ILSI North America

Food Safety Briefs

October and November 2016

Arsenic

Dietary Exposure of the Italian Population to Inorganic Arsenic: The 2012-2014 Total Diet Study

Cubadda F, D'Amato M, Aureli F, Raggi A, Mantovani A

Food and Chemical Toxicology. 2016;98(Pt B):148–158

DOI: 10.1016/j.fct.2016.10.015

Link to full text: Click here

Significance: These data show that the dietary exposure to iAs in Italy decreases with age; in particular the calculated mean intakes, expressed as µg/kg bw/day, in toddlers and children are about two-fold compared to those in adolescents, adults and elderly. On the other hand, considering the broad food categories, the main contributors to the total iAs exposure are generally similar among age groups.

Dietary exposure of the Italian population to inorganic arsenic has been assessed in the national Total Diet Study (TDS) carried out in 2012-2014. Within the TDS, food samples (>3000) were collected to be representative of the whole diet of the population, prepared as consumed, and pooled into 51 food groups, thus modelling the Italian diet. Inorganic arsenic was determined by HPLC-ICP-MS after chemical extraction and quantified in all samples. Occurrence data were combined with national individual consumption data to estimate mean and high level dietary exposure of the general population and of population subgroups according to age and gender, both at the national level and for each of the four main geographical areas of Italy. The intakes assessed are in the lower range of iAs exposure estimates in other European countries carried out without the support of the TDS approach. However, taking the lower limit of the $BMDL_{01}$ range established by the EFSA as reference point, the margins of exposure are <2 for the mean intake in infants and toddlers and <1 for the 95th percentile intakes in all younger age groups. Our results indicate the goal to check and further reduce the dietary exposure to inorganic arsenic.

Poultry Consumption and Arsenic Exposure in the U.S. Population

Nigra AE, Nachman KE, Love DC, Grau-Perez M, Navas-Acien A

Environmental Health Perspectives. Published ahead of print 13 October 2016

DOI: 10.1289/EHP351

Link to full text: Click here

Significance: Seasonally stratified analyses by poultry type provide strong suggestive evidence that the historical use of arsenic-based poultry drugs contributed to arsenic exposure in the U.S. population.

Arsenicals used in poultry production likely increase inorganic arsenic (iAs), monomethylarsonic acid (MMA), dimethylarsinic acid (DMA), and roxarsone or nitarsone concentrations in poultry meat. The association between poultry intake and exposure to these arsenic species, as reflected in elevated urinary arsenic

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concentrations, however, is unknown. The objectives were to evaluate the association between 24-hour dietary recall of poultry consumption and arsenic exposure in the U.S. population. The study evaluated 3,329 participants ≥6 years old from the 2003-2010 National Health and Nutrition Examination Survey (NHANES) with urine arsenic available and undetectable urine arsenobetaine levels. After adjustment, participants in the highest quartile of poultry consumption had urine total arsenic 1.12 (95% CI 1.04, 1.22) and DMA 1.13 (1.06, 1.20) times higher than non-consumers. During the fall/winter participants in the highest quartile of turkey intake had urine total arsenic and DMA 1.17 (0.99, 1.39, p-trend=0.02) and 1.13 (0.99, 1.30, p-trend=0.03) times higher, respectively, than non-consumers. Past 24-hour consumption of turkey was not associated with total arsenic or DMA during the spring/summer. Poultry intake was associated with increased urine total arsenic and DMA in NHANES 2003-2010, reflecting arsenic exposure.

Risk Assessment

New Challenges in Risk Assessment of Chemicals When Simulating Real Exposure Scenarios; Simultaneous Multi-Chemicals' Low Dose Exposure

Tsatsakis AM, Docea AO, Tsitsimpikou C

Food and Chemical Toxicology. 2016;96:174–176

DOI: 10.1016/j.fct.2016.08.011

Link to full text: Click here

Significance: A long term toxicity study of non-commercial chemical mixtures, consisting of common everyday life chemicals (pesticides, food additives, life-style products components) at low and realistic dose levels around the regulatory limits and key endpoints is proposed.

The general population experiences uncontrolled multi-chemicals exposure from many different sources at doses around or well below regulatory limits. Therefore, traditional chronic toxicity evaluations for a single chemical could possibly miss to identify adequately all the risks. For this an experimental methodology that has the ambition to provide at one strike multi-answers to multi-questions is hereby proposed: a long-term toxicity study of non-commercial chemical mixtures, consisting of common everyday life chemicals (pesticides, food additives, life-style products components) at low and realistic dose levels around the regulatory limits and with the simultaneous investigation of several key endpoints, like genotoxicity, endocrine disruption, target organ toxicity including the heart and systemic mechanistic pathways, like oxidative stress.

Exploring the Impact of n-6 PUFA-Rich Oilseed Production on Commercial Butter Compositions Worldwide

Botta A, Ghosh SJ

Journal of Agricultural and Food Chemistry. 2016;64:8026–8034

DOI: 10.1021/acs.jafc.6b03353

Link to full text: Click here

Significance: This study showcases new evidence of the impact of rising n-6 PUFA production on commercial butter fat composition.

Anecdotal evidence suggests that the incorporation of n-6 polyunsaturated fatty acid (n-6 PUFA) containing oilseeds in dairy feeds depletes saturated fatty acids (SFA) in dairy fats such as butter. However, due to the lack of chemical evidence,

the current status of n-6 PUFA or SFA in butter is unknown. We hypothesized that n-6 PUFA levels in commercial butter were inversely proportional to its SFA content and directly proportional to the extent of n-6 PUFA-rich oilseed production of its country of origin. We analyzed grass-fed and commercial butters from Australia, Belarus, Canada, China, England, France, Germany, Iceland, India, Israel, Japan, the Netherlands, New Zealand, Russia, and the United States via gas chromatography. Extent of n-6 PUFA containing oilseed production for countries was obtained from the FAOStat 2015 database. Globally, SFA from commercial butters had a strong negative correlation (Spearman $r = -0.53$, $p = 0.025$) with its n-6 PUFA content, with U.S. and Canadian butter demonstrating the highest n-6 PUFA as well as n-6/n-3 PUFA ratios. As predicted, we show that countries with >5% of its agricultural land dedicated to n-6 PUFA oilseed production demonstrate a "spillover" increase of n-6 PUFA in their commercial butters (Spearman $r = 0.85$, $p = 0.0054$). The overall significance of this study is that it presents novel evidence of the global impact of rising n-6 PUFA production on commercial butter fat composition. We hope these data will lead to inclusion of actual biochemical analyses of dairy fats in future clinical trials. We believe that this inclusion of analyses will better explain the differential health outcomes among different countries for such interventions.

Salmonella

Ultrasound Improves Chemical Reduction of Natural Contaminant Microbiota and Salmonella enterica subsp. enterica on Strawberries

do Rosário DK, da Silva Mutz Y, Peixoto JM, Oliveira SB, de Carvalho RV, Carneiro JC, et al.

International Journal of Food Microbiology. 2017;241:23–29

DOI: 10.1016/j.ijfoodmicro.2016.10.009

Link to full text: Click here

Significance: Ultrasound treatment can improve the effect of sanitizers that are substitutes of chlorine compounds without altering the quality of strawberries during storage.

New sanitization methods have been evaluated to improve food safety and food quality and to replace chlorine compounds. However, these new methods can lead to physicochemical and sensory changes in fruits and vegetables. The present study evaluated the effects of acetic acid, peracetic acid, and sodium dodecylbenzenesulfonate isolated or combined with 5min of ultrasound treatment (40kHz, 500W) on strawberry quality over 9 days of storage at 8°C. The strawberry natural contaminant microbiota (molds and yeasts, mesophilic aerobic and lactic acid bacteria), physicochemical quality (pH, total titratable acidity, total soluble solids, vitamin C, and color), sensory quality (triangle test) and inactivation of Salmonella enterica subsp. enterica intentionally inoculated onto strawberries were analyzed. Ultrasound increased the effect of all chemical compounds in the reduction of aerobic mesophilic, molds and yeasts. The best treatment for those groups of microorganisms was ultrasound combined with peracetic acid (US+PA) that reduced 1.8 and 2.0logcfu/g during 9days of storage. Bactericidal effect of peracetic acid was also improved by ultrasound inactivation of S. enterica, reaching a decimal reduction of 2.1logcfu/g. Moreover, synergistic effects were observed in contaminant natural microbiota inactivation for all tested compounds during storage, without any major physicochemical or sensory alteration to the strawberries.

Listeria

The Four-Component Aureocin A70 as a Promising Agent for Food Biopreservation

Carlin Fagundes P, Miceli de Farias F, Cabral da Silva Santos O, Souza da Paz JA, Ceotto-Vigoder H, Sales Alviano D, et al.

International Journal of Food Microbiology. 2016;237: 39–46

DOI: 10.1016/j.ijfoodmicro.2016.08.017

Link to full text: Click here

Significance: Aureocin A70 may be employed in bioactive packaging to control the growth of undesirable bacteria.

Aureocin A70 is the only four-component bacteriocin described to date. As it inhibits the growth of a wide range of Gram-positive bacteria, including Listeria monocytogenes strains isolated from food, its potential for improving food safety was investigated in this study. Aureocin A70 (10,240 AU/mL) proved to be bactericidal, but not extensively lytic, against listerial strains. The antibacterial activity of aureocin A70 (16 AU/mL) was then tested in UHT-treated skimmed milk inoculated with the food-associated L. monocytogenes L12 strain (4-log CFU/mL) during storage at 4°C for 1 week. Aureocin A70 caused a time-dependent reduction in the listerial viable cell counts (5.51-log units) up to 7 days of incubation. Aureocin A70 was neither toxic to the Vero and the L-929 cell lines nor exhibited a hemolytic activity against sheep red blood cells. Aureocin A70 proved to be completely stable for 1 month at 25°C, 16 weeks at 4°C and 20 weeks at -20°C. Aureocin A70 exhibited a time-dependent susceptibility to simulated gastric juice and bile salts mimicking gastrointestinal conditions. The entrapment of aureocin A70 in an alginate/gelatin matrix revealed that this bacteriocin can be released from this matrix. Moreover, it remained adsorbed to and active on a low-density polyethylene plastic surface suggesting that aureocin A70 may be employed in bioactive packaging to control the growth of undesirable bacteria. Taken together these results suggest that aureocin A70 is a promising alternative to be used in food applications.

Food Contact Materials

Printed Paper and Board Food Contact Materials as a Potential Source of Food Contamination

Van Bossuyt M, Van Hoeck E, Vanhaecke T, Rogiers V, Mertens B

Regulatory Toxicology and Pharmacology. 2016 Nov;81:10-19

DOI: 10.1016/j.yrtph.2016.06.025

Link to full text: Click here

Significance: The vast majority of over 6000 substances used in the manufacturing of printed paper and board FCM are considered non-evaluated, pointing out an important knowledge gap in the safety evaluation of these substances.

Food contact materials (FCM) are estimated to be the largest source of food contamination. Apart from plastics, the most commonly used FCM are made of printed paper and board. Unlike their plastic counterparts, these are not covered by a specific European regulation. Several contamination issues have raised concerns towards potential adverse health effects caused by exposure to substances migrating from printed paper and board FCM. In the current study, an inventory

combining the substances which may be used in printed paper and board FCM, was created. More than 6000 unique compounds were identified, the majority (77%) considered non-evaluated in terms of potential toxicity. Based on a preliminary study of their physicochemical properties, it is estimated that most of the non-evaluated single substances have the potential to migrate into the food and become bioavailable after oral intake. Almost all are included in the FACET tool, indicating that their use in primary food packaging has been confirmed by industry. Importantly, 19 substances are also present in one of the lists with substances of concern compiled by the European Chemicals Agency (ECHA). To ensure consumer safety, the actual use of these substances in printed paper and board FCM should be investigated urgently.

Micronisation and Nanosizing of Particles for an Enhanced Quality of Food: A Review

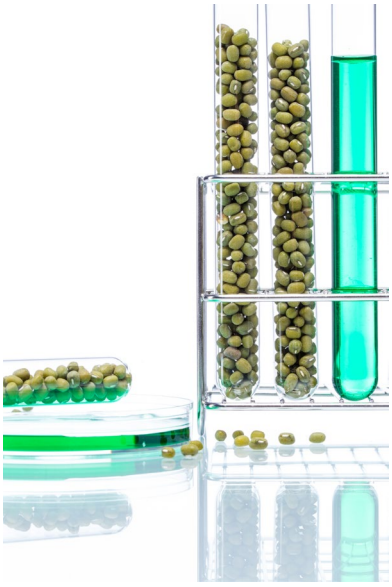
Chen T, Zhang M Bhandari B, Yang Z

Critical Reviews in Food Science and Nutrition. Published ahead of print 2016 October 14

DOI: 10.1080/10408398.2016.1236238

Link to full text: Click here

Significance: Due to the reduction in particle size, micron- and nanotechnology significantly enhance the physico-chemical and functional characteristics of food materials, resulting in the improvement of food quality.



Size reduction to micron to nano-size range is rapidly developing technology applied to foods in the recent decades. This article reviews the particle size reducing technologies for solid particulate and liquid materials. For solid particulate materials, the jet milling, ball milling and colloid milling are mainly used. For liquid materials, primarily the high pressure homogenization, ultrasonic homogenization and microfluidisation technologies are used. Due to the reduction in particle size, micron- and nanotechnology significantly enhance the physico-chemical and functional characteristics of food materials, resulting in the improvement of food quality.

Scientific Integrity

Nutrition Research Integrity: To Believe or Not to Believe? That Is the Question!

Myers EF

Nutrition Today. 2016;51(5):251–258

DOI: 10.1097/NT.0000000000000173

Link to full text: Click here

Nutrition research integrity has become a hotly debated topic. How much confidence we can place in the results of either an individual research study or the recommendations derived from a systematic review that combines multiple studies is crucial in interpreting the research findings. Using research as the basis of public policy is dependent upon the critical appraisal and description of the amount of confidence that can be placed in the research results. In the early 2000s, this was referred to as the "quality" of the individual research study. The methodology has continued to be refined, and more recently, this has been referred to as evaluating the "risk of bias." This refinement focuses more on the aspects of the research that are likely to compromise whether we can "believe the results" and set the stage for a thoughtful dialogue about the strengths and weaknesses of nutrition research itself, versus focusing on study funding.

Publications From the ILSI North America Task Force on Partially Hydrogenated Oils (PHOs)

Trans Fatty Acids and Cholesterol Levels: An Evidence Map of the Available Science

Liska DJ, Cook CM, Wang DD, Gaine PC, Baer DJ

Food and Chemical Toxicology. 2016;98(Pt B):269–281

DOI: 10.1016/j.fct.2016.07.002

Link to full text: Click here

Mode-of-Action Evaluation for the Effect of Trans Fatty Acids on Low-Density Lipoprotein Cholesterol

Reichard JF, Haber LT

Food and Chemical Toxicology. 2016;98(Pt B):282–294

DOI: 10.1016/j.fct.2016.05.018

Link to full text: Click here

Meta-Regression Analysis of the Effect of Trans Fatty Acids on Low-Density Lipoprotein Cholesterol

Allen BC, Vincent MJ, Liska D, Haber LT

Food and Chemical Toxicology. 2016;98(Pt B):295–307

DOI: 10.1016/j.fct.2016.10.014

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The North American branch of the International Life Sciences Institute (ILSI North America) is a public, non-profit scientific foundation that advances the understanding and application of science related to the nutritional quality and safety of the food supply.

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