Session Summary

Food additives:

• Definition
• Regulation and safety assessment in Australia
• Classifications and examples
• Health effects

Food Additives

(http://www.familieseatingbetter.com/2012/10/31/food-additives-safe-or-scary/)
Food Additives: Definition

• A food additive may be regarded as a substance that is not normally consumed as a food by itself, and which is intentionally added to food to enhance appearance, taste, texture or storage life, or to facilitate processing.

• Under this definition, added components such as salt, starch, sugar and water are not considered to be food additives but ingredients.

(Lennard, 2011)
Food Additives: Regulation

• In Australia food additives are regulated by Food Standards Australia New Zealand (FSANZ).

• Only those additives specified in the *Australia New Zealand Food Standards Code* may be permitted to be added to certain foods providing they meet certain conditions.

• Food additives are required to be identified by their class name and by an individual name or code number on food labels. The numbers used are based on an international system used to identify food additives.
Food Additives: Labelling

This is an example of an ingredient list, which might appear on a packaged stir-fry meal:

Ingredients - pork (30%), wheat flour (10%), capsicum, pineapple, green beans, sweet corn, sugar, tomato paste, pineapple concentrate, water, thickener (1422), acidity regulators (270, 260), soy sauce, salt, flavours, thickener (415).

(FSANZ, 2009)
Food Additives: Labelling

- If an additive makes up less than 5% of the complete food and is not considered to perform a technological function in the final food, it doesn’t have to be labelled.

- Flavourings are not labelled with a number due to the vast amount of them permitted in foods.

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(FSANZ, 2009)
Food Additives: Safety

- FSANZ carries out safety assessments on food additives before they can be used.
- FSANZ’s safety assessment process follows an internationally accepted (Codex Alimentarius) model involving a hazard (safety) assessment of the chemical and dietary exposure (consumption levels) assessment.
- FSANZ checks whether:
  - The food additive is safe (at the use levels being proposed)
  - There is a good technological reason for using the additive.

(FSANZ, 2013)
Food Additives: Safety

• Food additives are approved only if it can be shown no harmful effects are likely to result from their use.

• To assess their safety, extensive testing of food additives is required, including animal studies. Animal studies are designed to determine whether a substance can cause any adverse effects. They are usually conducted using very high concentrations in the diet—far greater than the level people are likely to consume if the substance was present in food.

• An uncertainty or safety factor is then applied to establish a maximum permitted level.

(FSANZ, 2013)
Food Additives: Safety

• A safe concentration determined from animal studies is divided by a safety (or uncertainty) factor of (usually)100 to provide a health based guidance value that would be applicable to humans, e.g. the acceptable daily intake (ADI).

• The ADI is the amount of a food additive that can be eaten every day for an entire lifetime without adverse effect.

• An exposure assessment predicts the likely amount of the additive that would be consumed if it was permitted. This estimate is then compared with the ADI. FSANZ recommends a maximum level of the food additive, providing the estimate based on this level is well within the range of the ADI based on this comparison.

(FSANZ, 2013)
Food Additives: Safety

For example, the food colour tartrazine has an ADI of 0.0-7.5 mg/kg bodyweight. A dietary exposure assessment predicted that tartrazine consumption for children aged between 2 and 16 years in Australia, even at the highest daily consumption, would be between 0.21 and 0.38 mg/kg bodyweight (which corresponds to between 3 and 5% of the ADI).

http://www.naturalhealingnews.com/would-you-eat-coal-tar-waste/#.VGbPFSxd7IU
Food Additives: Classification

- Acids
- Acidity regulators
- Alkalis
- Ant-caking agents
- Anti-foaming agents
- Antioxidants
- Bulking agents
- Colours
- Emulsifiers
- Enzymes
- Firming agents
- Flavours
- Flavour enhancers
- Foaming agents
- Gelling agents
- Humectants
- Mineral salts
- Modified starches
- Preservatives
- Raising agents
- Stabilisers
- Sweeteners
- Thickeners
- Vegetable gums
Food Additives: Examples

Food additives are listed according to their functional or class names:

- **Acidity Regulators**
  - Substances that lower the pH of foods
  - Inhibits microbial growth, ↑ susceptibility of microorganisms to heat
  - E.g. Metatartaric acid (353)

- **Anti-caking agents**
  - Substances that maintain the free-flowing characteristics of powdered foods –e.g. salt, icing sugar
  - E.g. Aluminium silicate (559)
Food Additives: Examples

- **Anti-foaming agents**
  - Substances that stop foaming and frothing e.g. prevent the frothing that may occur when water is added to instant coffee.
  - E.g. Dimethylpolysiloxane (900a)

- **Antioxidants**
  - Substances that retard oxidation reactions in foods.
  - Prevents oxidation and acidity of lipids, prevents destruction of lipids, amino acids, vitamins and stability and shelf life of a food product.
  - E.g. Ascorbic acid (300)
Food Additives: Examples

- **Artificial Sweeteners**
  - Provide sweetness without contributing to energy intake. E.g. Saccharin (954), Aspartame (951)

- **Bleaching agents**
  - Substances which cause the breakdown of the flour pigments.
  - Used to whiten flour e.g. Chlorine dioxide (926)

- **Bulking agents**
  - Substances which give bulk or body to food
  - E.g. Dextrin's (1400), Modified starches
Food Additives: Examples

- **Colours**
  - Food colours are used to replace or enhance natural colours. E.g. Tartrazine (102)

http://www.synthite.com/synthite/our-products/Industrial-Products-By-Category/Natural-Colours/myTextBlock/0/textBlock_files/file0/Natural-Colours.jpg
Food Additives: Colours

- **Colours obtained from natural sources**
  - Anthocyanins; Carotenoids; Porphyrrins

- **Synthetic compounds** chemically identical to naturally occurring colours
  - Betacarotene (160a); B apo-8-carotenol (160c)
  - Curcumin (100); Riboflavin (101); Beet red (162)

- **Synthetic compounds** with no chemical counter-part in nature
  - Amaranth – red (123); Sunset yellow – orange (110)
  - Tartrazine – yellow (102); Brilliant black – black (151)
  - Erythrosine – red (127); Quinoline yellow – yellow (104)
Food Additives: Examples

- **Emulsifiers**
  - Substances which help form emulsions; affect texture, structure and functional characteristics of food.
  - E.g. Lecithin (322)

- **Flavours**
  - Flavours classified as natural, nature identical, artificial or smoke flavourings; largest single group of additives.
Food Additives: Examples

- **Flavour enhancers**
  - Substances that modify the flavours present in foods without contributing a flavour of their own.
  - E.g. MSG (621)

- **Food acids**
  These substances perform a variety of functions:
  - Tart taste – jams, soft drinks
  - Gel formation – jams, jellies
  - Produce CO$_2$ from baking powder
  - Control browning of fruit increasing efficacy of preservatives
Food Additives: Examples

- **Glazing agents**
  - Substances which produce a polish or protective coating on the surface of food e.g. Apples
  - E.g. Beeswax (901)

- **Humectants**
  - Substances which absorb and retain moisture
  - E.g. Glycerin (422)

- **Mineral salts**
  - Carbonates, bicarbonates, Ca salts, phosphates e.g. act as a source of carbon dioxide during baking
Food Additives: Examples

- **Preservatives**
  - Used to control the growth of undesirable micro-organisms. E.g. Benzoic acid (210), Sulphur dioxide (220).

- **Propellants**
  - Gases used to dispense foods from containers and produce whipped toppings. E.g. Carbon dioxide (290)

- **Raising Agents**
  - Substances which produce a gas in batters and dough's thereby increasing volume (leavening agents/baking powder).
Food Additives: Examples

- **Stabilisers**
  - Substances which make it possible to form or maintain a dispersion of two or more immiscible substances such as an emulsion of oil in water.

- **Thickeners (modified starches)**
  - Substances which modify the texture or consistency of foods. E.g. Monostarch phosphate (1410).

- **Vegetable gums (gelling agents)**
  - Texture modifying agents derived mainly from plants e.g. guar gum (412), xanthum gum (415).
Food Additives: Health Effects

- Artificial sweeteners
- Olestra
- Sulphite sensitivity
- MSG sensitivity (Chinese Restaurant Syndrome)
- Food additives and ADHD
- Nitrates, nitrites and N-nitrosamines
Artificial Sweeteners

Artificial (non-nutritive) sweeteners and sugar replacers are covered in Session 23 Sweeteners. Examples include:

- Saccharin
- Aspartame
- Acesulphame-K
- Sugar alcohols such as sorbitol and xylitol
- Sucralose

Olestra

• Olestra is a non-absorbable substitute for triacylglycerols (triglycerides).
• It is comprised of sucrose with 6 to 8 of its hydroxyl groups forming ester links with long chain fatty acids.
• Olestra is not hydrolysed by fat-splitting enzymes in the small intestine; it is not absorbed from the small intestine into blood and tissues and therefore provides no energy that can be utilised by the body.
• The hedonic properties of Olestra are similar to triacylglycerols.
Olestra

Adverse Health Effects:

• Diarrhea and loose stools; abdominal cramps; flatulence

• Reduces the absorption of fat-soluble vitamins and carotenoids. (Food products containing Olestra must have vitamins A, D, E and K added.)
Olestra

Based on animal studies and theoretical biochemical understanding there is some concern that interfering with a predictive relationship between sensory properties of foods and kilojoules may contribute to dysregulation of energy balance, overweight and obesity.

Sulphite Sensitivity

- Sulphites are commonly added to foods and drinks to preserve their color, texture, and flavor.
- They are also used in the manufacture of wines, cheese, and dried fruits.

[Image: White Wine Glass](http://upload.wikimedia.org/wikipedia/commons/7/71/White_Wine_Glas.jpg)

[Image: Dried Fruit](https://www.golfenergybar.com/blog/wp-content/uploads/2013/05/dried-fruit2.jpg)
Sulphite Sensitivity

• There is general agreement that some people with asthma are sensitive to sulphites (220-228) added to foods. Research indicates that sulphur dioxide gas can provoke asthma in sulphite-sensitive people when it is inhaled. Sulphur dioxide may be inhaled as foods are eaten.

• Sulphite-sensitive people may also experience skin rashes and irritations after ingesting added sulphites.

• Foods with added sulphite likely to provoke reactions are cordials, dried fruit, sausages and wine.

( FSANZ, 2014 )
Sulphite Sensitivity

• Under the Food Standards Code added sulphites must be declared in the ingredients list on the label of a packaged food when present in foods in concentrations of 10 mg/kg or more.

• When a manufacturer meets this requirement by declaring sulphites in an ingredient list, the sulphites must be labelled by their prescribed class name (e.g. preservative), followed by the additive’s specific name (e.g. sulphur dioxide) or code number (e.g. 220 to 228).

• If the food is unpackaged (e.g. dried apricots sold in bulk bins), the presence of sulphites must be declared on or in connection with the display of the food, or the purchaser can request this information.

(FSANZ, 2014)
MSG Sensitivity

• Monosodium glutamate (MSG) (621) is a flavour enhancer which is widely utilised to enhance the flavour of prepared foods.

• MSG also occurs naturally in some foods (such as kombu, bonito flakes, shitake mushrooms, tomatoes, aged cheeses, cured meats and soy sauce) and provides the *umami* taste.

• The consumption of MSG has been associated with the Chinese Restaurant Syndrome – named because the effects were first described after eating at a Chinese restaurant.
MSG Sensitivity

“My fortune cookie says that in a few minutes I will get a headache, feel flush and experience all the other symptoms typical of MSG overdose.”

http://www.truthinlabeling.org/Cartoon.Stein.wsj033183+.jpg
MSG Sensitivity

- Whilst there are anecdotal reports of MSG sensitivity, current scientific evidence does not generally support these reports. The diagnosis of MSG sensitivity or Chinese Restaurant Syndrome remains controversial.

- The symptoms associated with MSG sensitivity include:
  - ‘Burning’
  - ‘Tightness’
  - ‘Numbness’ in the upper arms, neck, thorax or face
  - In susceptible people the symptoms usually begin shortly after consuming MSG and last for less than 4 hours. No lasting adverse effects have been reported.

  (Lennard, 2011)
MSG Sensitivity

Scientific research suggestive of adverse health effects associated with consumption of MSG include:

• Lee et al. (2011) conducted a small, 3-week trial on children with atopic eczema in Korea and found that those allocated to follow a diet that restricted processed food and MSG intakes showed improvement in eczema symptoms and a particular biomarker (eosinophil cationic protein).

• Shimada et al. (2013) conducted a small placebo-controlled trial on 14 healthy humans and found that 150 mg MSG per kg of body weight administered over 5 days resulted in some participants experiencing headaches, reduction in pain threshold in masseter muscle and increase in blood pressure.
MSG Sensitivity: Foods to Avoid

- MSG
- Gelatine
- Calcium Caseinate
- Monosodium glutamate
- Hydrolyzed Vegetable Protein (HVP)
- Textured Protein
- Monopotassium glutamate
- Hydrolyzed Plant Protein (HPP)
- Yeast Extract
- Glutamate
- Autolyzed Plant Protein
- Yeast food or nutrient
- Glutamic Acid
- Sodium Caseinate
- Autolyzed Yeast
- Vegetable Protein Protein Extract
- Senomyx (wheat extract labelled as artificial flavour)
Food Additives: ADHD

http://www.craftcompany.co.uk/media/catalog/category/fdcc.jpg
Food Additives: ADHD

• The aetiology of ADHD is complex and involves both genetic and environmental factors.

• The idea that there could be a link between diet and behaviour was first proposed in the 1920s but became well-known in the 1970s when Dr Ben Feingold, a paediatric allergist, published his ideas.

• Based on his clinical observations, Feingold suggested that artificial colours, flavours, some preservatives and salicylates might have a role to play in hyperactive behaviour and learning disabilities in some children.
Food Additives: ADHD

• An elimination diet based on Feingold’s hypothesis became known as the Feingold diet (also called the “Kaiser Permanente” or “K-P” diet) and Feingold reported that more than half of children who adhered to the diet showed improvements in behaviour.
• Feingold’s findings were controversial – medical colleagues remained sceptical.
• In 2004 and 2007 three landmark studies were published by researchers at Southampton University reigniting the debate about the impact of food colours and preservatives on children’s behaviour (referred to as the Southampton studies).
### Food Additives: ADHD

<table>
<thead>
<tr>
<th>Name</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium benzoate</td>
<td>E211</td>
</tr>
<tr>
<td>Tartrazine</td>
<td>E102</td>
</tr>
<tr>
<td>Quinoline yellow</td>
<td>E104</td>
</tr>
<tr>
<td>Sunset yellow</td>
<td>E110</td>
</tr>
<tr>
<td>Carmosine</td>
<td>E122</td>
</tr>
<tr>
<td>Ponceau 4R</td>
<td>E124</td>
</tr>
<tr>
<td>Allura red</td>
<td>E129</td>
</tr>
</tbody>
</table>

Colours and preservative found to have adverse effects on behaviour for some children in the Southampton studies.
Food Additives: ADHD

Key findings from Southampton study – McCann et al. (2007):

• Study was conducted on healthy children in the UK.
• Study authors concluded that a mix of six artificial colours and the preservative, sodium benzoate, resulted in increased hyperactivity in some children.
• There were substantial individual differences in the responses of children to the additives.
• The individual differences were most likely due to genetic differences.
• The results strongly supported a relationship between food additives and behaviour for some children.
Food Additives: ADHD

Responses from Food Regulatory Agencies to the Southampton studies:

• UK Food Standards Agency worked with the UK food industry to voluntarily remove the six colours from food and drink and advised parents to consider removing these colours from the diets of children who exhibit hyperactive behaviour.

• In Australia, FSANZ concluded there was not enough evidence to change the current limits for the use of the six colours and also stated that Australian children are consuming food colours at much lower levels than the amounts used in the studies.

• The USA FDA concluded that the evidence was too inconclusive to link food colours to hyperactivity and too insufficient to recommend warning labels for products containing colours.
Food Additives: ADHD

According to Arnold et al. (2012):

• Artificial Food Colours (AFCs) are not a main cause of ADHD, but they may contribute significantly to some cases, and in some cases may additively push a youngster over the diagnostic threshold.

• By affecting nutrients and other metabolism in the periphery, AFCs could affect the brain without crossing the blood-brain barrier.

• The deleterious effect does not appear to be confined to ADHD – i.e. the Southampton studies showed that AFCs had a negative effect on behaviour of healthy children. Therefore AFCs may be more a general public health problem than an ADHD problem.
Food Additives: ADHD

Arnold et al. (2012) conclude as follows:

“The current status of evidence is inconclusive ‘but too substantial to dismiss.’ Until safety can be better determined, we suggest minimizing children’s exposure to AFCs. With the current concerns about childhood obesity, there appears to be no need to make food look more attractive than its natural colour.”
Nitrates, Nitrites and N-Nitrosamines

- Nitrates occur naturally in plant foods and nitrites are used as food additives.
- Nitrites are added to cured meats to inhibit the growth of the micro-organism, *Clostridium botulinum*, and to give the characteristic pink colour.

Nitrates, Nitrites and N-Nitrosamines

• Nitrite can have a direct toxic effect or its effect can be indirect, via its conversion to a group of toxic and potentially carcinogenic compounds called N-nitrosamines.

• The main acute effect of toxic levels of nitrite is methaemoglobinemia.

• The human stomach provides conditions favourable for the formation of nitrosamines. Ascorbic acid (vitamin C) can block the formation of nitrosamines.

(Lennard, 2011)
Food Additives: Groups Most at Risk for Adverse Health Effects

- Children with ADHD or behavioural problems
- Children in general
- People with intolerances and sensitivities
- People with under-active liver detoxification pathway or who have liver disease
- Immune suppressed people
- Older adults
- People with allergies or atopic background
- Asthmatics
- People with mental illness
# Nutrients to Support Elimination and Detoxification

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutamine</td>
<td>Enhances gut barrier, fuels immune system esp GALT</td>
</tr>
<tr>
<td>Fibre</td>
<td>Binds &amp; excretes toxins, aids gut function</td>
</tr>
<tr>
<td>B vitamins</td>
<td>Involved in Liver detox pathways</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Boosts immune system, involved in liver detox pathway, antioxidant</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>Antioxidant, stabilises cell membranes</td>
</tr>
<tr>
<td>Glutathione</td>
<td>Antioxidant, liver detox pathway</td>
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<tr>
<td>Zinc</td>
<td>Boosts immune system, liver detox pathway</td>
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<td>Taurine</td>
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<tr>
<td>Lipoic acid</td>
<td>Antioxidant, liver detox pathway</td>
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<tr>
<td>Bioflavonoids</td>
<td>Boost immune system, antioxidants</td>
</tr>
<tr>
<td>Probiotics</td>
<td>Aids good gut function</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>Antioxidant, protects gut barrier</td>
</tr>
</tbody>
</table>
Holistic Nutrition Philosophy

• Within our holistic nutrition philosophy there is a preference for whole foods with minimal processing and minimal packaging.

• In clinical practice nutritionists sometimes find that various health problems improve when people consume a nutrient-dense whole foods diet that also eliminates food additives.

• Even though there is currently a lack of good quality scientific evidence to support a clear cause and effect relationship between various food additives and adverse health effects, it may be worth trying an additive-free, nutrient-dense diet for some clients.
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References


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