United States Department of Agriculture

Table 4-C-IV-2 Overview Table: Type 2 Diabetes

Incidence of Type 2 Diabetes: Mediterranean-Style Pattern

Citation Quality Rating Location	Study Design Duration Study / Cohort	Sample Size Age / Gender Race / Ethnicity	Dietary Pattern	Health Outcomes
Salas-Salvado, et al 2011 **Positive** **Spain**	Randomized controlled trial Median four years (inter-quartile range three to five years) PREDIMED Study (Mediterranean Diet)	**Initial N:** 418 **Final N:** Not reported / <418 Attrition rates described as "low" and attributed to major disease events or death 67.3 years 58% female Not reported	**Mediterranean Diet Pattern Med Diet** • A high consumption of grains, legumes, nuts, vegetables and fruits • A relatively high-fat consumption (up to 40% of total energy intake), mostly from MUFA (≥20% of total energy intake • Olive oil for culinary use and dressing of vegetables as the principal source of fat • Moderate to high fish consumption • Poultry and dairy products (usually as yogurt or cheese) consumed in moderate to small amounts • Low consumption of red meats, processed meats and meat products • Moderate alcohol intake, usually in the form of red wine consumed with meals. Low-fat diet was not described; the goal total fat was <35%. *Med diet goals:* Improved adherence to Med Diet (>10 points in the 14-point score), High (>2) MUFA:SFA ratio, high olive oil consumption (>20g per 1,000kcal per day), high nut consumption (>10g per 1,000kcal per day), high dietary fiber intake (>14g per 1,000 kcal per day), substantial weight loss (>5% of initial body weight) and high physical activity (>395kcal per day, the top tertile).	**T2D Incidence** **Cases of incident T2D:** • *MedDiet+VOO:* 10.1% (95% CI: 5.5 to 15.1) P=0.05 • *MedDiet+Nuts:* 11.0% (95% CI: 5.9 to 16.1) P=0.05 • *Control:* 17.9% (95% CI: 11.4 to 24.4). **Comparing MedDiet+virgin olive oil (VOO) and MedDiet+nuts to low-fat diet (control group):** • *MedDiet+VOO:* HR=0.49 (95% CI: 0.25 to 0.97) • *MedDiet+Nuts:* HR=0.48 (95% CI: 0.24 to 0.96) • *Both MedDiets:* HR=0.48 (95% CI: 0.27 to 0.86). **Comparing vegetarians to non-vegetarians in Blacks:** • *Vegan:* OR=0.304 (95% CI: 0.110 to 0.842) • *Lacto-ovo:* OR=0.472 (95% CI: 0.270 to 0.825) • *Pesco:* OR=0.618 (95% CI: 0.352 to 1.086) NS • *Semi-vegetarian:* OR=0.469 (95% CI: 0.153 to 1.438) NS.

Source: Nutrition Evidence Library. *A series of systematic reviews on the relationship between dietary patterns and health outcomes.* Alexandria, VA: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, March 2014.

Table 4-C-IV-2 Overview Table: Type 2 Diabetes

Incidence of Type 2 Diabetes: Vegetarian Pattern

Citation Quality Rating Location	Study Design Duration Study / Cohort	Sample Size Age / Gender Race / Ethnicity	Dietary Pattern	Health Outcomes
Tonstad et al, 2013 **Neutral** **U.S., Canada**	Prospective cohort study Two years Adventist Health Study 2 (vegetarian)	**Initial N:** 97,586 **Final N:** 41,387 58.5 years Approximately 63% female **17.3%:** Black (African American, West Indian / Caribbean, African or other Black) **No percent given:** Non-Black (White non-Hispanic, Hispanic, Middle Eastern, Asian, Native Hawaiian / other Pacific Islander or American Indian	**Vegetarian Diet Pattern** ***Vegetarian status:*** • *Vegans:* No animal products (red meat, poultry, fish, eggs, milk and dairy products <1 time per month) • *Lacto-ovo vegetarians:* Dairy products and eggs >1 time per month, but no fish or meat (red meat, poultry and fish <1 time per month) • *Pesco vegetarians:* Fish >1 time per month and dairy products and eggs, but no red meat or poultry (red meat and poultry <1 time per month) • *Semi-vegetarians:* Dairy products and eggs and (red meat and poultry >1 time per month and <1 time per week) • *Non-vegetarians:* Animal products (red meat, poultry, fish, eggs, milk and dairy products >1 time per week). **Alcohol:** Defined as consumption of any amount or none during the past 12 months.	**T2D Incidence** **Cases of incident T2D, comparing vegetarians to non-vegetarians:** • *Vegan:* 0.54% (P<0.0001) • *Lacto-ovo:* 1.08% (P<0.0001) • *Pesco-vegetarian:* 1.29% (P<0.0001) • *Semi-vegetarian:* 0.92% (P<0.0001). **Comparing vegetarians to non-vegetarians:** • *Vegan:* OR=0.381(95% CI: 0.236 to 0.617) • *Lacto-ovo:* OR=0.618 (95% CI: 0.503 to 0.760) • *Pesco-vegetarian:* OR=0.790 (95% CI: 0.575 to 1.086), NS • *Semi-vegetarian:* OR=0.486 (95% CI: 0.312 to 0.755). **Comparing Blacks to non-Blacks:** *Black ethnicity:* OR=1.364 (95% CI: 1.093 to 1.702).

Source: Nutrition Evidence Library. *A series of systematic reviews on the relationship between dietary patterns and health outcomes.* Alexandria, VA: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, March 2014.

Table 4-C-IV-2 Overview Table: Type 2 Diabetes

Impaired Glucose Tolerance and Insulin Resistance: Mediterranean-Style Pattern

Citation Quality Rating Location	Study Design Duration Study / Cohort	Sample Size Age / Gender Race / Ethnicity	Dietary Pattern	Health Outcomes
Esposito et al, 2004 **Positive** **Italy**	Randomized controlled trial Two years Mediterranean diet	**Initial N:** 180 **Final N:** 164 **Attrition:** 9% Analyses included all 180 subjects. 43.9 years 45% female Not reported	**Mediterranean Diet Pattern Intervention (Mediterranean diet)** Dietary advice based on three-day food records provided monthly with the nutritionist for the first year and bimonthly for the second year. *Diet:* 50% to 60% CHO, 15% to 20% protein, <30% total fat, <10% saturated fat and <300mg cholesterol; at least 250g to 300g of fruits (one to 1.3 cups), 125g to 150g of vegetables (0.5 to 0.65 cups), 25g to 50g of walnuts (1.75 to 3.5 Tbsp), and 400g of whole grains (14 oz, including legumes) daily and increase olive oil consumption *Control (Prudent diet):* Provided oral and written information about healthy food choices at baseline and at bimonthly sessions, but individualized advice was not offered *Diet:* 50% to 60% CHO, 15% to 20% protein and <30% total fat. * The volumes listed above are approximations and depend on the actual food consumed.	**Glucose Tolerance** **Comparing Mediterranean-style diet to Prudent diet (change over two years):** *Plasma glucose:* -6mg per dL (95% CI: -11 to -2); P<0.001. **Insulin Resistance** **Comparing Mediterranean-style diet to Prudent diet (change over two years):** • *Serum insulin:* -3.5mcgU per ml (95% CI: -6.1 to -1.7); P = 0.01 • *HOMA-IR:* -1.1 (95% CI: -1.9 to -0.3); P<0.001.

Source: Nutrition Evidence Library. *A series of systematic reviews on the relationship between dietary patterns and health outcomes.* Alexandria, VA: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, March 2014.

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Citation Quality Rating Location	Study Design Duration Study / Cohort	Sample Size Age / Gender Race / Ethnicity	Dietary Pattern	Health Outcomes
Ralllidis et al, 2009 **Positive** **Greece**	Randomized controlled trial Two months Greek Mediterranean diet	**Initial N:** 90 **Final N:** 82 **Attrition:** 9% 50.4 years Approximately 48% female Not reported	**Mediterranean Diet Pattern Intervention Group (Greek Mediterranean diet)** Daily consumption of whole-wheat grains, two to three portions of low-fat dairy, two salads (one with one tomato) and three fruits together with a concentrated fruit juice made without preservatives, 5ml olive oil-based margarine, extra virgin olive oil as main source of fat, 45ml extra virgin olive oil with one of the two salads, six whole raw almonds, 150ml (one glass) red wine with main meal, one portion of fish and at the most one portion of red meat weekly.	**Glucose Tolerance** **Comparing a Greek Mediterranean-style diet to control diet:** *Glucose, mmol per L:* P=0.95, NS. **Insulin Resistance** **Comparing a Greek Mediterranean-style diet to control diet:** • *Insulin, mcgU per mL:* P=0.35 • *NS HOMA-IR score:* P=0.07, NS.
Salas-Salvado et al, 2008 **Positive** **Spain**	Randomized controlled trial One year PREDIMED study (Mediterranean diet)	**Initial N:** 1,264 **Final N:** 1,224 **Attrition:** 3% 67.4 years 55% female Not reported	**Mediterranean Diet Pattern Med Diet** High intake of cereals, vegetables, fruits and olive oil; a moderate intake of fish and alcohol, mostly wine; and a low intake of dairy products, meats and sweets. • *MedDiet+VOO:* 1L per week • *MedDiet+nuts:* 30g per day) • *Control* (advice about low-fat diet).	**Comparing MedDiet+Virgin Olive Oil (VOO) and MedDiet+Nuts to Low-Fat Diet (control group)** **Elevated fasting glucose, reduction at one year:** • *MedDiet+VOO:* NS • *MedDiet+nuts:* NS.

Source: Nutrition Evidence Library. *A series of systematic reviews on the relationship between dietary patterns and health outcomes.* Alexandria, VA: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, March 2014.

Table 4-C-IV-2 Overview Table: Type 2 Diabetes

Impaired Glucose Tolerance and Insulin Resistance: DASH/modified DASH Pattern

Citation Quality Rating Location	Study Design Duration Study / Cohort	Sample Size Age / Gender Race / Ethnicity	Dietary Pattern	Health Outcomes
Blumenthal et al, 2010 **Positive** **U.S.**	Randomized controlled trial Four months ENCORE (Exercise and Nutrition Interventions for Cardiovascular Health)–DASH	**Initial N:** 144 **Final N:** 138 4% attrition **Mean:** 52±10 years 67% female 60% White, 39% Black, 1% Asian	**Dietary Approaches to Stop Hypertension (DASH) Pattern Control diet (UC)** Participants maintained their usual diet and exercise habits; 34% E from fat, 15% from protein; K, Mg, Ca and fiber levels approximately 25th percentile of U.S. consumption. *DASH diet:* Rich in fruits and vegetables (eight to 10 servings per day) and low-fat dairy foods; reduced amounts of saturated fat, total fat, and cholesterol; K, Mg, Ca content at approximately 75th percentile of U.S. consumption, high amounts of fiber and protein; 27% E from fat, and 18% E from protein *Sodium content:* 2,400mg per 2,000kcal. *DASH diet alone (DASH-A):* Subjects received instruction to meet DASH guidelines, told not to exercise or attempt to lose weight; met weekly in a small group for coaching on diet.	**Glucose Tolerance** **Comparing DASH-A to UC:** • *Fasting glucose:* P=0.21, NS • *Glucose AUC:* P=0.98, NS. **Insulin Resistance** **Comparing DASH-A to UC:** • *Fasting insulin:* P=0.71, NS • *Insulin sensitivity (ISI):* P=0.98, NS • *QUICKI:* P=0.85, NS**.**

Source: Nutrition Evidence Library. *A series of systematic reviews on the relationship between dietary patterns and health outcomes.* Alexandria, VA: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, March 2014.

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Citation Quality Rating Location	Study Design Duration Study / Cohort	Sample Size Age / Gender Race / Ethnicity	Dietary Pattern	Health Outcomes
Gadgil et al, 2013 **Positive** **U.S.**	Randomized controlled trial Six weeks OmniHeart (Optimal Macronutrient Intake Trial for Heart Health)– modified DASH	**Initial N:** 164 **Final N:** 164 **Mean:** 53.6 years 45% female 55% African-American, 40% non-Hispanic White, 5% Other	**Healthful Pattern 3:** Healthful diets that model the principles of the DASH dietary pattern. Each study diet differed in the amount of carbohydrates, protein and unsaturated fat while keeping the calorie levels the same. Each diet was reduced in saturated fat, cholesterol and sodium, and rich in fruits, vegetables, fiber, potassium and other minerals at recommended levels.	**Glucose Tolerance** **Comparing changes in fasting glucose (mg/dL):** • *Carb:* 0.84 (95% CI: -1.29 to 2.97), NS • *Unsat:* 0.11 (95% CI: -2.25 to 2.47), NS • *Protein:* 0.28 (95% CI: -1.37 to 1.93), NS • *Unsat vs. Carb:* -0.77 (95% CI: -2.18 to 0.73), NS • *Prot vs. Carb:* -0.56 (95% CI: -2.23 to 1.20), NS • *Unsat vs. Prot:* -0.16 (95% CI: -2.11 to 1.77), NS. **Insulin Resistance** **Comparing changes in insulin sensitivity:** ***QUICKI:*** • *Carb:* 0.002 (95% CI: -0.003 to 0.007), NS • *Unsat:* 0.007 (95% CI: 0.002 to 0.012), P<0.5 • *Protein:* 0.004 (95% CI: -0.002 to 0.009), NS • *Unsat vs. Carb:* 0.005 (95% CI: 0.000 to 0.009), P=0.04 • *Prot vs. Carb:* 0.001 (95% CI: -0.004 to 0.007), NS • *Unsat vs. Prot:* 0.003 (95% CI: -0.002 to 0.009), NS. ***HOMA-IR:*** • *Carb:* 0.03 (95% CI: -0.07 to 0.12), NS • *Unsat:* 0.14 (95% CI: 0.02 to 0.26), P<0.5 • *Protein:* 0.06 (95% CI: -0.04 to 0.17), NS • *Unsat vs. Carb:* 0.11 (95% CI: 0.03 to 0.20), P<0.05 • *Prot vs. Carb:* 0.04 (95% CI: -0.07 to 0.14), NS • *Unsat vs. Prot:* 0.08 (95% CI: -0.05 to 0.20), NS. **Comparing changes in fasting insulin (mcgU per ml):** • *Carb:* -0.41 (95% CI: -1.72 to 0.91), NS • *Unsat:* -0.77 (95% CI: -1.75 to 0.21), NS • *Protein:* -0.06 (95% CI: -1.64 to 0.40), NS

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				• *Unsat vs. Carb:* -0.36 (95% CI: -1.64 to 0.92), NS • *Prot vs. Carb:* -0.22 (95% CI: -1.56 to 1.12), NS • *Unsat vs. Prot:* 0.14 (95% CI: 1.0 to 0.67), NS.

Impaired Glucose Tolerance and Insulin Resistance: Nordic Pattern

Citation Quality Rating Location	Study Design Duration Study / Cohort	Sample Size Age / Gender Race / Ethnicity	Dietary Pattern	Health Outcomes
Adamsson et al, 2011 **Positive** **Sweden**	Randomized controlled trial Six weeks NORDIET (Nordic Diet)	**Initial N:** 88 **Final N:** 86 2% attrition **Mean:** Approximately 53 years Approximately 63% female Not reported	**Nordic diet pattern dietary goals:** Consume Nordic diet (ND) based on Nordic nutrition recommendations. ND is rich in high-fiber plant foods from fruits, berries, vegetables, whole grains (oats and barley), rapeseed oil, nuts, fatty fish and low-fat dairy products but low in salt, added sugars and saturated fats. Contains some poultry, red meat, fish and low-fat milk. **Macronutrient distribution:** A total of 27%, 52%, 19% and 2% of energy from fat, CHO, protein and alcohol, respectively.	**Glucose Tolerance** **Comparing the Nordic diet to the control diet:** ***Change in plasma glucose:*** • *Control:* 0.05±0.34mmol per L • *Nordic diet:* 0.00±0.41mmol per L (P=0.52), NS. **Insulin Resistance** **Comparing the Nordic diet to the control diet:** ***Change in plasma insulin:*** • *Control:* 0.90±2.88mU per L • *Nordic diet:* 0.51±2.25mU per L (P=0.01). ***Change in HOMA-IR:*** • *Control:* 0.22±0.64 • *Nordic diet:* 0.11±0.51 (P=0.01).

Source: Nutrition Evidence Library. *A series of systematic reviews on the relationship between dietary patterns and health outcomes.* Alexandria, VA: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, March 2014.