**SUPPLEMENTARY TABLE 1**

Meat items and their standard portion sizes in the Costa Rica Heart Study

|  |  |  |
| --- | --- | --- |
| Food group | Food items | Standard portion size (g) |
| Unprocessed red meat | Hamburger | 55.0 |
|  | Beef, pork, or lamb as a main dish | 108.0 |
|  | Beef, pork, or lamb as a sandwich | 73.0 |
|  | Beef, pork, or lamb in mixed dishes | 35.0 |
| Processed red meat | Bacon | 45.0 |
|  | Hot dogs | 45.0 |
|  | Sausage, bologna, salami, ham, and other processed meats | 13.0 |
| Fish | Dark meat fish (e.g., sardine) | 74.0 |
|  | Shrimp, lobster, or scallops | 60.0 |
|  | Canned tuna | 98.0 |
|  | Other fish (e.g., swordfish) | 81.0 |
| Chicken | Chicken or turkey, with skin and fat | 115.0 |
|  | Chicken or turkey, without skin | 115.0 |
|  | Chicken or turkey, without fat | 115.0 |

**SUPPLEMENTARY TABLE 2**

General characteristics and dietary factors by quintiles of total, processed, and unprocessed red meat intakes among the 2,131 population-based controls of the Costa Rica Heart Studya

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Q1 |  | Q2 |  | Q3 |  | Q4 |  | Q5 |  |
| *n* | Mean or % | SD | Mean or % | SD | Mean or % | SD | Mean or % | SD | Mean or % | SD |
| Total | 422 |  | 464 |  | 452 |  | 442 |  | 351 |  |
| Processed | 401 |  | 446 |  | 462 |  | 451 |  | 371 |  |
| Unprocessed | 420 |  | 447 |  | 461 |  | 425 |  | 378 |  |
| Age, y |  |  |  |  |  |  |  |  |  |  |
| Total | 59.8 | 11.3 | 59.3 | 10.9 | 58.3 | 11.4 | 57.1 | 11.0 | 55.8 | 11.7 |
| Processed | 59.6 | 11.3 | 59.6 | 10.7 | 58.1 | 11.8 | 57.5 | 11.3 | 55.7 | 11.1 |
| Unprocessed | 59.0 | 11.0 | 59.4 | 11.0 | 58.2 | 11.8 | 57.4 | 11.4 | 56.6 | 11.3 |
| Women, % |  |  |  |  |  |  |  |  |  |  |
| Total | 28.7 |  | 29.7 |  | 29.2 |  | 24.2 |  | 19.4 |  |
| Processed | 25.7 |  | 27.6 |  | 30.5 |  | 30.2 |  | 17.0 |  |
| Unprocessed | 24.5 |  | 32.4 |  | 29.5 |  | 24.9 |  | 20.1 |  |
| Urban residence, % |  |  |  |  |  |  |  |  |  |  |
| Total | 40.1 |  | 33.2 |  | 40.0 |  | 40.1 |  | 41.6 |  |
| Processed | 40.7 |  | 39.0 |  | 40.5 |  | 36.4 |  | 37.5 |  |
| Unprocessed | 37.9 |  | 33.8 |  | 40.8 |  | 40.9 |  | 41.0 |  |
| Waist-to-hip ratio |  |  |  |  |  |  |  |  |  |  |
| Total | 0.95 | 0.07 | 0.94 | 0.08 | 0.95 | 0.08 | 0.95 | 0.07 | 0.96 | 0.07 |
| Processed | 0.95 | 0.07 | 0.95 | 0.07 | 0.95 | 0.08 | 0.94 | 0.08 | 0.97 | 0.07 |
| Unprocessed | 0.95 | 0.07 | 0.94 | 0.08 | 0.94 | 0.08 | 0.95 | 0.07 | 0.96 | 0.07 |
| Physical activity, MET/d |  |  |  |  |  |  |  |  |  |  |
| Total | 35.9 | 17.0 | 35.6 | 16.0 | 35.3 | 15.3 | 36.0 | 17.3 | 34.7 | 15.4 |
| Processed | 35.7 | 16.9 | 35.2 | 14.4 | 35.6 | 16.4 | 35.3 | 16.7 | 36.1 | 16.9 |
| Unprocessed | 36.9 | 17.9 | 34.9 | 15.9 | 35.7 | 15.8 | 34.8 | 14.0 | 35.4 | 17.6 |
| Monthly household income, US dollars |  |  |  |  |  |  |  |  |  |  |
| Total | 525.5 | 417.2 | 553.8 | 429.1 | 556.8 | 428.7 | 615.9 | 434.4 | 612.5 | 414.1 |
| Processed | 582.6 | 421.2 | 587.6 | 448.6 | 543.5 | 419.7 | 555.7 | 418.0 | 594.8 | 422.1 |
| Unprocessed | 538.9 | 427.5 | 522.4 | 426.6 | 578.5 | 423.8 | 590.8 | 408.4 | 635.6 | 439.1 |
| Secondary education or higher, % |  |  |  |  |  |  |  |  |  |  |
| Total | 38.4 |  | 37.5 |  | 34.7 |  | 45.4 |  | 45.6 |  |
| Processed | 41.7 |  | 39.7 |  | 39.8 |  | 39.7 |  | 39.5 |  |
| Unprocessed | 38.6 |  | 33.3 |  | 38.0 |  | 43.9 |  | 47.9 |  |
| History of diabetes, % |  |  |  |  |  |  |  |  |  |  |
| Total | 11.9 |  | 14.9 |  | 15.3 |  | 16.7 |  | 10.8 |  |
| Processed | 12.7 |  | 13.2 |  | 16.9 |  | 13.3 |  | 14.0 |  |
| Unprocessed | 13.1 |  | 14.8 |  | 14.3 |  | 16.7 |  | 11.1 |  |
| History of hypertension, % |  |  |  |  |  |  |  |  |  |  |
| Total | 27.0 |  | 32.1 |  | 32.5 |  | 28.1 |  | 25.9 |  |
| Processed | 28.2 |  | 31.4 |  | 30.7 |  | 28.4 |  | 27.5 |  |
| Unprocessed | 26.2 |  | 32.9 |  | 29.9 |  | 30.6 |  | 26.5 |  |
| Current smoker, % |  |  |  |  |  |  |  |  |  |  |
| Total | 18.3 |  | 19.2 |  | 20.6 |  | 20.6 |  | 28.2 |  |
| Processed | 20.7 |  | 17.9 |  | 20.6 |  | 23.1 |  | 23.5 |  |
| Unprocessed | 19.8 |  | 18.8 |  | 19.5 |  | 22.8 |  | 25.1 |  |
| Current alcohol drinker, % |  |  |  |  |  |  |  |  |  |  |
| Total | 53.6 |  | 49.8 |  | 49.6 |  | 53.6 |  | 59.8 |  |
| Processed | 54.6 |  | 51.1 |  | 53.5 |  | 49.9 |  | 56.3 |  |
| Unprocessed | 53.6 |  | 48.3 |  | 51.8 |  | 53.4 |  | 58.5 |  |
| Total energy intake, MJ/d |  |  |  |  |  |  |  |  |  |  |
| Total | 11.9 | 3.4 | 9.7 | 3.0 | 9.2 | 2.9 | 9.9 | 3.0 | 10.8 | 3.0 |
| Processed | 13.1 | 3.0 | 10.2 | 2.4 | 9.1 | 2.5 | 9.0 | 3.0 | 10.2 | 3.4 |
| Unprocessed | 11.8 | 3.7 | 9.3 | 2.8 | 9.2 | 3.0 | 10.3 | 2.8 | 10.9 | 3.0 |
| Total fat, % energy |  |  |  |  |  |  |  |  |  |  |
| Total | 30.6 | 6.9 | 30.4 | 5.6 | 30.9 | 5.4 | 32.9 | 4.9 | 35.3 | 5.0 |
| Processed | 32.0 | 6.2 | 30.7 | 5.8 | 31.0 | 5.6 | 31.7 | 5.6 | 34.4 | 5.5 |
| Unprocessed | 30.9 | 6.9 | 30.3 | 5.9 | 31.4 | 5.4 | 32.3 | 4.6 | 34.8 | 5.4 |
| SFA, % energy |  |  |  |  |  |  |  |  |  |  |
| Total | 10.9 | 3.0 | 11.0 | 3.0 | 11.2 | 2.7 | 12.0 | 2.5 | 13.6 | 2.5 |
| Processed | 11.7 | 2.9 | 11.2 | 3.0 | 11.4 | 2.8 | 11.6 | 2.8 | 12.7 | 2.8 |
| Unprocessed | 11.1 | 3.0 | 10.9 | 3.0 | 11.4 | 2.8 | 12.0 | 2.6 | 13.2 | 2.6 |
| MUFA, % energy |  |  |  |  |  |  |  |  |  |  |
| Total | 11.3 | 5.4 | 10.4 | 3.8 | 10.6 | 3.6 | 11.5 | 3.2 | 12.5 | 3.4 |
| Processed | 11.7 | 5.1 | 10.6 | 3.9 | 10.7 | 3.7 | 11.0 | 3.7 | 12.3 | 3.4 |
| Unprocessed | 11.4 | 5.3 | 10.6 | 4.2 | 10.8 | 3.5 | 11.2 | 2.9 | 12.3 | 3.7 |
| PUFA, % energy |  |  |  |  |  |  |  |  |  |  |
| Total | 6.6 | 2.2 | 7.1 | 2.4 | 7.2 | 2.5 | 7.4 | 2.3 | 7.0 | 2.2 |
| Processed | 6.8 | 2.1 | 7.0 | 2.4 | 6.9 | 2.3 | 7.2 | 2.4 | 7.5 | 2.4 |
| Unprocessed | 6.8 | 2.2 | 7.1 | 2.5 | 7.3 | 2.5 | 7.1 | 2.2 | 7.1 | 2.2 |
| *Trans* fat, % energy |  |  |  |  |  |  |  |  |  |  |
| Total | 1.2 | 0.6 | 1.3 | 0.7 | 1.3 | 0.6 | 1.4 | 0.7 | 1.5 | 0.6 |
| Processed | 1.3 | 0.6 | 1.3 | 0.6 | 1.4 | 0.7 | 1.3 | 0.7 | 1.3 | 0.6 |
| Unprocessed | 1.2 | 0.6 | 1.3 | 0.7 | 1.2 | 0.6 | 1.4 | 0.6 | 1.6 | 0.7 |
| Carbohydrates, % energy |  |  |  |  |  |  |  |  |  |  |
| Total | 58.0 | 7.7 | 57.8 | 6.8 | 56.8 | 6.7 | 53.4 | 6.0 | 50.1 | 6.0 |
| Processed | 56.1 | 7.2 | 56.9 | 7.2 | 56.2 | 7.1 | 55.4 | 7.3 | 52.0 | 6.9 |
| Unprocessed | 57.4 | 7.6 | 57.9 | 7.5 | 56.1 | 6.6 | 54.2 | 6.1 | 50.8 | 6.2 |
| Protein, % energy |  |  |  |  |  |  |  |  |  |  |
| Total | 11.8 | 2.0 | 12.4 | 2.0 | 12.9 | 2.0 | 13.5 | 1.8 | 14.4 | 1.7 |
| Processed | 12.4 | 2.2 | 12.8 | 2.1 | 12.9 | 2.2 | 13.0 | 2.1 | 13.5 | 1.9 |
| Unprocessed | 11.9 | 2.0 | 12.3 | 2.1 | 12.9 | 2.0 | 13.4 | 1.7 | 14.3 | 1.8 |
| Cholesterol, mg/kJ |  |  |  |  |  |  |  |  |  |  |
| Total | 25.6 | 13.5 | 26.6 | 12.6 | 27.7 | 12.0 | 29.3 | 11.3 | 32.0 | 11.3 |
| Processed | 27.6 | 13.4 | 26.3 | 10.8 | 27.6 | 13.0 | 28.6 | 12.2 | 30.7 | 12.0 |
| Unprocessed | 26.4 | 14.6 | 26.0 | 12.4 | 28.2 | 11.8 | 29.2 | 11.5 | 31.0 | 10.5 |
| Sodiumb, g/d |  |  |  |  |  |  |  |  |  |  |
| Total | 2.15 | 0.52 | 2.29 | 0.40 | 2.33 | 0.41 | 2.29 | 0.42 | 2.34 | 0.46 |
| Processed | 2.09 | 0.52 | 2.20 | 0.40 | 2.26 | 0.36 | 2.34 | 0.40 | 2.52 | 0.44 |
| Unprocessed | 2.23 | 0.55 | 2.33 | 0.42 | 2.32 | 0.36 | 2.25 | 0.43 | 2.25 | 0.44 |
| Fishb, g/d |  |  |  |  |  |  |  |  |  |  |
| Total | 30.2 | 24.6 | 29.6 | 20.6 | 31.8 | 22.2 | 29.6 | 21.3 | 31.9 | 25.3 |
| Processed | 29.2 | 25.2 | 30.7 | 23.0 | 28.4 | 19.0 | 32.7 | 22.9 | 32.1 | 23.3 |
| Unprocessed | 30.6 | 24.4 | 30.1 | 21.8 | 31.6 | 21.5 | 29.5 | 20.6 | 31.1 | 25.4 |
| Chickenb, g/d |  |  |  |  |  |  |  |  |  |  |
| Total | 35.3 | 27.6 | 34.4 | 27.7 | 34.2 | 21.9 | 38.3 | 26.3 | 36.6 | 22.7 |
| Processed | 35.6 | 30.4 | 37.2 | 24.1 | 35.8 | 27.3 | 34.0 | 22.3 | 35.8 | 22.3 |
| Unprocessed | 34.4 | 27.8 | 34.2 | 26.7 | 34.5 | 22.6 | 38.6 | 23.8 | 37.2 | 26.2 |
| Fruitsc, serving/d |  |  |  |  |  |  |  |  |  |  |
| Total | 5.6 | 3.9 | 4.1 | 2.8 | 3.8 | 2.6 | 3.8 | 2.6 | 3.8 | 2.4 |
| Processed | 6.0 | 4.0 | 4.3 | 2.6 | 3.7 | 2.6 | 3.7 | 2.5 | 3.7 | 2.6 |
| Unprocessed | 5.4 | 3.8 | 4.0 | 2.9 | 3.7 | 2.3 | 4.2 | 3.0 | 4.0 | 2.6 |
| Green leafy vegetablesd, serving/d |  |  |  |  |  |  |  |  |  |  |
| Total | 0.9 | 0.7 | 0.8 | 0.7 | 0.7 | 0.6 | 0.8 | 0.6 | 0.8 | 0.5 |
| Processed | 1.0 | 0.8 | 0.8 | 0.6 | 0.7 | 0.6 | 0.7 | 0.6 | 0.7 | 0.6 |
| Unprocessed | 0.9 | 0.7 | 0.7 | 0.6 | 0.8 | 0.7 | 0.8 | 0.6 | 0.8 | 0.6 |

Abbreviations used: Q1, the first quintile; Q2, the second quintile; Q3, the third quintile; Q4, the fourth quintile; Q5, the fifth quintile; SD, standard deviation; MET, metabolic equivalent; SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids.

a Values are mean and standard deviation for continuous variables, and percentage for categorical variables.

b Adjusted for total energy intake using the residual method.

c Includes pineapples, papaya, bananas, cantaloupe, apples, pears, mango, oranges, watermelon, tangerine, lychee, peach palm, avocado, tomatoes, cukes, plantain, zucchini, and yellow squash.

d Includes broccoli, coleslaw, cabbage, spinach, kale, and lettuce.

**SUPPLEMENTARY TABLE 3**

## Quintiles of total, processed, and unprocessed red meat intakes and nonfatal acute myocardial infarction among 3,641 participants who did not believe that diet was the main cause of heart attacks

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Q1 | Q2 |  | Q3 |  | Q4 |  | Q5 |  | *P*-trend |
| Total red meat |  |  |  |  |  |  |  |  |  |  |
|  |  | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |  |
| Basic modela | 1.00 | 0.81 | 0.66, 1.00 | 0.91 | 0.74, 1.12 | 0.89 | 0.73, 1.10 | 1.35 | 1.10, 1.66 | 0.001 |
| Multivariate 1b | 1.00 | 0.75 | 0.60, 0.94 | 0.82 | 0.66, 1.01 | 0.80 | 0.65, 1.00 | 1.12 | 0.90, 1.41 | 0.15 |
| Multivariate 2c | 1.00 | 0.90 | 0.72, 1.14 | 1.02 | 0.81, 1.28 | 0.94 | 0.75, 1.18 | 1.23 | 0.97, 1.54 | 0.06 |
| Processed red meat |  |  |  |  |  |  |  |  |  |  |
|  |  | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |  |
| Basic modela | 1.00 | 0.86 | 0.70, 1.06 | 0.77 | 0.62, 0.94 | 0.83 | 0.67, 1.02 | 1.11 | 0.90, 1.37 | 0.21 |
| Multivariate 1b | 1.00 | 0.86 | 0.69, 1.07 | 0.71 | 0.57, 0.89 | 0.77 | 0.62, 0.97 | 0.99 | 0.79, 1.23 | 0.99 |
| Multivariate 2c | 1.00 | 1.08 | 0.85, 1.37 | 1.00 | 0.78, 1.29 | 1.08 | 0.85, 1.38 | 1.25 | 0.98, 1.58 | 0.06 |
| Multivariate 3d | 1.00 | 1.08 | 0.85, 1.37 | 1.00 | 0.78, 1.29 | 1.08 | 0.84, 1.38 | 1.24 | 0.97, 1.57 | 0.07 |
| Unprocessed red meat |  |  |  |  |  |  |  |  |  |  |
|  |  | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |  |
| Basic modela | 1.00 | 0.85 | 0.69, 1.05 | 0.85 | 0.69, 1.05 | 0.98 | 0.80, 1.20 | 1.19 | 0.96, 1.46 | 0.02 |
| Multivariate 1b | 1.00 | 0.83 | 0.66, 1.03 | 0.82 | 0.66, 1.02 | 0.89 | 0.72, 1.11 | 1.06 | 0.85, 1.33 | 0.28 |
| Multivariate 2c | 1.00 | 1.00 | 0.79, 1.26 | 1.00 | 0.79, 1.26 | 0.97 | 0.77, 1.22 | 1.12 | 0.89, 1.40 | 0.38 |
| Multivariate 3e | 1.00 | 0.99 | 0.79, 1.25 | 0.99 | 0.78, 1.25 | 0.95 | 0.76, 1.20 | 1.09 | 0.86, 1.37 | 0.53 |

Abbreviations used: Q1, the first quintile; Q2, the second quintile; Q3, the third quintile; Q4, the fourth quintile; Q5, the fifth quintile; OR, odds ratio; CI, confidence interval.

a Adjusted for the matching factors (age, sex, and area of residence).

b In addition to the basic model, adjusted for waist-to-hip ratio (quintiles), physical activity level (quintiles), monthly household income (quintiles plus an indicator for missing data), history of diabetes (yes or no), history of hypertension (yes or no), smoking status (never, former, or current <10, 10 to 20, or >20 cigarettes/d), and alcohol intake (never, former, or current tertiles).

c In addition to the Multivariate 1, adjusted for total energy intake, fruit servings, green leafy vegetable servings, energy-adjusted chicken intake, and energy-adjusted fish intake (all in quintiles).

d In addition to the Multivariate 2, adjusted for energy-adjusted unprocessed red meat intake in quintiles (mutual adjustment).

e In addition to the Multivariate 2, adjusted for energy-adjusted processed red meat intake in quintiles (mutual adjustment).