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Out-of-hand nut consumption is associated with improved nutrient intake and health risk markers in US children and adults: National Health and Nutrition Examination Survey 1999-2004

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Abstract

The purpose of this study was to determine the association of out-of-hand nut (OOHN) consumption with nutrient intake, diet quality, and the prevalence of risk factors for cardiovascular disease and metabolic syndrome. Data from 24-hour recalls from individuals aged 2+ years (n = 24 385) participating in the 1999-2004 National Health and Nutrition Examination Survey were used. The population was divided into children aged 2 to 11, 12 to 18, and adults 19+ years, and each group was dichotomized into OOHN consumers and nonconsumers. Out-of-hand nut consumers were defined as those individuals consuming ¼ oz of nuts or more per d. Means, standard errors, and covariate-adjusted analyses of variance were determined using appropriate sample weights. Diet quality was determined using the Healthy Eating Index-2005. Significance was set at $P < .05$. The percent of OOHN consumers increased with age: 2.1% ± 0.3%, 2.6% ± 0.3%, 6.5% ± 0.5%, and 9.6% ± 0.5% those aged 2 to 11, 12 to 18, 19 to 50, and 51+ years, respectively. The 2 latter groups were combined into a single group of consumers aged 19+ years for subsequent analyses. Consumers of OOHN from all age groups had higher intakes of energy, monounsaturated and polyunsaturated fatty acids, dietary fiber, copper, and magnesium and lower intakes of carbohydrates, cholesterol, and sodium than did nonconsumers. Diet quality was higher in OOHN consumers of all age groups. In children aged 2 to 11 years, consumers had a higher prevalence of overweight/obesity. In those aged 12 to 18 years, weight and percent overweight were lower in consumers. Adult consumers had higher high-density lipoprotein cholesterol, red blood cell folate, and serum folate levels and lower insulin, glycohemoglobin, and C-reactive protein levels than did nonconsumers. Adult consumers also had a 19% decreased risk of hypertension and a 21% decreased risk of low high-density lipoprotein cholesterol levels. Data suggested that OOHN consumption was associated with improved nutrient intake, diet quality, and, in adults, a lower prevalence of 2 risk factors for metabolic syndrome. Consumption of OOHN, as part of a healthy diet, should be encouraged by health professionals.

Keywords: Nuts; Tree nuts; Peanuts; Nutrient intake; Diet quality; Health risk factors; Metabolic syndrome; NHANES

Abbreviations: AT, α-tocopherol; BMI, body mass index; BP, blood pressure; CRP, C-reactive protein; CVD, cardiovascular disease; HDL-C, high-density lipoprotein cholesterol; HEI-2005, Healthy Eating Index-2005; LDL-C,

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low-density lipoprotein cholesterol; MetS, metabolic syndrome; MUFA, monounsaturated fatty acids; NHANES, National Health and Nutrition Examination Survey; OOHN, out-of-hand nuts; PUFA, polyunsaturated fatty acids; RAE, retinal activity equivalents; SFA, saturated fatty acids; SoFAAS, solid fat, alcohol, and added sugars; USDA, United States Department of Agriculture.

1. Introduction

Throughout history, "nuts," variously defined as peanuts or tree nuts or both, have provided a concentrated source of energy and nutrients to consumers. Nuts are not used as a staple food today; however, King et al [1], using data from the National Health and Nutrition Examination Survey (NHANES) 1999-2004 showed that nuts (including tree nuts and peanuts) were consumed by 34% of the US population 2 years or older. O'Neil et al, using the same data set, showed that only 5.5% and 8.4% of adults aged 19 to 50 and 51+ years, respectively, consumed tree nuts [2]. Differences in the prevalence of consumers may relate to the inclusion or exclusion of peanuts in the definition of "nuts" [2], difference in the age of the population, and the definition of "consumer."

The nutrient content of nuts varies by species, but in general, they provide rich sources of vegetable protein, monosaturated (MUFA) and polyunsaturated fatty acids (PUFA), dietary fiber, vitamins E and K, folate, magnesium, copper, selenium, and potassium. Nuts are also naturally low in saturated fatty acids (SFA) and sodium [3]. Participants of the NHANES 1999-2004 that consumed nuts had a better nutrient intake profile [1,2], including higher intakes nutrients of public health concern or under consumed nutrients [4] including dietary fiber, calcium, potassium, folate, magnesium, and vitamins A, C, and K, than did nonconsumers [2]. Tree nut consumers also had lower intakes of sodium [1,2] than did nonconsumers. In adults, diet quality, as assessed using the Healthy Eating Index-2005 (HEI), was significantly higher in tree nut consumers than nonconsumers [2]. Nuts also provide phenols, phytosterols, flavonoids, proanthocyanidins [5,6], resveratrol, and arginine; these bioactive compounds, coupled with micronutrients such as vitamin E and selenium, serve as antioxidants and are anti-inflammatory [6].

A recent review of 25 clinical trials has shown that nut consumption may be cardioprotective by improving serum lipid profiles [7]. Nut consumption also improves levels of inflammatory markers associated with coronary heart disease [8] and, possibly, type 2 diabetes [8,9]. Many of the nutrients found in nuts, including dietary fiber [9], magnesium [9,10], α-linolenic acid [10], L-arginine, and MUFA [10], have been shown to reduce the risk of type 2 diabetes and improve insulin resistance. Data from epidemiologic studies have supported results from clinical trials and have shown that tree nut consumption, in some populations, was inversely related to coronary heart disease [11-13], hypertension [14], type 2 diabetes [15], and obesity [16].

Metabolic syndrome (MetS) is characterized by dyslipidemia, hypertension, abdominal obesity, insulin resistance, and hyperglycemia, and it is a major risk factor for cardiovascular disease (CVD) [17,18] and type 2 diabetes [18]. The prevalence of MetS in US adults, using the NHANES 2003-2006 data, was 34.3% [19]. Limited trials have shown conflicting results after the consumption of tree nuts and health benefits related to MetS [20,21]. Overall, however, the association between MetS and consumption of all nuts has not been adequately explored. Because consumption of tree nuts has been shown to reduce the risk factors associated with MetS, it was posited that consumption of all nuts would be associated with reduced risk of MetS.

Epidemiologic studies looked at the total consumption of all nuts or tree nuts and health parameters, including nuts used as ingredients in other foods such as cereals or breads [1,2]. King et al [1] also looked at nutrient intake of out-of-hand nuts (OOHNs; including peanuts); however, there are no studies using a nationally representative US population that have examined the association of consumption of OOHN with diet quality and health risk factors, especially MetS. This study used OOHN because consumption constituted a conscious decision to consume nuts, which may be associated with a desire for a healthier lifestyle. The objective of this study was to determine the association of OOHN consumption with nutrient intake, diet quality, anthropometric measures, and blood pressure (BP) in children and adults in a nationally representative sample and health risk factors for CVD and MetS in adults.

2. Methods and materials

2.1. Study population

Data from adults aged 2+ years participating in the NHANES 1999-2000, 2001-2002, and 2003-2004 were concatenated for these analyses to provide a larger sample size [22]. The population was divided into 3 age groups: children aged 2 to 11 and 12 to 18 years and adults aged 19+ years. Intake data were obtained from in-person 24-hour dietary recalls using an automated multiple-pass method [23]. Parents/guardians of children aged 2 to 5 years provided the 24-hour dietary recalls; children (age, 6-11 years) were assisted by an adult, and all others provided their own recall. Beginning with the 2003 to 2004 cycle, 2 days of intake were collected; however, for this study, only the data from the in-person interview (first recall) were used to ensure consistency. Recall data judged to be incomplete or unreliable by the Food Surveys Research Group staff were excluded from analyses. Pregnant or lactating females (n = 995) were also excluded from the sample. Descriptions of the dietary interview methods are available in the NHANES