

## SUMMARY OF TREE NUT STUDIES

### **EPIDEMIOLOGIC STUDIES:**

#### **Cancer**

Two published studies have examined the relationship between general nut consumption and cancer, in particular, prostate cancer.<sup>1-2</sup> Both found nut consumption to have a protective effect. In one study, data from three case-control studies involving 1,253 subjects followed for five years, revealed a decreased risk for prostate cancer with an increased intake of beans/lentils/nuts.<sup>1</sup> The second study, published in the *Journal of the National Cancer Institute*, included data for men ages 45-74 years from 59 countries. As the consumption of nuts and oilseeds increased, prostate cancer mortality decreased.<sup>2</sup>

#### **Cardiovascular Disease**

Five published prospective cohort studies have examined the relationship between general nut consumption and cardiovascular disease (CVD)<sup>3-7</sup> and one study has focused on walnuts in particular.<sup>8</sup> In all of the studies, nut consumption had a protective effect.

##### *Iowa Women's Health Study*

The Iowa Women's Health Study followed nearly 35,000 postmenopausal women without CVD for 7 years, from 1986 to 1992. Women who ate nuts and seeds more than four times a month had a 40% reduction in risk of coronary heart disease (CHD) compared to those who never ate nuts or seeds.<sup>3</sup>

##### *The Adventist Health Study*

Three studies were part of The Adventist Health Study, which followed nearly 35,000 California Seventh-Day Adventists for up to 12 years. The first of the three studies followed 31,208 non-Hispanic, white Adventists for six years and found that those who consumed nuts five or more times per week decreased their risk of nonfatal myocardial infarction (MI) by 51% and risk of fatal CHD by 48%, compared to those who ate nuts less than once a week. Even those who ate nuts only one to four times a week decreased their risk of nonfatal MI by 22% and fatal CHD by 24%, compared to those who ate nuts less than once a week.<sup>4</sup>

The second study followed 27,321 Adventists without known heart disease from 1977 to 1982 and found that those who consumed high quantities of nuts had a 12.4% lower lifetime risk of CHD, compared to those consuming low quantities of nuts. Consumers of high quantities of nuts also experienced an extra 5.6 years of life expectancy free of CHD.<sup>5</sup>

The third Adventist study followed 603 subjects who were 84 years old or older, for 12 years. A protective effect of nut consumption was still clearly found in this older group. Subjects who consumed nuts five or more times per week had an 18% decreased risk of death from all causes and a 39% decreased risk of death from coronary disease compared to those who consumed nuts less than once per week.<sup>6</sup>

### *Nurses' Health Study*

The Nurses' Health Study followed more than 86,000 women for 14 years and found that those women consuming 5 or more ounces of nuts per week had a 35% reduced risk for total CHD, a 39% reduced risk for fatal CHD, and a 32% decreased risk for nonfatal MI compared to those who consumed less than one ounce of nuts per week.<sup>7</sup>

### *Walnut Study*

The association between walnut consumption and blood lipid levels was assessed in 793 adults living in a walnut-producing area of France. The study found that high levels of high-density lipoprotein (HDL) cholesterol and apolipoprotein A-1 (apo A-1) were associated with increased walnut consumption, both oil and kernel. These lipid parameters are associated with a reduced risk of CVD.<sup>8</sup>

### **Menarche**

A cross-sectional study of 777 schoolgirls in Spain, ages 8-16 years, found that in girls 12-years or older, the age of menarche was essentially related to the intake of nuts and seeds. The study concluded that girls who eat larger amounts of nuts and seeds tend to have their menarche delayed.<sup>9</sup>

## **CLINICAL INTERVENTION TRIALS:**

### **Cardiovascular Disease, Mixed Nut Studies**

There have been six published clinical trials involving mixed nuts.<sup>10-15</sup> In all of the studies, the "nut diets" significantly reduced total cholesterol (TC) from 7-25% and low-density lipoprotein (LDL) cholesterol by 10-33%. No studies found any significant effect on HDL, and two found a significant decrease in triglycerides (TG).<sup>11,14</sup>

The most recent study involved 12 hyperlipidemic women in a crossover design that lasted for two 4-week periods. Subjects first consumed a refined-food diet and then switched to a phytochemical-rich diet primarily consisting of whole grains, legumes, fruits, vegetables, seeds and two tablespoons of almonds, hazelnuts or pecans per day. Compared to the refined-food diet, the phytochemical-rich diet lowered TC by 13% and LDL by 16% with no significant changes in HDL or TG.<sup>10</sup>

A second study involved 10 adults in a randomized crossover design that lasted for two 2-week periods. The control diet was the subjects' habitual diet. The study diet consisted of mainly vegetables, fruit, avocados and nuts (limited to 60-120g/day, average consumption was 100g/day). Compared to the control diet, TC was reduced by approximately 25%, LDL by 33% and TG by 20%, with no significant change in HDL.<sup>11</sup>

Another intervention study involved 15 adults who ate a plant-based diet that included whole grains, sun-dried raisins and mixed nuts (almonds, hazelnuts and walnuts) and nut butters (almond and sesame). After four weeks, TC decreased by 8%, LDL decreased by 15% and HDL was not significantly effected.<sup>12</sup>

The fourth study involved 16 normolipidemic men in a consecutive, supplemental field study that lasted for three 3-week dietary periods. During the first three weeks, subjects consumed a reference diet that included a background diet supplemented with 50g/day of peanuts, 40g/day of coconut, and 50g/day of a coconut confectionary bar. During the second three weeks, subjects consumed the background diet supplemented with almonds (84g/day) and during weeks 7-9, subjects consumed the background diet supplemented with walnuts (68g/day). The almond diet lowered TC by 7% and LDL by 10%, while the walnut diet lowered TC by 5% and LDL by 9%. Neither diet had a significant effect on HDL or TG.<sup>13</sup>

A fifth study involved 406 patients who were recruited 24 to 48 hours after having an acute myocardial infarction (MI). The randomized, single-blind intervention study lasted 6 weeks. Subjects were divided into two groups. One group consumed Diet A in which meat and eggs were replaced by fish, vegetarian meat substitutes and nuts (almonds and walnuts). Those following Diet B ate a low-calorie, typical hospital diet, followed by a diet prescribed by their doctors. Those consuming Diet A had a 9% decrease in TC, 10% decrease in LDL and 9% decrease in TG. Those following Diet A also had a 36% decrease in cardiovascular events compared to those consuming Diet B.<sup>14</sup>

Finally, the Jerusalem Nutrition Study was a randomized, controlled crossover study involving 18 young men that examined the effects of a high mono-unsaturated fat (MUFA) diet (including almonds, olive oil and avocado) versus a high polyunsaturated fat (PUFA) diet (including walnuts, safflower and soy oils) during two 12-week dietary periods. The MUFA diet lowered TC by approximately 10% and LDL by 14% compared to baseline values, while the PUFA diet lowered TC by 16% and LDL by 21%. There were no significant effects on HDL or TG.<sup>15</sup>

### **Cardiovascular Disease, Single Nut Studies (alphabetical order)**

#### *Almonds*

There have been three published clinical trials involving almonds and all found that the almond diets significantly reduced TC (range 8-12%) and LDL (range 9-15%). There were no significant changes in HDL or TG.<sup>16-18</sup> The most recent study involved 45 hypercholesterolemic adults in a randomized, controlled, parallel study that lasted four weeks (following one week on a baseline diet). The control group consumed a diet of whole and unrefined foods plus 85g/day of cheddar cheese, 28g/day of butter, and 21g/day of rye crackers. The olive oil group consumed a base diet of whole and unrefined foods plus 48g/day of olive oil, 113g/day of cottage cheese and 21g/day of rye crackers. The almond group consumed the same base diet of whole and unrefined foods plus 100g/day of raw, unblanched almonds (both whole and ground). The almond diet lowered TC by 12% and LDL by 15% compared to baseline values, while the olive oil diet had no significant effects.<sup>16</sup>

#### *Hazelnuts*

In one recent study, 30 healthy medical students added 1 gram of hazelnuts per kilogram of body weight per day to their normal daily diet for 30 days. TC was lowered by 6%,

LDL by 19%, while HDL increased 7% and TG 25% compared to baseline values. Plasma antioxidant potential (AOP) also increased by 20%.<sup>19</sup>

#### *Macadamia Nuts*

Two randomized, crossover studies have examined the effects of macadamia nuts on cholesterol levels. Both studies reported a reduction in TC (range 5-8%), LDL (range 5-11%) and TG (range 10-21%). Only one of the studies found a significant effect on HDL (5% decrease).<sup>20,21</sup> The more recent study involved 30 subjects who consumed three different diets each for 30 days. The first diet was a typical American diet (AM), high in saturated fat, the second diet was the American Heart Association (AHA) Step 1 diet and the third diet was a macadamia based diet (MAC) high in monounsaturated fatty acids. Compared to the AM diet, the MAC diet lowered TC, LDL and HDL each by 5% and TG by 10%. The AHA diet had similar results except for an 8% increase in TG.<sup>20</sup>

#### *Pecans*

A randomized, controlled, parallel study involved 19 healthy adults who followed either a control diet (no nuts) or a pecan diet which included 68 grams of pecans per day (with no additional nuts). After eight weeks, those following the pecan diet had a 6% decrease in LDL compared to the baseline value. Effects on TC, HDL and TG were not significant.<sup>22</sup>

#### *Pistachios*

Ten patients with moderate hypercholesterolemia were enrolled in a controlled, randomized, crossover study for two 3-week periods. A reference diet of 37% total fat was compared to a pistachio diet of 39% total fat (66g/day of pistachios) in which 20% of the daily caloric intake was substituted with pistachios. Compared to initial values, the pistachio diet decreased TC by 2%, and increased HDL by 12%, while there was no significant effect on LDL or TG.<sup>23</sup>

#### *Walnuts*

There have been four published clinical trials involving walnuts. All found that the walnut diets reduced TC (range 4-12%) and LDL (range 8-16%).<sup>24-27</sup> HDL decreased by 5% in one study,<sup>27</sup> increased by 14% in another,<sup>26</sup> and remained unchanged in the other two.<sup>24,25</sup> No significant changes were reported in TG levels in three of the studies,<sup>25-27</sup> while one found an 8% decrease.<sup>24</sup> Apo A-1 levels were measured in only one study, which showed a 5% decrease.<sup>24</sup> Three studies measured apolipoprotein B levels and observed a decrease of 7-13%. Only one study recorded lipoprotein(a) levels (9% decrease) and VLDL levels (12% decrease).<sup>24</sup>

The most recent walnut study was a randomized, crossover feeding study in which 49 adults with hypercholesterolemia consumed a Mediterranean diet (MD) emphasizing vegetable products, fish and olive oil (no nuts), and a walnut diet (WD) which partially replaced olive oil and other fatty foods of the MD with 41-56 grams of walnuts per day. Compared to baseline values, the WD and MD lowered TC by 9% and 5%, and LDL by 11% and 6%, respectively, but had no significant effect on HDL. Only the WD lowered TG by 8%.<sup>24</sup>

## Weight Reduction

In a recent randomized, parallel study that has not yet been published, 101 overweight adults were followed for 18 months. Subjects were divided into two groups and consumed one of two study diets, both of which were calorie controlled (1200 kcal/day for women; 1500 kcal/day for men). The low-fat diet (LF) had a total of 20% calories from fat, while the high-unsaturated fat diet (UNSAT) consisted of 35% total fat and included tree nuts, peanuts, canola and olive oils.

After six months the average weight loss was comparable in both groups. However, there was a significant difference at the end of the 18 months in participation rates. In the LF group, only 20% were still actively participating in the study compared to 54% of the UNSAT group. One factor which may contribute to the greater participation rate is that a moderate fat diet may induce the feelings of satiety after a snack or meal. In addition, the participants in the UNSAT group reported that they did not feel like they were “dieting” and therefore, did not feel deprived.<sup>28</sup>

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