that intersectoral approach is

[4] Former USSR, 1978 : Primary Health Care (PHC), Report of the International Conference on PHC, WHO, Geneva, 1978

fundamental to universally accepted health policies and called for the coordination of health-related activities of the various sectors.

Conceived in these terms, the improvement of health requires more than the services delivered by the health services alone. The contributions of other sectors, in particular agriculture, animal husbandry, food industry, education, housing, public works and communication, was explicitly recognized as vital for improving the health and well-being of a population. Such a concerted action is particularly critical in developing countries with weak infrastructures and limited resources. They have to ensure the optimum utilisation of available resources and minimum duplication of efforts.

The WHO Glossary of Terms used in the Series “Health for All”, describes “Intersectoral Action“ as “*a global process which involves thought, coordination and action*”.

Despite the fact that the Alma-Ata declaration mentioned above, recognized intersectoral cooperation as one of the pillars of world-wide health ideology, public health planning remained a more or less self-contained exercise within the health and veterinary sectors respectively. In fact, there is a wide gap between intentions and reality, declarations and practice in intersectoral cooperation.

Intersectoral involvement and cooperation although universally recognized as essential factors for health development and promotion, in all respects, create different kinds of obstacles, sometimes becoming even barriers, impeding the so needed process for their achievement. Due to this situation, in most countries the cooperation prevailing among sectors and even within a sector is at a very low level. Conflicts occur between sectoral interests and administrative and financial constraints, while rigid bureaucratic, centralised systems create further limitations to intersectoral actions.

Health professionals or veterinarians perform all activities in isolation from other development processes. This isolation is reinforced by the tendency of most sectors to perceive public health as comprising mainly of medical services or veterinary services alone. In this context, other development sectors tend to regard intersectoral collaboration for health as a diversion of time and resources from their own sectoral priorities.

<u>Intersectoral cooperation in animal health and veterinary public health (VPH)</u>

The concept of a multi-disciplinary approach to health has been widely advocated and strongly promoted for years. It is through this multi-disciplinary concept that the veterinary public health programme formally evolved as part of public health activities.

VPH has been defined as "a *component of public health activities devoted to the application of professional veterinary skills, knowledge and resources to the protection and improvement of human health*". The principles on which it is based are deeply rooted in the biological, physical and social sciences and are widely shared in agriculture, medicine and the environmental sciences. VPH involves veterinarians, animal health scientists and professionals, medical specialists, environmental and sanitary engineers, as well as medical and veterinary assistants. It defines a broad set of activities, tasks and responsibilities in animal health, which directly relate to public health. It serves as a focal point to channel independent efforts and resources in the various sectors, institutions and disciplines involved in animal health and production towards the improvement of human health.

Process of development of intersectoral cooperation

Processes involved in planning and implementation of intersectoral actions are complex. Each country, region or sub-region and locality must develop its own strategy and approaches for intersectoral action, always taking into consideration the existing administrative, economic and human conditions and situations.

The institutional and administrative structure of the country, the legal bounds of the authorities and the parameters of institutional relationships should be recognized by those involved in planning and implementing the concept of intersectoral collaboration.

The process for the development of intersectoral cooperation should include, among others, the following:

- elaborating and implementing policies, rules and requirements aiming at effective collaboration in specific projects, including supervision of the project and sub-projects;
- improving communications throughout the bureaucratic structure;
- establishing an appropriate information system;
- identifying health and related problems requiring intersectoral action;
- identifying technical and financial resources;
- identifying and allocating specific responsibilities and activities for each of the co-operating sectors;
- locating and providing funds for each individual participating sector;
- planning and implementing joint in-service training programmes for workers from various sectors;
- identifying contradictory and/or conflicting policies between different sectors and also other constraints resulting in hampering effective collaboration;
- establishing interministerial committees.

Traditionally, emphasis on zoonoses and foodborne infections has been directed at programmes for their *prevention*, *control* and *elimination*.

Within these broad groupings, increased consideration should be placed on intersectoral programmes supported by veterinary public health integrated activities.

Structuring intersectoral cooperation in food hygiene programmes

a) *Role of Veterinary Public Health and Medical Services*

Foodborne diseases due to consumption of food of animal origin have become increasingly prevalent in many countries partly due to the greatly expanded international and national trade in live animals, animal products and animal feed, facilitating the spread of the infection. Many other factors have contributed recently to the increasing outbreaks of foodborne diseases. These include:

- the rapid growth of the world population, with its ever-greater demand for food;
- the increase in urban populations with a corresponding decrease in rural populations, which stimulates increased production of processed or semi-processed foods;
- advances in food technology resulting in new and more “sophisticated” presentation of food, the handling of which may not be properly understood by the consumer.

Bacterial diseases, such as salmonellosis are now the most serious zoonoses occurring throughout the world, including the MR and affecting millions of people. In some countries, helminthic or protozoal parasites are also very important foodborne hazards.

Added to these changing patterns of hazards associated with food of animal origin is the increased presence of different additives (pesticide residues, antibiotics, artificial hormonal substances, and heavy metals). The solution of these problems, constitutes a major challenge in the food protection field, depending very much on veterinary public health activities.

In the present situation, the role of veterinarians and physicians specialised in modern food hygiene is increasing tremendously and food protection is one of the highest priority areas for initiation of veterinary public health services.

Early recognition of the importance of animal origin foods in the aetiology of foodborne disease outbreaks places a public health responsibility on veterinary and medical food specialists.

The activities performed by veterinarians and physicians in food hygiene programmes could also contribute very much to epidemiological surveillance, outbreak investigation and reporting as well as environmental protection, livestock diseases, etc. The veterinary specialist in slaughterhouses and food control laboratories has an excellent opportunity, in collaboration with epidemiologists in the field, to trace back diseased animals or food of animal origin, locate the site of production and determine the primary source of infection.

However, the aforementioned activities in food hygiene could not achieve the ultimate goal without close intersectoral coordination, especially between animal health and public health services.

b) *Role of the Community*

Collaboration between veterinarians, meat inspectors, physicians and environmental hygienists is indispensable to monitor disease patterns, to identify possible sources of infection for people and livestock and to arrange common local or small-scale preventive and control measures. This group is the core of any technical committee.

Moreover, consumers' associations can play a major role. On one hand, they can improve awareness and behaviour of the general public. On the other hand, they can influence authorities to pay more attention to this and related problems, to improve legislation and to apply more severe control on food and environmental hygiene, including working conditions. However consumers' associations in collaboration with educational, medical and veterinary officers, can organise health education programmes in which the consumers are correctly informed on hygienic food handling practices, possible sources of infection and symptoms of the disease in man. In such a way, "self-reporting" for diagnosis and treatment of people having salmonellosis can be enhanced. The "*List of Important Rules to prevent foodborne disease*" should be well known by consumers, housewives and food handlers in order to prevent foodborne diseases (see ANNEX VI).

<u>Problems in the intersectoral collaboration between Public Health and Animal Health services</u>

All health and veterinary professionals, even most of the decision-makers, recognize that zoonotic disease control and food hygiene programmes cannot be achieved without concerted actions of all sectors by any mean involved. Regretfully, this is the theory. The practice in most of the countries is completely different. Experience has shown that many programmes in zoonoses control have failed because it was felt that a liaison office or a veterinary public health scheme at the national level alone would solve the problem. In the absence of a national programme (i.e. commitment to a comprehensive plan), such liaison offices often had

difficulty in functioning usefully. Similarly, the establishment of Intersectoral Committees including directors of services seldom led to successful programme implementation because budgeting, staff supervision, and information exchange still remained strictly vertically oriented within the various sections, without making practice of the horizontal communication.

Although Animal Health and Public Health services, Committees, or Intersectoral Zoonoses Committees, may be able to prepare the technical background and plans for a national zoonoses control programme or a food hygiene programme, it should be made clear that such programmes should be approved and executed by the Ministries concerned. This means that decisions are to be made at ministerial level not only on the operational aspects but also on the allocation and commitment of funds, staff and equipment. A concrete example could be foodborne diseases. Cooperation for the control of these diseases at national level is often hampered by the diversity of technical specialisations required. Thus, it is not surprising to see up to six Ministries maintaining services, including laboratories, dealing with the control of a distinct zoonosis such as salmonellosis. Such services may be found under the Ministries of Agriculture, Education, Trade and Environment Protection as well as in the municipalities. Unfortunately, such multi-focal services very often have no working contacts with each other, even at national level, because integrated systems are largely missing.

The establishment of an *Integrated Quality Assurance System* could help resolve this dilemma. It is seen as the most promising mechanism to break of the separation or even isolation of each of the involved sectors of the food chain, especially with regard to food safety. It lends itself to an integrated system approach from the farm to the table. The many points along the food chain must be fundamentally linked and considered as a single system. There are multiple jurisdictions, responsibilities and activities shared by many people and groups along the chain that should be well coordinated.

Duplication of manpower, facilities, and administrative activities directed at zoonotic disease control that occur in the respective Ministries of Health and Agriculture in virtually every country could be significantly minimised, or curtailed entirely, if active efforts were put forth by the members of the animal and public health communities.

5. STRATEGIES FOR THE CONTROL OF SALMONELLOSIS AND FOODBORNE INFECTIONS

5.1. Epidemiological surveillance systems, investigation and reporting

Salmonellosis is considered to be the most common foodborne infection in spite of the numerous surveillance programmes and preventive measures that have been adopted. A dramatic increase in the number of salmonellosis' cases has been observed from the early 1980s in both human and animals. In most countries, poultry and poultry products are considered an important source of infection for humans. To face the problem, specific surveillance systems were developed in the USA and some other countries in order to trace back the case of human infections to the farm of the origin.

Epidemiological surveillance has been defined as "*the use of epidemiology to single out, plan, manage and evaluate the important services (prevention, control and treatment) for the health status of human and animal population*"[1]. The aim is the

continuous monitoring of its dynamics in order to determine specific control or prevention actions and to evaluate actions adopted. It is not passive disease reporting or even comprehensive disease monitoring with simple objective of ascertaining the existence and frequency of disease. The principal purposes of a surveillance system are[1]:

a) determination of needs for immediate or longer range actions in the response to diseases,
b) determination of priorities, for such longer range actions,
c) designing of alternative actions and

[1]Caporale V. Organization and Management of the Natural Surveillance and Control Programmes on Zoonoses in : WHO/EMRO/MZCP Regional Seminar on International and Intersectoral Cooperation in Surveillance and Control of Major Zoonoses, Nicosia, Cyprus, 19-21 November 1996; Doc. WHO/EM/VHP/27/E/L, Alexandria, Egypt, 1997).

d) determination of their likely costs and benefits.

Epidemiological surveillance for an effective operation needs the establishment of an Information System (IS). This has been defined as "*a set of institutions, facilities, activities and procedures in order to collect, analyse, transfer and diffuse information for planning, management, evaluation of activities in a given field, sector, service (veterinary and/ or public health), and for decision making*". The components of a surveillance system are:

- **Institutions involved in the system**: local veterinary and human health units, regional veterinary and human health services, central veterinary service, laboratories, data processing centres and epidemiological centres;
- **Facilities used by the system**: all physical resources used for the performing and monitoring of activities, such as vehicles, computers, archives, etc.;
- **Activities exploited for the passive collection of zoonotic foodborne infections related data**: herd serological and bacteriological collection of data etc.;
- **Procedures for data collection and processing**: filling of data forms, procedures for active collection data, procedures for data storage, validation, analysis and transfer, procedures for data diffusion and divulgation.

On the basis of the objectives of the system, the information needs are identified both in terms of epidemiological data and of capability of the human health and veterinary services to cope with health problems. Since the collection and management of information is an expensive activity the following actions should be taken:

- only resources necessary for the running of the system should be mobilized
- only the minimal set of information needed should be collected
- only the most suitable routinely performed activities should be used to collect information.

The general objectives of animal health IS are aimed at providing information for decision making activities and management of veterinary services in order to improve food animal production and control such production in terms of human and animal health.

The specific objectives of the IS are to:

- obtain an inventory of disease conditions in the area;
- identify shortcomings in veterinary activities;
- evaluate the efficacy and efficiency of veterinary activities;
- publish information about health conditions of the area, the activities of the veterinary services, etc. and
- promote specific research; etc.

Epidemiological surveillance for *Salmonella* infection in humans is important, especially for discovering shortcomings in the handling of animals and food. Early detection and reporting is crucial for the implementation of effective preventive measures in order to hinder new cases. Investigation for the control of outbreaks and for long-term prevention has been demonstrated frequently for a favourable cost/benefit.

In order for a specific surveillance system to be effective in its activities (among which tracing back of the human outbreaks to the animal population, is very important), it should be based on regular intersectoral cooperation and communication between Agencies (public/animal health) and specialists.

The Italian experience

In Italy, the operation of public health and veterinary services under the same central service (Ministry of Health), as well as the fact that the physicians and veterinarians, are working together in the regional Local Sanitary Units, could be sufficient to ensure an adequate control of the situation. Unfortunately the quality and quantity of the information exchange between these two sectors often does not permit the tracing back of the infection. Furthermore the results of the whole surveillance system do not reflect the real situation. A disagreement was confirm on data concerning infection in man and animals as well as on the contamination of animal products until 1990.

In order to cope with this situation, especially tracing-back activities, it was developed a specific surveillance system based on the effective cooperation between physicians, veterinarians and biologists.

In this *ad hoc* surveillance programme, cases in humans were considered as indicators of infection of the territory. The aim was to gather reliable information to develop effective preventive measures on the field. The single units involved in the tracing-back programmes were:

- Hospitals (Giulianova and Vasto) (H)
- Public Hygiene Service of the Local Sanitary Unit (PHS)
- Public Veterinary Service of the Local Sanitary Unit (PVS)
- Istituto Zooprofilattico Sperimentale (IZS)

The area covered by the surveillance programme consisted of two Local Sanitary Units (LSU) (Giulianova and Vasto). The population of these two areas was 148.834 people. The animal population consisted of 8.764 cattle, 24.000 sheep, 12.449 swine and 354.000 of poultry. In each of the two LSUs, a hospital with a microbial laboratory was included.

The surveillance system, was established in January 1992 and was organized as follows:

1. **Notification**. Tracing-back started from reported outbreaks (hospitalized patients, or patients with acute symptoms, bacteriologically positive).
2. ***Salmonella* typing**. *Salmonella* strains isolated, were biochemically tested and serotyped at the IZS.
3. **Collection of the epidemiological data**. Appropriate fill-in-the-blank worksheets were prepared for the hospital personnel. In this way, data concerning the patient was collected and forwarded to the PHS and PVS. The PHS, with the aid of the information collected, carried out inquiries among components of the affected community, in order to establish the food responsible for the infection.
4. **Sample collection**. After the collection of the suspected food samples, the PHS delivered them to the IZS for microbiological test. In all cases where the suspected food was of animal origin, the PVS was in charge of finding its source (place of purchase and where possible, farm of origin). These samples were also delivered to the IZS for microbiological tests.

5. **Epidemiological analysis.** The information concerning the outbreak (present on the worksheet) was collected and analysed at the epidemiological observatory of the IZS and returned to the other components of the programme. All the information collected was reported on the worksheet, in order to inform each component of the programme of the results achieved with previous steps.

A total of 11 salmonellosis outbreaks were studied during 1992.

The majority (63%) of the outbreaks occurred between July and August, each involving a few numbers of people, often belonging to the same family.

Only in a limited number of outbreaks, a relative high number of people were affected (16, 25, 80), due to the fact that the source of infection was part of a banquet.

The information collected, allowed the identification of the source of infection in 9 cases out of the 11 (81,8%). In particular, most of them consisted of home-made, raw or partially cooked egg-derived products, often not stored at an appropriate temperature. In 77,7% of these, isolation was possible from food and in 55,5% of the cases it was possible to trace-back salmonella to the infected farm.

From the data reported above, it appears that, although it initially seemed that there was no correlation between human and animal outbreaks, the two categories were clearly linked.

A link between consumption of egg-derived products and infection in humans has been observed in many European countries. The fact that the majority of the outbreaks occurred in the warm season can probably be related to the inadequate storage temperature of the source of infection. Furthermore, the low number of people involved in the outbreaks and the large number of isolated cases may be related to the consumption of home-made foods.

Considering the characteristics of the outbreaks (few people involved, consumption of home-made products, contaminated raw materials often produced in rural type breeding), the tracing back to the source of infection may be considered satisfactory.

Unfortunately it was not possible to carry out a proper epidemiological survey in the isolated cases, which probably determined the failure in tracing back the contaminated food (1 case out of 111).

The success obtained in tracing back the source of infection in the outbreaks was probably due to the rapidity with which the various steps were carried out, as well as the effective coordinating role of the IZS.

In conclusion, the continuous cooperation of human and animal health authorities at local levels, is essential to prevent zoonoses in general and foodborne infections or intoxications in particular.

5.2. Prevention and control of foodborne salmonellosis

Foodborne diseases caused by non-typhoid *Salmonella* is known to represent a very important public health problem in many parts of the world. Data from foodborne disease surveillance programmes in developed countries indicate that *Salmonella* is the main cause of foodborne infections. This situation has lead to substantial costs in public health terms and in various economic losses for the food industry.

Although salmonellae are ubiquitous, the primary reservoir of this pathogen is the intestinal tract of infected or colonized domestic and wild animals and humans.

The primary source of *Salmonella* infection in humans world-wide, is contaminated food and water. Foods of animal origin such as poultry, eggs, milk, beef and pork are the main sources.

Fresh fruits and vegetables have also been implicated as vehicles of *Salmonella* transmission. Contamination of these foods can occur during production, processing, distribution, retail marketing and handling preparations.

A large proportion of *Salmonella* infections is potentially preventable, hence the burden of disease and its repercussions are largely avoidable. There are many approaches to controlling *Salmonella* in foods, which are all based on prevention. In order to reduce the incidence of human salmonellosis, measures should be taken simultaneously on several levels to prevent the introduction and multiplication of *Salmonella* in food. An integrated approach should involve preventive measures in the areas of animal production, slaughter/processing, and food handling in homes and food service establishments. Risks and cost-benefit analyses will provide the rationale for the choice of prevention strategies at the most effective point(s) of intervention.

Owing to the complex nature of salmonellae dissemination and cycles of infection, should be taken specific preventive measures in order to control salmonellosis at several levels.

At the level of animal production, all measures taken to reduce the prevalence of *Salmonella* and other microbial pathogens should be based on good production practices (GPP) which include biosecurity, cleaning and disinfecting and animal hygiene. These GPP should be incorporated in industry efforts such as commodity, food safety/quality assurance programmes. Integral to the success of further interventions at the animal production level is an in-depth understanding of the epidemiology, ecology and microbial characteristics of specific pathogens, animal identification and diagnostics.

Disinfecting of effluents and other waste materials from farms, abattoirs, processing plants and mass catering establishments, reduces contamination and consequently to a certain degree foodborne infections.

Food industries, including animal slaughter and processing, should be encouraged, as previously referred, to develop Hazard Analysis and Critical Control Point (HACCP) programmes. These programmes endorsed and adopted by international bodies and governments as effective, scientific, risk-based systems for protecting the public from foodborne illness, emphasize prevention of contamination by focusing intervention targeted at specific points in food processing. (see details in paragraph 4.2).

At the consumption end of the line, the public and especially food handlers, need education in safe food handling. Vulnerable groups such as the elderly, the immuno-compromized (including the infants, the sick and pregnant women), should be made aware of their increased susceptibility to foodborne diseases. Furthermore, important recommendations about several measures reducing the general risk of infection from foods of animal origin should be given i.e., use of pasteurized milk and, where available, pasteurized eggs. For example, it is recommended, that hospitals, nursing homes and commercial kitchens should use pasteurized egg products for all recipes requiring raw or undercooked eggs.

Globally, the challenge to control salmonellosis needs to be supported by an effective surveillance programme. *Salmonella* surveillance data, as previously referred, underestimate the actual number of persons affected. It has been estimated that 10 to as many as 100 or more cases go underreported for each case reported.

The importance of laboratory-based surveillance of these infections in the development of a sound control programme, cannot be overemphasized. Effective surveillance allows the recognition and investigation of outbreaks and emerging pathogens strains and the ability to assess the need for and evaluate interventions by monitoring longer-term trends.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

1. Salmonellae and other foodborne disease (FBD) agents continue to cause morbidity, mortality and significant economic losses world-wide including the Mediterranean countries.
2. There is no system of actual surveillance and investigation of outbreaks of FBDs in many countries of the region, resulting in the lack of authentic epidemiological data on these infections. Therefore planning and application of preventive and control measures become particularly difficult.
3. Food hygiene standards in markets, street food vending, and vendor stands as well as raw food consumption in developing countries create hazards for public health and demand improvement.
4. The recognition that salmonellosis and other FBD control measures and food hygiene contribute to minimising the spread of these diseases, lead most of the concerned national authorities to increase their efforts to fulfil their responsibilities and assess the safety and quality of foods.
5. Resources to meet the many pressing health needs of several Mediterranean countries are limited. Moreover, while distributing the available resources, public health and other administrations often seem to neglect the demands of food control services.
6. The implementation and maintenance of the Hazard Analysis Critical Control Points (HACCP) system in food establishments will enhance the prevention of FBDs.
7. Public health education, particularly of food handlers, together with close intersectoral cooperation, principally between public health and veterinary services, are basic components for the success of zoonoses and foodborne disease national control programmes.
8. There is a shortage of adequately trained food inspectors, laboratory facilities, technical staff and epidemiologists able to deal with the major FBDs in most countries of the region.
9. The group recognises the particular significance of FBD prevention for the tourist industry of the Mediterranean countries.

6.2 RECOMMENDATIONS

1. The success of salmonellosis and other FBDs surveillance and control programmes depends amongst other, on the will of the national authorities to provide all kinds of resources and to strengthen surveillance and control services
2. The existing legislation for surveillance and control programmes should periodically be re-examined and amended in light of new developments and needs to ensure effective surveillance and control operations
3. Continuous training of all personnel involved in food control programmes is strongly recommended especially to those involved in surveillance operations.

4. Training of the necessary personnel who undertake the quality control and hygiene programmes of foods of animal origin should be devised, with particular attention given to the food inspectors and food analysts. Guidelines should be prepared for such training programmes for personnel at all levels.
5. There is great need for updating informational and educational material on food safety. The WHO/HQs, WHO/EMRO and the WHO/MZCC should therefore issue and disseminate guidelines on which the Mediterranean countries will base their own relevant material according to local conditions.
6. Educating the public on the prevention and control of salmonellosis and other foodborne diseases should be continuously carried out by the responsible agencies of each country. The MZCC should develop and disseminate the necessary educational material. MZCP Member States should improve and strengthen their programmes for the prevention and control of salmonellosis and other FBDs in collaboration with the MZCC.
7. Establishing/strengthening Public Health Laboratories capable of performing microbiological and chemical analysis of food. Such laboratories should be accredited at international level.
8. National food control programmes should include as essential components:
   a) surveillance of FBDs,
   b) training of health and food industry personnel
   c) HACCP should be introduced in food establishments provided that :
      - the implementation of HACCP is approved and verified by competent government authorities
      - comprehensive, scaled down HACCP systems are available for small food enterprises unable to afford the cost of development of HACC programs. This can be organised by industry associations, cooperatives and/or government agencies.
9. The exchange of experience and information on the surveillance and control of salmonellosis and other FBDs between Mediterranean countries through WHO/EMRO and WHO/MZCP should be further strengthened.
10. National authorities should further recognize the importance of surveillance systems as sources of epidemiological information as well as the assessment of effectiveness of food hygiene programmes implemented.
11. The Mediterranean region is a highly tourist attracting region where travellers are exposed to FBD hazards. Therefore physicians in the region should be well prepared to face FBD syndromes.
12. Specific under- and post-graduate education :
    a) Modern concepts of epidemiology and zoonotic disease control should be taught in the veterinary schools of the region
    b) There is a need for post-graduate programs with courses on preventive veterinary medicine
    c) Attention should be given to zoonotic and FBDs during the training of physicians.

ANNEX I

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ANNEX II

LIST OF WORKING PAPERS

1. *Salmonella* as a causative agent of diarrhoeal disease and its implications on public health (*Prof Y. Tselentis, WHO-CC, Heraklion, Greece*)
2. Role of animals and food of animal origin in the epidemiology of salmonellosis (*Dr P. Colin, CNEVA, Ploufragen, France*)
3. Epidemiology of meat borne and milk borne infections in the Mediterranean Region
   (*Dr A.M. Abdou, f. WHO/EMRO, Alexandria, Egypt*)
4. Country reports and Review of the Activities implemented in the MZCP Countries for the control of Human and Animal Salmonellosis and other Foodborne Infections
   - CYPRUS (*Dr. C. Taliotis*)
   - EGYPT (*Dr. M. M. F. Abd El Baky*)
   - GREECE (*Dr C. Vlassiotis*)
   - ITALY (*Dr A. Giovannini*)
   - LEBANON (*Dr J. Jabbour*)
   - SAUDI ARABIA (*Dr N. A. Alwetaid*)
   - SPAIN (*Dr M. L. Aguilar Zambalamberri*)
   - SYRIAN ARAB REPUBLIC (*Dr R. Salloum*)
   - TURKEY (*Dr S. Yilmaz*)
5. Public Health Education - Community Participation (*Dr A. Seimenis, WHO/MZCC, Athens, Greece*)
6. Intersectoral Cooperation in Prevention and Control of Foodborne Diseases (*Dr A. Seimenis, WHO/MZCC, Athens, Greece*)
7. Tourists and Food Safety (*Prof Y. Tselentis, WHO-CC, Heraklion, Greece*)
8. Hazard Analysis Critical Control Points (HACCP): concept and applications (*Prof K. Genigiorgis, Veterinary Faculty, Aristotelian University, Thessaloniki, Greece*)
9. Application of food safety in developing countries: practical criteria - safety of street food - Public health implications of consumption of raw food of animal origin (*Dr A.M. Abdou, WHO/EMRO, Alexandria, Egypt*)
10. Epidemiological surveillance systems - Outbreak investigation methodology and reporting (*Prof V. Caporale, WHO-CC, Teramo, Italy*)
11. Prevention and control of foodborne Salmonellosis (*WHO/MZCC, Athens, Greece*)

ANNEX III

MEASURES SUGGESTED TO ACHIEVE *SALMONELLA-FREE* FLOCKS/HERDS

- The floor and the walls of stables should be made of smooth, lasting material, which allows proper cleaning and disinfecting.
- All utensils and equipment used should be cleaned and disinfected regularly.
- No feed inaccessible to animals should be left in stables.
- Water is better to be supplied by means of nipples situated above the slatted part of the floor in order to allow free drainage and avoid moisture.
- Rodents and insects should be eliminated.
- Different species of animals or different ages of the same species should be kept separately.
- No pet animals should be kept or allowed near the productive animals (cats should not be used for rodent control).
- No visitors should enter the premises.
- All personnel should change coats and footwear and disinfect their boots before entering.
- If pelleting is not possible, irradiation, where possible, is a good method for the decontamination of foodstuffs.
- Proper storage of the decontaminated feed in order to avoid recontamination.
- Frequent examination of the water (*E. coli* counts are used as indicator organisms).
- In some developed countries efforts are been made for the establishment of a specific pathogen-free population (i.e. piglets should be removed aseptically from the uterus by hysterectomy and raised in *Salmonella*-free areas or premises).
    - ♦ New animals of unknown health status should not be introduced to a clean herd.
    - ♦ Separate premises should be used to place newcomers in quarantine. They should be tested three times for the absence of pathogens before being introduced into the breeding stock (cattle quarantine period should be at least three weeks).
- Grazing grounds should not be fertilised by untreated manure or sewage sludge.
- In case of an outbreak of salmonellosis:
    - ♦ competent authorities should be notified.
    - ♦ samples of rectal contents for laboratory examination should be collected.
    - ♦ the veterinary authorities should supervise the herd.
    - ♦ sick animals should be isolated and premises disinfected with chlorine, chloramine or hydrochlorite solutions.
    - ♦ faecal samples from sick animals should be continuously examined until pathogenic microorganisms are no longer isolated.
- Animals from the infected herd should not be sold for breeding purposes.
- Sick or dead animals and birds should be removed as soon as possible.
- All eggs should be fumigated on arrival at the hatchery.

ANNEX IV

PREVENTION OF CONTAMINATION IN THE SLAUGHTERHOUSE

For the prevention of contamination in the slaughterhouses the following measures should be taken before, during and after slaughtering:

- Allow animals to rest in order to reduce stress.
- Wash of the surface filth prior to slaughtering, in order to improve the cleanliness of the carcass.
- Only animals found healthy during the ante-mortem inspection should be slaughtered. Sick or suspect animals should be slaughtered in special (emergency slaughterhouses) or at the end of the run.
- Take care that the hides do not touch the exposed areas of the carcass. Hands that hold the skin must not touch the carcass. Avoid spraying the contaminated parts of the carcass with water because this spreads the contamination to the rest of the carcass. Contaminated parts of the carcass must be cut off and destroyed.
- On a pig slaughter line, the scalding and dehairing temperatures should never be lower than 62^{o}C.
- Cleaning and disinfecting of surfaces and equipment. Reduction of the bacterial load of the machinery by the addition of a small quantity of chlorine to the water used during the process. (75-100 ppm is effective under experimental conditions)
- Maintaining the cold chain during cutting and transport to suppress proliferation of bacteria (the temperature must be below 4^{o}C). To achieve quick and effective chilling, whole parts of carcasses must not touch one another or the walls of the chill rooms.
- Training and educating the personnel.
- Maintaining good hygiene control during the slaughter process.

PREVENTION OF CONTAMINATION DURING THE PROCESSING OF ANIMAL PRODUCTS

- The authorities should approve the meat processing establishments.
- The buildings should be constructed in such a way in order to exclude the entrance of insects, rodents, birds or wild animals.
- The working areas should be waterproof, non-absorbent, without crevices and easy to clean (wooden working surfaces should not be used because they develop cracks where *Salmonella* or other microorganisms may proliferate and once they do it is extremely difficult to decontaminate).
- The hot water used for disinfecting purposes should be 80^{o}C and the time for disinfecting at least 2 minutes.
- Waste should be disposed of properly, so feed or drinking water is not affected.
- Modern toilets with hand washing facilities and paper towels are required in every working area. Educated personnel should always wash hands before starting work, after visiting the toilet and after handling contaminated material.
- Adequate ventilation, since water condensation may encourage the growth of *Salmonella.*
- Proper designed equipment and utensils easy to be cleaned and disinfected.
- Frequent routine inspection of the premises by authorised inspectors or managers.

PEST CONTROL

It is always better to use physical barriers for preventing the contamination of working areas by flies and rodents. Where pesticides are unavoidable, then their use should be approved and supervised by the competent authorities. After spraying, all equipment and utensils should be washed before being used again.

STORAGE TEMPERATURE

In order to prevent the growth of *Salmonella,* proper storage temperature should be below 4^{o}C or above 60^{o}C.

MEDICAL EXAMINATION OF PERSONNEL

Meat handlers infected by enteric diseases should produce evidence that their faeces are negative for *Salmonella* before they start working again (at least 48 hours after recovery)

DECONTAMINATION OF FOOD

Salmonella spp*.* is relatively sensitive to physical and chemical changes of the environment. However, methods of decontamination are limited because they may render the products unacceptable to the consumers by changing the organoleptic characteristics of the food.

HEAT PROCESSING

Heat processing which is very effective for the elimination of *Salmonella,* is employed for canned meat products,. Liquid milk and dairy products manufactured, from pasteurised milk are quite safe because these temperatures destroy not only *Salmonella* but other pathogenic microorganisms as well.

IONISING RADIATION (OR RADICIDATION)

In order to reduce the number of viable non-spore forming pathogenic (gram-negative) bacteria including *Salmonella,* ionising radiation is applied to foods where posible*.* No adverse effects have been found in humans or animals after consumption of irradiated food.

pH AND ACIDITY

Loss of viability of *Salmonella* commences below 4,5 and above 9,0.

DRYING, CURING AND SMOKING

Heavy curing may kill *Salmonella* or hinder its multiplication. Mild curing, with slight drying and light smoking cannot guarantee that the growth of *Salmonella* will be inhibited.

CHEMICALS

They may be used in some cases but they are bacteriostatics rather than bactericidals. Chlorine and its derivatives, glutaraldehyde and biguanide, are used on food processing equipment. However, their bactericidal effects *in vivo* are low despite their lethal effects *in vitro*.

ANNEX V

BIBLIOGRAPHY FOR FURTHER READING ON HACCP

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ANNEX VI

HYGIENE IN MASS CATERING

Important rules to prevent foodborne disease ("Food poisoning")

PERSONAL HYGIENE

- **Wear clean clothes !**
  Why? To avoid contaminating food with microorganisms and any foreign objects. The cleaner the clothes, the smaller the risk of contamination.

- **Remove jewellery (rings, watches) before staring work !**
  Why? Jewellery makes hand washing less effective

- **Always cover your hair while working in the kitchen !**
  (Use headgear provided!)
  Why? Because this prevent hair from falling into food.

- **Refrain from smoking !**
  Why? Cigarette ash and butts can fall into food.

- **Hands should always be washed before work and especially after visiting the toilet !**
  Why? Hands can be contaminated with disease-causing microorganisms, particularly after visiting the toilet. In some cases, use of gloves is advisable.

- **If suffering from an illness involving any of the following, report to the employer before commencing work !**
  Jaundice, diarrhoea, vomiting, fever, sore throat, skin rash or other shin lesions (boils, cuts, etc. however small)
  Why? It may be necessary to be temporarily assigned to another task.

- **Wounds on hands and arms should be carefully bandaged with impermeable material !**
  Why? Wounds may be infected with microorganisms, which cause diseases.

- **Cover your nose and mouth when sneezing/coughing !**
  Why? Even healthy people have microorganisms in their nose and throat. Use a paper handkerchief that should then be thrown away. Hands should be washed afterwards.

HYGIENIC HANDLING OF FOOD

- **Perishable food should be refrigerated !**
  Why? Chilling to a temperature preferably lower reduces multiplication of most micro-organisms of 10°C,

- **Thoroughly defrost frozen meat and poultry before cooking !**
  Why? If all parts are not completely defrosted, the temperature increase in some thicker parts, e.g. chicken breast, may not be sufficient to kill all microorganisms during cooking.

- **Discard all liquid accumulated during defrosting of meat and poultry, and if refrigerator shelves, table tops or utensils are soiled with it, they should be thoroughly washed !**
  Why? These liquids may contain disease-causing microorganisms.

- **Cook food thoroughly !**
  Why? Thorough cooking will kill microorganisms. But remember that thorough cooking also means that all parts of the food must reach a temperature of at least 70°C. (Use special thermometers if in doubt !)

- **Keep cooked food hot - at temperature of at least 60°C !**
  Why? Microorganisms multiply at temperatures below 60°C. Therefore, food that is ready for consumption should be kept either hot or be cooled quickly.

see also next page

- **Reheat cooked food to at least 70°C !**
  Why? Proper reheating kills microorganisms that may have developed during storage. This rule also applies when freshly cooked food is added to left- over.

- **Perishable food should not be stored too long, even at refrigeration temperature !**
  Why? Chilling prevents the growth of many microorganisms. For others chilling only slows down the growth and some microorganisms may even multiply at low temperatures.

- **Keep cooked food separate form raw food!**
  Why? This reduces the risk of cross-contamination.

- **Cooked food should not be touched by hand !**
  Why? Microorganisms are present even on a clean hand and may be transferred to food.

PREMISES AND KITCHEN UTENSILS

- **Keep kitchen area and adjoining rooms clean !**
  Why? every food scrap, crumb or spot is a potential reservoir of germs.

- **Frequent cleaning up as you go along ensures hygienic kitchens !**
  Why? Dried and encrusted leftovers are hard to remove from surfaces and utensils. The working area must therefore be cleaned thoroughly after each process of production.

- **Clothes and drying towels that come into contact with dishes and utensils should be changed every day !**
  Why? Thorough washing at higher temperatures removes dirt and kills microorganisms. Separate cloths should be used for cleaning the floors, and these also require frequent washing.

- **Keep kitchens tidy !**
  Why? Tidy kitchens are more easily kept hygienically clean. Personal belongings, for example, should be left in the cloakrooms provided.

- **Protect kitchen and storage area from insects and other vermin !**
  Why? These pests may carry disease-causing organisms.

- **Keep dangerous/poisonous substances, e.g. detergents, disinfectants and insecticides, outside the kitchen area in labelled and closed containers !**
  Why? Accidents can easily occur when food and poisonous substances are confused.

- **When preparing mixed dishes, e.g. potato or noodle salads, always cool the cooked component before adding other ingredients !**
  Why? Large amounts of hot food cool down very slowly, and during that period microorganisms from other components may multiply.

- **Avoid overcharging the cold-storage equipment !**
  Why? This leads to a slow and ineffective chilling of the food, which may promote an increase of microorganisms.

- **Refrigerate cooked food in shallow containers !**
  Why? Shallow containers allow faster cooling than do deeper pans.

- **All work with perishable food must be carried out quickly !**
  Why? The longer the food is exposed to the warmth of the kitchen, the higher the risk of an increase of microorganisms to disease-causing levels.

- **Do not change dishwasher timings/techniques/temperatures !**
  Why? Food particles may stick to objects in dishwashers, and bacteria may survive if the temperature is not correct or the specified amount of detergent is not used or the timing is inadequate. The manufacturers' guidelines must be followed when using equipment.

From a brochure produced jointly by WHO's Food Safety Unit, Geneva, Switzerland and the Federal Health Office, Berlin, Germany