Cheng and Brittin (1991) confirmed other previous research that foods cooked in iron utensils were greater in iron content than foods cooked in non-iron utensils. Since many people have an iron deficiency due to inadequate intake of iron, one might suggest that all cooking utensils be iron. Iron is an essential mineral necessary for the production of heme of hemoglobin in the blood and myoglobin in muscles. The principal dietary sources of iron are green leafy vegetables, whole grains and cereals, and red meats.

Effect of Aluminum and Iron Utensils on Food

In the past, people used iron cooking kettles and skillets to cook foods. In recent years, non-iron utensils constructed of aluminum and stainless steel have been the most common metallic compounds used in the production of cookware used in homes and institutions. Reasons for using these metals include weight of the equipment and ease of cleaning. Stainless steel surfaces do not combine with compounds present in foods and therefore have little effect on the appearance and flavors of food. Stainless steel does not rust and is very durable. Some cooking utensils used in homes are made from glass. Glass surfaces do not combine with reactive materials (unless the glass contains high amounts of lead) in food and are good containers. However, glass utensils are seldom used for institutional food preparation because of breakage.

A principal problem with both iron and aluminum is that these metals can react with compounds present in food to adversely affect the color and flavor of food products. For example, when tomato sauces are cooked in uncoated aluminum utensils, the sauce darkens; when potatoes are fried in an iron skillet, they darken or turn grey; and when eggs are cooked or fried on an iron surface, the green compound, ferrous sulfide is formed. Iron in the ferrous state is also known to catalyze oxidation of fats which cause the development of off-flavors in food.

Aluminum cooking utensils are light, durable, and are good conductors of heat. If the utensils are coated with teflon, there is no leaching of the metal during cooking as long as the coating is in tact. Aluminum can accumulate in foods stored or cooked in uncoated aluminum pans. The amounts of aluminum that accumulate in foods during preparation depend on the pH of the foods, the length of cooking periods and the types of utensils. Acid foods, particularly tomato products can accumulate aluminum during the cooking period. The longer the cooking time, the greater the accumulation of aluminum. Greger et al. (1985) reported that tomatoes heated in aluminum pans for a few minutes accumulated only 0.02- 0.03 mg Al/100 g serving, while tomato sauces cooked for 3 hours in aluminum pans accumulated 5.7mg Al/100g serving. Greger (1985) estimates that the amount of aluminum added to the daily diet through the use of aluminum pans, tray, and foil during food and beverage preparation to be about 3.5 mg/day.

Aluminum Effect on the Body

Aluminum cookware and foil containers are widely used in both institutional and home foodservice. In recent years, aluminum has been hypothesized to be part of cause of several serious conditions: such as dialysis dementia (disorder of the mental processes during kidney
dialysis) and osteodystrophy (characteristic change in bones as a result of kidney disorder),
amyotrophic lateral sclerosis (hardening of tissue in the lateral columns of the spinal column and
medulla of the brain), and Alzheimer's disease (a leading cause of senile dementia). Many
members of the British medical society are convinced that consumption of significant amounts of
aluminum may be a causative factor in Alzheimer's disease (Martyn et al., 1989). This
conclusion is not supported by the American medical society at the present time. More research
is needed to define the long term effect(s) of aluminum in the human diet.

**Aluminum in Food**
Foods containing the highest amount of aluminum are spices, herbs and tea leaves. However,
these food products contribute only a small amount to the total amount of aluminum consumed
per day due to the fact that spices are used in such small amounts and that much of the aluminum
in tea does not dissolve into tea infusions when this beverage is prepared. The highest sources of
aluminum in the American diet are food additives (e.g., aluminum salts added to processed
cheeses and pickles); baked products because some baking powders contain aluminum salts
(notably those containing sodium aluminum phosphate); and pharmaceutical preparations (e.g.,
antacids and buffered products). See Table 1.

**TABLE 1. ESTIMATED ALUMINUM CONCENTRATION OF SELECTED FOOD**

<table>
<thead>
<tr>
<th>Food</th>
<th>Aluminum Content (mg/100g)</th>
<th>Food</th>
<th>Aluminum Content (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat, poultry, fish*</td>
<td>0.02 - 0.12</td>
<td>Peanut butter</td>
<td>0.20</td>
</tr>
<tr>
<td>Cheese, natural*</td>
<td>1.57</td>
<td>Walnuts</td>
<td>0.20</td>
</tr>
<tr>
<td>Cheese, processed</td>
<td>29.7</td>
<td>Most Vegetables</td>
<td>0.01 - 0.44</td>
</tr>
<tr>
<td>Fruits</td>
<td>0.01 - 0.04</td>
<td>Spinach</td>
<td>2.52</td>
</tr>
<tr>
<td>Bran, wheat</td>
<td>1.28</td>
<td>Baking powder</td>
<td>2,300</td>
</tr>
<tr>
<td>Bread, white</td>
<td>0.30</td>
<td>Cocoa</td>
<td>4.50</td>
</tr>
<tr>
<td>Bread, whole wheat</td>
<td>0.54</td>
<td>Pickles with aluminum additives</td>
<td>3.92</td>
</tr>
<tr>
<td>Herbs and spices</td>
<td>8.2 - 75.0</td>
<td>Tea bag, dry</td>
<td>128</td>
</tr>
<tr>
<td>Salt with aluminum additives</td>
<td>16.4</td>
<td>Tea, steeped</td>
<td>0.46</td>
</tr>
</tbody>
</table>

*Food not cooked or stored in aluminum pans, trays or foil.

References:
584-585.
Greger, J.L., Goetz, W., and Sullivan, D. 1985. Aluminum levels in foods cooked and stored in aluminum pans,
trays and foil. J. Food Protect. 48 (9): 772-777.
between Alzheimer's Disease and aluminium in drinking water. Lancet i, 59-62.