

# AgroStat



Marseille, 14-16 March 2018

Due to the increasing quantity of data in agrosociences, there is a need for specific tools which place statistics and data science at the heart of challenges of the contemporary world. The AGROSTAT conference gives statisticians, engineers and users of statistical methods a unique opportunity to exchange around topics, such as sensometrics, chemometrics, experimental designs, risk analysis, process control or big data.

This event brings together internationally recognized academic and industrial organizations representatives, to take stock of advances in statistics, express their needs and to anticipate future challenges.

This conference, which is held every two years, is organized this year by **Aix-Marseille University**, the "Mediterranean Institute of Biodiversity and Marine and Continental Ecology", UMR CNRS 7263 / IRD 237, team Toxicology & Environmental Health (TSE), under the auspices of the Agro-Industry Group of the French Statistical Society (SFdS). The SFdS is a non-profit organization bringing together researchers, engineers, teachers and statistics users.

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## Wednesday 14 March

9h00	Welcome speech - M. SERGENT, M. QANNARI		
<i>Inaugural conference</i>			
9h15	PL1	B. K. Ersbøll	Big Data from Farm to Fork, advantages and challenges
<u>Session 1: BIG DATA/MACHINE LEARNING/DEEP LEARNING - Chair: S. Marque</u>			
10h20	O01	P. Rebenaque	Automated analysis of tasting comments in sensory analysis
10h40	O02	M.-B Blanquart	Impact of the questionnaire structure on overall results in preference mapping: a meta-analysis on 285 consumer studies
11h00	O03	S. Bougeard	Current multiblock methods: competition or complementarity? A comparative study in a unified framework
11h20	<i>Coffee break</i>		
<u>Session 2: DEVELOPMENT TOOLS - Chair: D. Brémaud</u>			
11h50	O04	N. Pineau	Use of R-Shiny apps to communicate sensory and consumer modeling tools outputs
12h10	O05	I. Rebhi	An interactive shiny tool for sensory and consumer data mapping : sensmapui
12h30	<i>Lunch</i>		
<u>Session 3: CHEMOMETRICS - Chairs: D. Rutledge/ E. Vigneau</u>			
14h00	PL2	P. Bastien	Use of sparse methods in cosmetics
15h00	O06	B. Jaillais	Random forests for the prediction of water content by near-infrared hyperspectral imaging spectroscopy in biscuits
15h20	O07	C. Peltier	What is the better test to detect multivariate differences in large dimensional data?
15h40	O08	D.N. Rutledge	Comparison of Principal Components Analysis, Independent Components Analysis and Common Components Analysis
16h00	<i>Coffee break</i>		
16h30	O09	E. Vigneau	Analyse des relations entre plusieurs blocs de données par l'approche Path-Comdim: une application pour évaluer la qualité environnementale sur le littoral atlantique français
16h50	Poster presentations		
17h15	POSTER SESSION		
18h00	<i>Welcome Reception: Les Halles de la Major</i>		

## Thurs day 15 March

### Session 4: SENSOMETRICS - Chairs : Ph. Courcoux / P. Schlich

8h45	PL3	J. Castura	Consumer diversity in sensory evaluation data
9h30	O10	M. Brard	A latent class regression model for the clustering of multivariate binary ratings
9h50	O11	E. Qannari	One thousand and one ways to analyze free sorting data
10h10	O12	N. Pineau	CATA as an alternative method to free sorting

10h30 *Coffee break*

11h00	O13	F. Llobell	Clustatis: a cluster analysis of multiblock datasets. application to sensometrics
11h20	O14	G. Lecuelle	Modeling temporal dominance of sensations data with stochastic processes
11h40	PL4	B. Boulanger	Round table: The world beyond p-values: how to make research in the 21 <sup>st</sup> ?

12h30 *Lunch & posters*

14h30 *SOCIAL EVENT*

19h30 *Gala diner : Reverso - Les Terrasses du port*

## Friday 16 March

### Session 5: EXPERIMENTAL DESIGNS - Chairs: M. Claeys/M. Sergent

<b>9h00</b>	<b>PL5</b>	<b>J-P Gauchi</b>	<b>Metamodeling and global sensitivity analysis for computer models with correlated input</b>
<b>9h45</b>	<b>O15</b>	S. Marque	Plan d'expériences et simulations sur le contrôle qualité des contaminants microbiologiques de produits finaux
<b>10h05</b>	<b>O16</b>	Q. Carboué	Experimental design and solid state fermentation: a holistic approach to improve cultural medium for the production of fungal metabolites
<b>10h25</b>	<i>Coffee break</i>		
<b>10h55</b>	<b>O17</b>	V. Rodrigues	Food source attribution of human campylobacteriosis by meta-analysis of case-control studies
<b>11h15</b>	<b>O18</b>	U. Gonzales-Barron	An extended bigelow-type meta-regression model describing the heat resistance of neosartorya spores
<b>11h35</b>	<b>O19</b>	V. Cadavez	Dynamic determination of optimum growth rate of listeria monocytogenes in minas soft cheese during cold shelf-life
<b>11h55</b>		P. Schlich	Statistical analysis of chocolate tasting data obtained from participants
<b>12h15</b>	<i>Closing of the conference, Awards</i> <i>Lunch</i>		

# FOOD SOURCE ATTRIBUTION OF HUMAN CAMPYLOBACTERIOSIS BY META-ANALYSIS OF CASE-CONTROL STUDIES

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## Abstract

A case-control study is a powerful approach among epidemiologists to investigate the causal effect of exposure and enteric illness. To combine the associations between sporadic campylobacteriosis and the different food pathways of exposure, the results from relevant case-control studies were extracted and their odds-ratio (OR) measures were meta-analysed within food category partitions by population type, extracting the variability due to both primary studies and model types. In the mixed population, the most important determinants of disease turned out to be: consumption of raw milk (pooled OR=2.64), poultry (OR=1.78), raw milk's cheese (OR=1.72), BBQ meats (OR=1.67), fast-food composite (OR=1.59) and raw seafood (OR=1.50). On the other hand, consumption of raw-egg containing products (OR=4.85), raw milk (OR=3.05), pork (OR=2.34), minced beef (OR=2.27), processed meats (OR=2.18), any composite food eaten out (OR=2.16) and poultry meat (OR=2.08) were found to bear the highest risk of campylobacteriosis in the children population.

**Keywords** - Systematic review, Retrospective study, Odds-ratio, Risk factor, Route of transmission

## INTRODUCTION

A case-control study has been defined as an investigation into a relationship between a given disease and one or more causal or preventive factors, in which persons selected because they have the disease (i.e., cases) and suitably selected persons who do not have the disease (i.e., controls) are compared in terms of their exposure to the factor under study. The sporadic cases of gastrointestinal disease do not share a common contamination exposure, so the odds-ratio (OR) measures of association between exposures and disease from any single source is attenuated, making true risk differences between cases and controls more difficult to detect. Such 'diluted' odds-ratios, characteristic of sporadic studies, can be combined by meta-analysis in order to produce a more precise estimate of the association between risk factor and disease, with an increased statistical power. The objective of this study was to determine the most important food sources of campylobacteriosis by meta-analysing the associations between the different food pathways of exposure and sporadic disease, as investigated in relevant case-control studies.

## METHODOLOGY

A systematic search using a combination of appropriate keywords was conducted using the bibliographic engines Science Direct, Pubmed, Scielo, Scopus and Web of Science using key terms in English, Spanish, French and Portuguese. Primary studies that passed the screening for relevance were marked as having potential for bias if they failed to meet at least one of the methodological quality assessment criteria, which were related to evidence of selection bias, misclassification bias or biased data analysis. From each case-control study, ORs were extracted, as well as study characteristics such as population type, design, model, analysis type and risk factor hierarchy. The general mixed-effects meta-analysis model,

$$\log OR_{ijkt} = \beta_{0i} + \beta_{1tj} \text{AnalysisType}_t + \beta_{2k} \text{Food Class}_k + \varepsilon_{ijkt}$$

$$\beta_{1tj} = \bar{\beta}_{1t} + v_{tj}$$

$$\beta_{0i} = \bar{\beta}_0 + u_i$$

was adjusted to each food category data partition by population type (i.e., mixed population and children) to estimate pooled ORs for every food class  $k$ . To extract the variability due to the different primary studies  $i$ , the model's intercept  $\beta_{0i}$  was allowed to shift according to the random effect  $u_i$  due to the deviation of the primary

study  $i$  from the true estimate. The random effects  $v_{ij}$  accounted for the variability in log OR due to model type  $j$  (i.e., chi square, Mantel-Haenszel, unconditional or conditional logistic) within the analysis type  $t$  (i.e., univariate or multivariate).

## RESULTS

Seventy-one primary studies, conducted between 1981 and 2012, passed the quality assessment stage, and provided 703 ORs which were duly hierarchised for meta-analysis. In the mixed population, produce (including fruits, vegetables, spices and roots) was the food pathway least associated with campylobacteriosis at an overall OR of 1.477 (95% CI: 1.221–1.788). At a higher association level laid both the seafood pathways (overall OR=1.800; 95% CI: 1.474–2.201) – mainly consisting of fish, oysters, shellfish and raw seafood – and multi-ingredients foods (overall OR=1.800; 95% CI: 1.493–2.168). The category of beverages, represented by bottled water purchased in Ireland, UK, Norway, Finland, USA, Canada and Australia, was as important a determinant of disease (overall OR=1.868; 95% CI: 1.533–2.277) as the broad category of meats and meat products (overall OR=1.933; 95% CI: 1.611–2.319). Meat was the food most frequently scrutinised in case-control studies, made up of a total of 471 ORs, from which 227 corresponded only to poultry meat. The meta-analysis pooling the different kinds of chicken preparations such as poultry meat, BBQ chicken, chicken fondue, chicken pieces, chicken giblets, grilled, fried and roasted chicken produced a high pooled OR (1.779; 95% CI: 1.540–2.052). The pooled OR due to poultry consumption in Western European countries only is shown in Fig. 1. The “Other Meats” category, which was created to accommodate meat of non-specified origin, such as meat fondue, BBQ meat, grilled meat, minced meat, offal and tripe, presented the highest association with campylobacteriosis at a pooled OR of 2.210 (95% CI: 1.900–2.570). Dairy products, which comprised basically raw milk, unpasteurised milk cheese and fresh cheese (overall OR=2.063; 95% CI: 1.683–2.524), and eggs, including raw eggs and mayonnaise (overall OR=2.056; 95% CI: 1.683–2.524), had both a slightly higher association with campylobacteriosis than meat in the mixed population.

Children were more susceptible to campylobacteriosis, since the meta-analysed ORs for composite, dairy, eggs, meat, produce and seafood were in all cases higher (2.307–3.215) than those of the mixed population. Children who consumed multi-ingredient foods (overall OR=2.307; 95% CI: 1.609–3.310), meat (overall OR=2.452; 95% CI: 1.778–3.380) or produce (overall OR=2.678; 95% CI: 1.784–4.015) were at about equal (-ly high) odds of acquiring campylobacteriosis than those who did not. Slightly more exposed to campylobacteriosis were those children having any kind of raw egg-based preparation (overall OR=2.768; 95% CI: 1.809–4.229) as well as infants having powder infant formula and children younger than 6 years old having any unpasteurised dairy product (overall OR=3.216; 95% CI: 2.131–5.795).

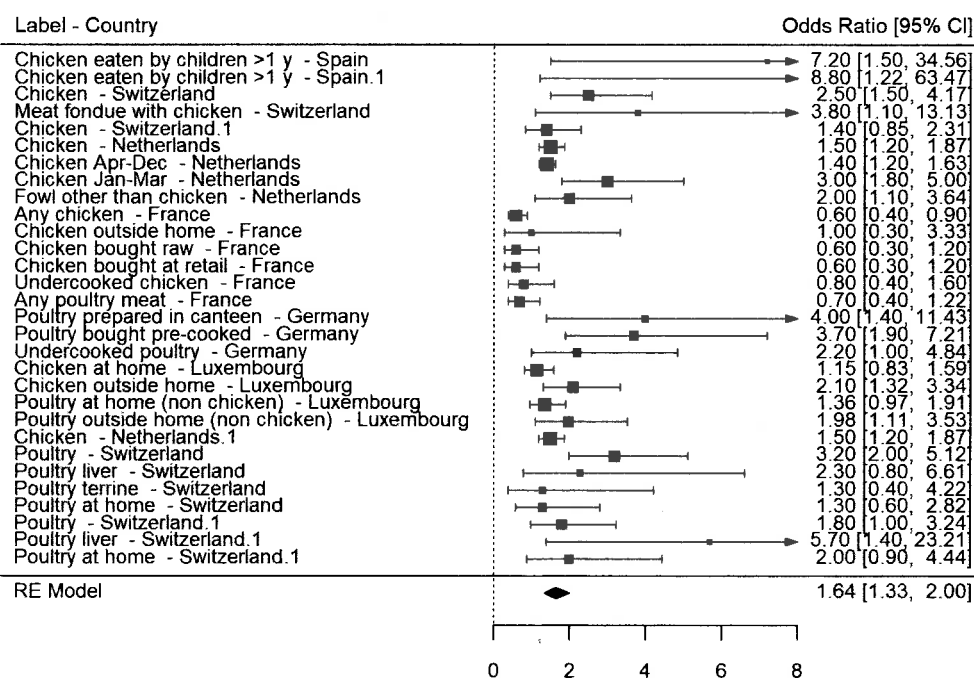


Fig.1. Forest plot of the meta-analysis on the association between campylobacteriosis and poultry meat consumption in the Western European mixed population