RESEARCH PAPER

FOODBORNE DISEASE OUTBREAKS IN AUSTRALIA 2001 – 2009

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BACKGROUND: Analysis of surveillance data from foodborne disease outbreaks can help identify high-risk aetiological agents, food vehicles and settings. This information may help prevent future illness by informing the development of public health policy, food standards development and other food safety intervention programs.

METHODS: We analysed national data on foodborne and suspected foodborne disease outbreaks, defined as two or more cases of gastroenteritis associated with a common food, investigated in Australia between 2001 and 2009 inclusive. Data were described by aetiology, food vehicle and setting of food preparation.

RESULTS: During the surveillance period there were 1,025 outbreaks reported affecting 16,411 people, with 1,588 hospitalised and 38 deaths. *Salmonella* was the most frequently identified aetiological agent causing 33% of all outbreaks (336/1025), followed by norovirus which was responsible for 10% of outbreaks (100/1025). Food vehicles commonly associated with outbreaks included eggs, poultry, seafood, meats, condiments/sauces, desserts, salads and sandwiches. The most frequent reported setting where food was prepared in these outbreaks was restaurants, representing 40% of the total outbreaks (409/1025).

CONCLUSION: To minimise foodborne disease outbreaks, the food industry, governments and consumers should focus food safety attention where the most outbreaks occur or impacts are most serious. The main aetiological agent causing foodborne disease outbreaks was found to be *Salmonella*, often associated with poultry and egg products. Other areas of concern included foodborne viruses linked to extensively handled foods such as salads/sandwiches and seafood toxins linked to seafood products.

Introduction

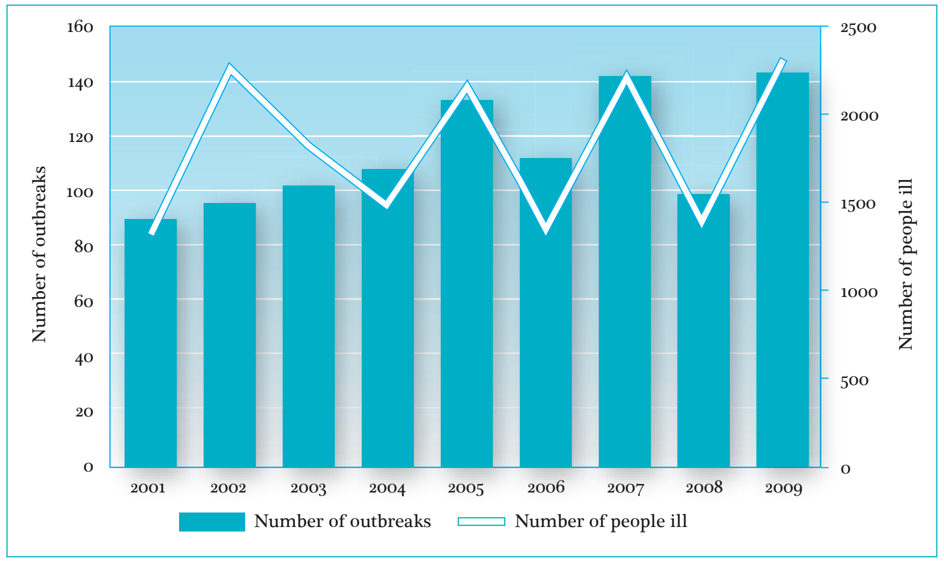
Contaminated food is an important cause of gastrointestinal illness in Australia, which is largely preventable through effective food safety. There are an estimated 5.4 million episodes of foodborne gastroenteritis each year, along with 76 related deaths (Hall, Kirk et al. 2005). Foodborne illness results in approximately 1.2 million visits to a doctor, 300,000 prescriptions for antibiotics and 2.1 million days of missed employment (Kirk, McKay et al. 2008).

These outcomes cost the community an estimated $1.2 billion annually, mainly through lost productivity (Abelson 2006). Cases of foodborne disease may occur as sporadic isolated cases, or associated with other epidemiologically-related cases as part of outbreaks. Knowledge from investigations of foodborne disease outbreaks can assist with the development of control strategies to prevent future illness and help determine priorities for food policy and food safety interventions (Desmarchelier 1996; CDC 2010).

Data on foodborne disease outbreaks may also be used to monitor trends over time (Kirk, McKay et al. 2008), detect new threats (such as emerging pathogens), provide evidence for food attribution to illness and can be included in the evaluation of strategies implemented to help prevent foodborne illness (Tauxe, Doyle et al. 2010).

OzFoodNet is a national network in Australia that conducts enhanced surveillance to identify and control foodborne illness (Kirk, McKay et al. 2008). Under the OzFoodNet program of work, each state and territory health department in Australia employs one or more epidemiologists (OzFoodNet 2009). In 2001, OzFoodNet established the OzFoodNet outbreak register, a surveillance system for gastroenteritis outbreak investigations. This prospective collection of national foodborne disease outbreak data builds on previous historical surveys about the causes of foodborne disease outbreaks in Australia (Sutton 1973; Davey 1985; Crerar, Dalton et al. 1996; Dalton, Gregory et al. 2004). To summarise the causes of foodborne disease outbreaks and make recommendations to reduce future risks we analysed data from the OzFoodNet outbreak register on investigations conducted in Australia between 2001 and 2009.

Figure 1
Number of foodborne disease outbreaks and number of individual's ill by year 2001-2009



Methods

The OzFoodNet outbreak register is a Microsoft (MS) Access database, which houses data on all gastrointestinal outbreak investigations conducted in Australia. This register includes data for each outbreak on the mode of transmission, the numbers of people affected, hospitalisations, deaths, symptoms experienced, incubation periods and duration, exposures leading to illness (including foods and other contamination factors), causative aetiological agent/s, epidemiological methods used, food traceback and environmental investigation results. We analysed data on all reported outbreaks classified as 'foodborne' and/or 'suspected foodborne', defined as two or more cases of gastroenteritis associated with a common food source, which occurred between January 2001 and December 2009. OzFoodNet epidemiologists assessed the epidemiological, micro-biological, and laboratory evidence collected during the investigation of outbreaks prior to data entry into the register. In this study, we accepted how epidemiologists categorised the mode of transmission (e.g. foodborne and suspected foodborne), and attribution of outbreaks to a specific food vehicle.

Analysis of data was performed using Microsoft Excel 2003 and STATA v11.2 (Stata Corp, College Station, TX, USA) (STATA). We removed all outbreaks that were not classified as either foodborne or suspected foodborne. Aetiological agent data were classified per the United States CDC "Guidelines for the confirmation of foodborne disease outbreaks" (CDC 2000; Lynch, Painter et al. 2006; CDC 2010). Food vehicles were classified into the following 17 categories: meat/meat products, chicken/poultry products, fish/seafood products, dairy products, nuts, eggs/egg products, sandwiches/rolls, soup, pizza, rice/pasta, condiments/sauces, desserts, fruit, vegetables/salads, mixed dishes, other (those not able to be captured in any of the listed categories) and unknown vehicle (noted 'unknown' or having missing data). In outbreaks where the implicated foods were from a mixture of commodities (e.g. *Salmonella* outbreak associated with 'Caesar salad made with raw egg') the ingredient mentioned in the description that was the most biologically plausible to the outbreak (e.g. egg) were coded as the implicated food vehicle, and where this could not be easily determined the food was coded as a mixed dish or the category that best fit their description (e.g. desserts).

Results

From 2001 to 2009 inclusive, there were 378 (37%, 378/1025) foodborne and 647 (63%, 647/1025) suspected foodborne, a total of 1,025 (all referred to from here on as foodborne) disease outbreaks reported. These affected 16,411 people, and resulted in 1,588 hospitalisations and 38 deaths. The annual mean number of outbreaks was 114 per year, ranging between 90 outbreaks in 2001 to 143 in

2009. This increase was not consistent across the years (Figure 1, page 45), and the difference between years were not found to be statistically significant ($p>0.05$). The median number of people affected in an outbreak was 8 persons (range 2 - 442) and in 453 outbreaks (44% of the total), 10 or more people were affected.

Main etiological agents causing foodborne disease outbreaks

Salmonella was the most frequently identified aetiological agent implicated in outbreaks, affecting 40% of the total number of people ill (6573/16411) and accounting for 33% of the total number of outbreaks investigated (336/1025). Norovirus was implicated as the agent of 100 foodborne disease outbreaks affecting a total of 3015 individuals. Hepatitis A virus (HAV) accounted for nine outbreaks affecting 362 individuals. Seafood toxins, comprising ciguatera fish poisoning and histamine poisoning, caused a total of 86 outbreaks (8%), with a median number of 3 people affected per outbreaks and only 2% of the total individuals affected in all foodborne outbreaks (358/16411) *(*Table 1*)*.

Deaths were most frequently associated with *Salmonella* outbreaks (21 deaths, case fatality rate 0.3%), followed by outbreaks caused by *Clostridium perfringens* (10 deaths, case fatality rate 0.8%), *Listeria monocytogenes* (5 deaths, case fatality rate 12%), ciguatera poisoning (1 death, case fatality rate 0.4%) and hepatitis A virus (1 death, case fatality rate 0.3%).

Main foods vehicles

A causative or suspected food vehicle was identified in 59% of outbreaks (608/1025). Of these, 27% (162/608) were confirmed via direct microbiological laboratory evidence. Food vehicles associated with the highest burden of illness included egg/egg products, where 1404 (9%) people were affected, poultry products affecting1155 (7%); vegetables/salads affecting 1119 (7%); and fish/seafood products affecting 1002 (6%) people (Table 2, page 48). Eggs were implicated as the sole food vehicle in 68 (7%) outbreaks. Of these outbreaks, 66 (97%) were found to be due to *Salmonella* with the remainder of unknown aetiology. Poultry products, were associated with 82 outbreaks and of these 25 (30%) were found to be due to *Salmonella*, 13 (16%) due to *Campylobacter*, while 33 (40%) were due to an unknown aetiology. The main aetiological agents associated with fresh produce (vegetable/salad and fruit) associated outbreaks were found to be of unknown aetiology (30%), *Salmonella* (30%), norovirus (21%) and Hepatitis A virus (9%). Seafood products (including fish) was the implicated vehicle in 136 (13%) outbreaks, with 86 outbreaks (66%) being due to seafood toxins. Of these 58 (67%) were due to ciguatera poisoning and the remaining 28 (33%) were due to histamine fish poisoning. The majority of ciguatera outbreaks occurred in Queensland (52/58, 90%). The consumption of fish species leading to ciguatera poisoning included mackerel, yellowtail kingfish and trevally. Histamine fish poisoning outbreaks were identified across Australia with the most common fish species consumed by those affected being tuna (14/28, 50%).

Settings where implicated foods were prepared

The most common settings where foods implicated in outbreaks were prepared were restaurants with 409 outbreaks (40%), followed by catering operators (including commercial caterers, take away outlets, fast food outlets and bakeries) at a combined 22% of outbreaks (221/1025) and private residences at 10% (101/1025) (Table 3, page 49).

Discussion

In this report we document the factors that led to over one thousand foodborne disease outbreaks occurring in Australia between 2001 and 2009. This represents the most substantial analysis of the likely causes of Australian foodborne disease outbreaks, including the identification of hazardous foods and the aetiological agents responsible (Giorgi Rossi, Faustini et al. 2003). Outbreak investigations, such as those summarised in this paper, are important for public health practitioners to identify the reasons for and isolate the identified sources of contamination in order to prevent additional illnesses. Whilst foodborne gastroenteritis is typically mild and self limiting, some foodborne illnesses may be serious and cause severe suffering and death (Barton Behravesh, Jones et al. 2011). There was an average of 114 foodborne disease outbreaks reported each year during the study period. Prior to this, the number of outbreaks occurring in Australia was not well understood. The implementation of OzFoodNet, along with improved interactions between public health agencies, food regulatory agencies, public health laboratories and consultation with the food industry has vastly improved the detection, investigation and documentation of foodborne gastrointestinal outbreaks over the past decade (Kirk, McKay et al. 2008).

During the study period, *Salmonella* was the main aetiological agent of concern. This is consistent with previously published summaries of foodborne outbreaks in Australia (Crerar, Dalton et al. 1996; Dalton, Gregory et al. 2004). Although this may be influenced by the ease of investigation of *Salmonella* outbreaks where there is an epidemiologically robust typing scheme to assist with initial outbreak identification (Baggesen, Sorensen et al. 2010). Food vehicles which were commonly associated with *Salmonella* outbreaks included poultry products, meat products, egg products, and dishes such as condiments/sauces, desserts and sandwiches. These results are consistent with international studies on food attribution to *Salmonella* (including non S. Enteritidis serotypes) (Pires, Vigre et al. 2010). Poultry meat and egg products have also been shown to act as a potential sources of introducing *Salmonella* organisms into food preparation environments (Fearnley, Raupach et al. 2011), with hazardous handling practices such as cross contamination potentially playing a role in its spread to other foods.

Eggs, as a specific cause, would have contributed to *Salmonella* outbreaks where they were not specifically mentioned in the food vehicle description. These outbreaks were classified under other food vehicle categories; such as desserts (e.g. tiramisu) and condiments/sauces (e.g. aioli). To maintain consistency across outbreaks, we categorised food vehicles according to our pre-defined criteria. Consequently, the data more closely represent food vehicles causing outbreaks, but not the ingredient that was contaminated. During the surveillance period, the proportion of outbreaks that were due to eggs would be much higher than the 7% we report in this paper. In recent years, health departments have recorded an increasing number of outbreaks associated with dishes containing raw or undercooked eggs (OzFoodNet, 2009). In addition to *Salmonella* outbreaks being classically linked to animal proteins, like poultry and eggs (Pigott 2008; Pires, Vigre et al. 2010) and to exposures such as international travel (Johnson, Gould et al. 2011), recently there has also been an identified trend seen with *Salmonella* outbreaks associated with fresh produce (Tauxe, Doyle et al. 2010; Kirk, McKay et al. 2008; Munnoch, Ward et al. 2009). *Salmonella* infections generally show seasonal and regional variations across Australia, with warmer climates experiencing higher rates of infection (OzFoodNet 2009).

Foodborne viral and seafood toxin illnesses are not routinely notifiable to health departments in Australia, except for hepatitis A virus, or as part of notification requirements for suspected food and waterborne outbreaks. This makes foodborne outbreak surveillance an important means of collating information on these aetiological agents. Noroviruses (formally Norwalk and Norwalk like viruses) are known to be common agents of gastrointestinal

Table 1
Foodborne disease outbreaks by aetiological agent, numbers and proportion of total outbreaks, the number of individuals ill, hospitalised and died, 2001-2009.

Aetiological agent	Number of outbreaks	% of total no of outbreaks	Number ill	Hospitalised	Died
BACTERIAL					
Salmonella	336	*33*	6573	1138	21
Clostridium perfringens	51	*5*	1219	11	10
Campylobacter	37	*4*	467	19	0
Staphylococcus aureus	12	*1*	365	23	0
Bacillus cereus	6	*1*	108	0	0
Listeria monocytogenes	3	*0*	43	19	5
Shigella sonnei	*1*	*0*	*55*	*3*	*0*
Vibrio parahaemolyticus	*2*	*0*	*4*	*0*	*0*
STEC	*1*		*31*	*5*	*0*
Vibrio cholerae	*1*	*0*	*3*	*2*	*1*
VIRAL					
Norovirus	100	*10*	3015	28	0
Hepatitis A Virus	9	*1*	362	145	1
Rotavirus	2	*0*	22	0	0
Adenovirus	1	*0*	20	0	0
Other viral	3	0	37	0	0
OTHER					
Ciguatera poisoning	58	*5*	261	45	1
Histamine poisoning	28	*3*	97	18	0
Miscellaneous chemicals	11	*1*	88	8	0
Cryptosporidium	1	*0*	8	4	0
Cyclospora	1	*0*	8	0	0
Mixed infection (*B cereus* and *C Perfringens*)	1	*0*	75	0	0
Unknown agent	361	*35*	3550	120	0
TOTAL	**1025**	*100*	**16411**	**1588**	**38**

Table 2
Foodborne disease outbreaks by food vehicle by numbers and proportion of people ill, numbers and proportion of outbreaks, hospitalisations and deaths, 2001-2009

Food vehicle (including products)	Number of outbreaks	% of total no of outbreaks	Number ill	Hospitalised	Died
Seafood/fish	136	*13*	1002	89	1
Chicken/poultry	82	*8*	1155	93	3
Eggs	68	*7*	1404	322	2
Meat/meat	56	*5*	726	57	0
Dessert	49	*5*	987	158	2
Vegetables/Salads	35	*3*	1119	200	1
Sandwiches/Rolls	30	*3*	705	60	1
Condiments	19	*2*	864	72	0
Rice/Pasta	15	*1*	259	2	0
Pizza	14	*1*	101	1	0
Fruit	8	*1*	118	18	0
Dairy	5	*0*	70	4	0
Soup	3	*0*	47	35	0
Nuts	2	*0*	30	3	0
Other	6	*1*	104	9	0
Unknown	417	*41*	6026	377	21
Mixed dishes	80	*8*	1694	88	7
TOTAL	**1025**	**100**	**16411**	**1588**	**38**

outbreaks globally and are likely to be underestimated as a source of foodborne disease (Kroneman, Harris et al. 2008; Baert, Uyttendaele et al. 2009). In terms of the total burden of gastrointestinal illness due to both sporadic and outbreaks associated disease, foodborne viruses are estimated to cause the largest number of cases in Australia (Fleet, Heiskanen et al. 2000; Hall, Kirk et al. 2005) and in the United States (Scallan, Hoekstra et al. 2011). Our results from outbreak surveillance indicated that foodborne noroviruses were often associated with foods that required extensive handling, such as salads and sandwiches. This is consistent with what is seen internationally and is likely due to food handlers working while they are ill with gastroenteritis due to norovirus (Widdowson, Sulka et al. 2005; Baert, Uyttendaele et al. 2009). Fresh produce, especially consumed raw or minimally processed, has also recently been associated with an increasing number of viral foodborne disease outbreaks worldwide (De Roever 1998; Brackett 1999; Sivapalasingam, Friedman et al. 2004; Bassett and McClure 2008; Doyle and Erickson 2008).

Seafood toxin outbreaks in Australia between 2001 and 2009 were common and were largely due to ciguatera toxins and histamine fish poisoning. These outbreaks were generally small, affecting small groups (e.g. a single family or group meal) and affected a relatively small number of individuals. Ciguatera poisoning is generally a self limiting illness occurring after consumption of fish contaminated with a marine biotoxin (ciguatoxins), originally produced by dinoflagellates algae or bacteria which are consumed and bio-accumulated by piscivorous fish (Swift and Swift 1993; Sobel and Painter 2005; Schep, Slaughter et al. 2010). Contaminated fish are often caught off tropical or subtropical coral reefs in Queensland and the Northern Territory (Gillespie, Lewis et al. 1986; Lucas, Lewis et al. 1997; Ng and Gregory 2000). Histamine fish poisoning, also referred to as Scombroid fish poisoning, is caused by the consumption of fish with high histamine levels due to inadequate refrigeration post catch, the intoxication is generally short-lived and cases are often not be reported (Becker, Southwick et al. 2001; Attaran and Probst 2002). Fish species reported to be the responsible vehicle for histamine poisoning included tuna, kingfish, mahi-mahi and mackerel (Sobel and Painter 2005).

There are limitations associated with analysing outbreak data (O'Brien, Elson et al. 2002). Underreporting and therefore underestimation of foodborne outbreaks may be due to some illnesses not being notifiable, being relatively mild with patients not seeking medical advice upon becoming ill and/or not being correctly diagnosed/tested (Mead, Slutsker et al. 1999; Jones, Scallan et al. 2007). An additional factor in using an outbreak surveillance tools, such as this

Table 3
Foodborne disease outbreaks by setting by numbers and proportion of people ill, numbers and proportion of outbreaks, hospitalisations and deaths, 2001-2009.

Setting where foods were prepared	Number of outbreaks	% of total no of outbreaks	Number ill	Hospitalised	Died
Restaurant	409	*40*	6081	329	1
Private residence	101	*10*	849	165	0
Commercial caterer	93	*9*	2017	83	3
Take-away outlet	81	*8*	1094	101	1
Primary produce	67	*6*	526	97	1
Aged cage facility	65	*6*	1075	73	23
Bakery	26	*3*	803	289	2
National fast food franchise	21	*2*	203	24	0
Commercially manufactured	19	*2*	437	139	1
Institution	18	*2*	410	80	1
Camp	14	*1*	339	15	0
Grocery store/delicatessen	12	*1*	76	1	0
School	9	*1*	346	5	0
Child care	8	*1*	111	2	0
Hospital	8	*1*	86	13	0
Fair/festival/mobile service	4	*0*	291	17	0
Cruise/airline	3	*0*	66	12	3
Imported food	3	*0*	54	11	0
Military	3	*0*	68	0	0
Other	23	*2*	725	43	0
Unknown	38	*4*	754	89	2
TOTAL	**1025**	**100**	**16411**	**1588**	**38**

register, is that particular characteristics of the food vehicle, the aetiological agent and/or the illness experienced may make the outbreak inherently more or less likely to be reported, potentially introducing bias (De Roever 1998; Batz, Doyle et al. 2005). There is the also potential for variation in the categorisation of many of the described features of outbreaks (e.g. the implicated food vehicle) as this may depend on the individual epidemiologist's interpretation and the evidence available at the time (Pires, Vigre et al. 2010). Consequently the description of foodborne versus non foodborne transmission (e.g. waterborne, person-to-person, person-to-food-to-person, animal-to-food-to-person) and that of the implicated food vehicle may not be consistent. Caution must also be exercised when comparing published historical reports of foodborne disease outbreaks. Over time there have been changes in public health priorities and surveillance, along with emerging aetiological agents and advances in laboratory techniques.

A recommendation for the future would be to improve training for epidemiologists in consistently categorising food vehicles implicated in outbreaks in the register and to engage a more sophisticated food classification system, such as that described by Painter et al (2005), during future analysis of the data. These measures would improve food attribution data (Batz, Doyle et al. 2005). Future studies should also focus on the food handling practices identified to have occurred during or prior to that of foodborne disease outbreaks. Previous studies have estimated that up to 85% of all foodborne outbreaks have resulted from the mishandling of foods (Giorgi Rossi, Faustini et al. 2003) and more information of this aspect would be useful.

Conclusion

Robust information from investigated foodborne disease outbreaks can guide food policy, food standards development and food industry led programs to prevent future foodborne illness. Public health policy makers and food regulatory agencies should work with industry to prioritise on key areas where foodborne disease outbreaks have occurred previously. *Salmonella* has consistently been identified as the main aetiology of foodborne disease outbreaks, and is often associated with common foods (including eggs and poultry products) being the responsible vehicle for transmission. Foodborne virus outbreaks are often linked to food vehicles which have undergone a high degree of human handling, and are increasingly being linked to fresh produce vehicles internationally. Seafood toxins have also been identified as a common agent of foodborne disease outbreaks in Australia. Many foodborne disease outbreaks are of unknown aetiology, however over time better testing methods and data collection will allow for more accurate attribution of food vehicles linked to gastrointestinal outbreaks in the future.

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March 6-8. OH&S Strategy 2012. Sheraton Mirage Resort, Gold Coast, Queensland. Further information at www.ohsstrategy.com.au.
March 7-9. Ecoforum Conference & Exhibition. Australian Technology Park, Everleigh, Sydney. Ecoforum Ltd; tel: (02) 9410 1302, email: quitz@ecoforum.net.au, web: www.ecoforum.net.au/2012/program.asp.
March 7-9. Food Structures, Digestion and Health. Palmerston North, New Zealand. Further information at www.riddet.ac.nz
March 2-21. Melbourne Food and Wine Festival. Melbourne. Further information at www.melbournefoodandwine.com.au
April 26-May 3. Tasting Australia. Events in Adelaide and SA. Further information available at www.tasting-australia.com.au.
May 1-4. Australasian Aquaculture 2012. Melbourne Convention & Exhibition Centre. Further information and registration available at www.was.org.
May 10-12. AUSVEG National Convention, Trade Show and Awards for Excellence. Wrest Point Hotel Casino, Hobart, Tasmania. Further information at www.ausveg.com.au/convention
May 27-29. FoodService & Bakery Australia. Royal Hall of Industries & Hordern Pavilion, Moore Park, Sydney. Exhibitions and Trade Fairs Pty Limited, tel: (02) 9556 7985.

July 15-18. 45th Annual AIFST Convention. Reaping the Rewards. Adelaide Convention Centre. AIFST Inc; tel: (02) 8399 3996, fax: (02) 8399 3997, email: aifst@aifst.com.au, web: www.aifst.com.au.

September 5-8. 16th International Congress of Dietetics. Sydney Convention and Exhibition Centre. ICD 2012 Congress Managers; tel: (02) 9265 0700, fax: (02) 9267 5443, email: lcd2012@arinex.com.au, web: www.icd2012.com.

INTERNATIONAL 2011

December 6-7. Eurocereal 2011 Conference. Campden BRI, Chipping Campden, Gloucestershire, UK. Campden BRI; web: www.eurocerealconference.com.
December 6-8. Dairy Universe India. Sweet & Snack Tea India. Bombay Exhibition Center, Mumbai, India. Koelnmesse YA Tradefair; email: info@koelnmesse-india.com, web: www.koelnmesse-india.com.

INTERNATIONAL 2012

January 29-February 1. ProSweets Cologne 2012/ISM International Sweets and Biscuits Fair. Koelnmesse Cologne, Germany. Koelnmesse; web: www.prosweets-cologne.com, www.ism-cologne.com.
March 28-30. Food Ingredients China 2012. Shanghai World Expo Exhibition and Convention Center. Further information at www.chinafoodadditives.com/d_e.htm
March 27-30. Anuga FoodTec. Koelnmesse, Cologne, Germany. Koelnmesse GmbH and the German Agricultural Society; tel: +49 221 821-2875, fax: +49 221 821 2574, email info@koelnmesse.de, web: www.anugafoodtec.com.
April 10-13. Techlac Dairy Technology. Parque de Eventos Bento Gonçalves City, Brazil. Information; tel: +55 11 8255 7546, email: techke@newtrade.com.br, web: www.techlac.com.br.
April 17-20. Food and Hotel Asia. Singapore Expo, Singapore. Singapore Exhibition Services Pte Ltd; web: foodnhotelasia.com.
April 22-24. 2012 Hydrocolloid Conference. Westin Hotel, Valencia, Spain. IMR International; web: www.hydrocolloid.com.
May 9-11. SIAL China 2012 The Asian Food Marketplace. New International Expo Centre, Shanghai. Further information at www.sialchina.com.
May 24-25. Stevia Tasteful 2012. Food & Beverage Formulation: The Subtle Balance. Paris, France. World Stevia Organisation; web: www.Info-site.com.
June 19-21. IDF-INRA International Symposium on Spray Dried Dairy Products. Saint Malo, France. Call for abstracts. Deadline 1 February 2012. Submission at www.colloque.inra.fr/sddp2012. Abstract information: Pierre.schuck@rennes.invra.fr or sddp2012@rennes.inra.fra.
July 1-5. Food Oral Processing 2012. Palais des Congres. Beaune, France. Further information at https://colloque.inra.fr/fop.
August 5-9. XVI IUFoST World Congress. Addressing global food security and wellness through Food Science and Technology. Rafain Palace Hotel & Convention Center, Iguazu Falls, Brazil. Organizing Committee; web; www.iufost.org.br.
November 5-9. 7th Conference of the World Mycotoxin Forum and XIIIth IUPAC International Symposium on Mycotoxins and Phycotoxins. Beurs World Trade Center, Rotterdam, The Netherlands. Bastiaanse Communication; web: www.WMFmeetsIUPAC.org.

INTERNATIONAL 2013

September 16-20. drinktec 2013. New Munich Trade Fair Centre. Munich, Germany. Messe München GmbH; web: www.drinktec.com.