Polyphenols in your diet may regulate food intake

Role of dietary polyphenols in food intake

 Frontier Voice of Nutrition Remarks (May 06, 2013)
 Nalin Siriwardhana, Ph.D., interviewed Dr. Kiran Panickar, Ph.D., Assistant Professor, Department of Pediatrics, University of Maryland School of Medicine, Baltimore, MD and Diet, Genomics, and Immunology Laboratory, Beltsville Human Nutrition Research Center, Agriculture Research Service, USDA, Beltsville MD.

Dietary polyphenols may regulate food intake due to potential effects on certain brain regions (hypothalamus), nervous system (neuroregulators), adipose tissue, digestive system and metabolism related hormones (Ghrelin, Leptin, and Insulin).
Among healthy dietary phytonutrients, polyphenols are well studied, characterized and recognized as important dietary bioactives that can lower variety of risk factors links with cardiovascular, neurodegenerative, and metabolic diseases as well as certain cancers.

New research indicates that the dietary polyphenols may have a potential in regulating food intake. In a recent review article published in the journal of Molecular Nutrition and Food Research journal, by Dr. Kiran Panickar, the potential effects of dietary polyphenols on neuroregulatory factors, the neural signaling pathways and/or the peripheral feedback mechanisms that modulate food intake has been discussed.

Nutrition Remarks interviewed Dr. Kiran Panickar, Ph.D., to clarify the role of dietary polyphenols in food intake. Below is a concise summary of the interview:

**Question from Nutrition Remarks:** In general, how is human food intake and satiety regulated?

**Answer from Dr. Panickar:** The process of food intake and satiety is complex at the cellular and molecular level. The precise mechanisms involved are not clear although we know more about it today than we did a few decades ago. The functions of several peptides including those of neuropeptide Y, leptin, and ghrelin are important in food regulation in human, and they act on the region in the brain called the hypothalamus which is an important area that controls food intake and satiety. However, it is not just such peptides acting on food-regulating regions in the brain that is important but there is also a psychological component mediated chiefly by the hippocampus, another region in the brain, that may mediate food-related memories that should also be considered before we understand how food intake is regulated. So now in addition to the peripheral factors that interact with the central nervous system, a clearer understanding of how different regions in the brain interact with each other is also required before we can appreciate how food intake and satiety is regulated.

**Question:** How do polyphenols modulate/influence the neuroregulatory factors?

**Answer:** Several polyphenols including those from cinnamon and cocoa appear to improve insulin sensitivity in humans. Also, polyphenols from soy has been shown to increase plasma peptide YY (PYY), a satiety hormone, in women. Whether these polyphenols do that by acting in the brain in humans is not known. But it could be a possibility if you collectively take the information that is also obtained from cell culture and animal studies. Several other polyphenols including resveratrol, green tea polyphenols and berries, also influence neuroregulatory factors and a more detailed list of such polyphenols can be found in my article published in Molecular Nutrition and Food Research (Panickar, KS. Effects of dietary polyphenols on neuroregulatory factors and pathways that mediate food intake and energy regulation in obesity. Molecular Nutrition and Food Research, 2013; 57:37-47).

**Question:** What are the polyphenols or polyphenol classes that will increase or decrease food intake?
Answer: Following table is not an exhaustive list but will give a fair idea of the sources of polyphenols and some of their potential effects that has been taken from animal and human studies.

<table>
<thead>
<tr>
<th>Polyphenol/ polyphenol classes</th>
<th>Food source</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type-A polyphenols</td>
<td>Cinnamon, cocoa</td>
<td>Improves insulin sensitivity and thus regulates glucose levels</td>
</tr>
<tr>
<td>Resveratrol</td>
<td>Red grapes</td>
<td>Improves insulin resistance</td>
</tr>
<tr>
<td>Apigenin</td>
<td>Celery, parsley</td>
<td>Decreases food intake in animals fed a high-fat diet</td>
</tr>
<tr>
<td>Green tea polyphenols</td>
<td>Green tea</td>
<td>Decreases ghrelin levels in the liver of rats</td>
</tr>
<tr>
<td>Blueberry polyphenols</td>
<td>Blueberries</td>
<td>Improves insulin and leptin sensitivity</td>
</tr>
<tr>
<td>Curcumin</td>
<td>Turmeric</td>
<td>May improve insulin and leptin resistance</td>
</tr>
</tbody>
</table>

Question: What are the effective amounts (intake vs serum levels) of potentially beneficial polyphenols?

Answer: This is an important question. Unfortunately, this can not be answered with certainty. Dietary intake of polyphenols appears to vary amongst countries. The rough estimates of polyphenol intake from different studies appear to be 500 mg-1g/day in the United States, 23 mg/day for the Dutch, 863 mg/day in Finland, and approximately 1 gm/day for the French. As far as spices are concerned, that may be rich in polyphenols, in Nepal and India, the average consumption of turmeric may range from 0.5g/person to 1.5 g/person. In New Zealand the average intake of spices appears to be 0.36 kg/person/year whereas in Europe it is 0.18kg/person/year and in the United States it is 2.8 kg/person/year [c.f. Fowles J et al., Assessment of cancer risk from ethylene oxide residues in spices imported into New Zealand. Food Chem Toxicol. 2001, 39(11), 1055-1062]. In addition the bioavailability of polyphenols also appears to
be variable with studies reporting less than 0.1% for anthocyanins to about 5% for quercetin and to 10-15% for flavonols.

**Question:** How do the polyphenols from our diet or other sources interact with the functioning of some of the enzymes in our body?

**Answer:** One example of this is vitexin in millet that can inhibit thyroid peroxidases and thus when taken in excess may contribute to thyroid toxicity in humans. Estrogenic activity of soy flavones is also well-known. In addition, polyphenols can interact with various enzymes in the body that are responsible for the metabolism of drugs and so care should be taken and medical supervision should be sought before taking such polyphenols when taking any other medications. For instance, grapefruit juice can inhibit or reduce the activity of CYP3A4, an enzyme that is involved in drug metabolism and a study has shown that if taken with benzodiazepines it may increase the serum levels of benzodiazepines, an effect that may not have been accounted for in the dosage prescribed. Another example is that of apigenin which can inhibit the activity of CYP2C9, another enzyme involved in drug metabolism. So such interactions have to be taken into account and therefore the need for medical supervision.

**Question:** Based on currently available evidence what is your opinion on role of dietary polyphenols for a healthy life?

**Answer:** Dietary polyphenols especially from cinnamon appear to have a beneficial effect in regulating blood glucose and insulin sensitivity in humans. In addition, cinnamon polyphenols also appear to have antioxidant effects in people with impaired fasting glucose that are overweight or obese (Qin, B et al for review, *J Diabetes Sci Technol.* 2010 May 1;4(3):685-93). Nevertheless, there are some studies that do not show a clear beneficial effect of cinnamon but these reported studies have to be examined in detail to see where such discrepancies arise from when compared to other published studies that show a beneficial effect. In addition other polyphenols including those from green tea and berries also appear to have several beneficial effects but their effects on dyslipidemia and hyperglycemia may not be clear. In short, diets rich in fruits and vegetables are important in maintaining a healthy lifestyle and preventing several chronic conditions. However, further clinical studies are needed to better understand their role in glucose regulation, improving insulin sensitivity, and regulating LDL-cholesterol levels.

**Question:** Are there any other important information that we did not discuss here?

**Answer:** One important aspect that is not covered here is the potential beneficial effects of polyphenols in neural disease and injury including cerebral ischemia, stroke, Alzheimer’s disease and traumatic brain injury. Several articles are however available that the reader can refer to on these
topics. The research on the effects of polyphenols is growing at a fast pace and any one review article may not be able to cover all aspects of the role of polyphenols in diet and nutrition in various disease conditions. Therefore closely following interesting and relevant literature/articles on healthy polyphenols will increase the knowledge and understanding.

This news release was based on the following original scientific article published by Dr. Panickar. Additional general background information was acquired from PubMed, CDC and NIH sources.


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