**Supplementary tables**

**Table S1: The difference between chrono-nutrition component according to the weekend and weekdays in Iranian adults (n=825).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Weekdays ∞** | **weekends©** | **Pvalue \*\*** |
| **Number of EOs** (n/day) | 6.38 ± 1.86 | 6.29 ± 1.81 | 0.75 |
| **Breakfast time (h:m, a.m.)** | 8:01 ± 1:08 | 8:11 ± 1:23 | 0.53 |
| **Lunch time (h:m, p.m.)** | 1:51 ± 0:50 | 2:08 ± 1:03 | 0.42 |
| **Dinner time(h:m, p.m.)** | 8:38 ± 1:39 | 8:48 ± 1:45 | 0.41 |

**Abbreviations:**

EOs, eating occasions; n, number; h:m, hour:minute.

 Calculated by one-way ANOVA, values are mean ± SD.

\*P-value < 0·05 indicates significant level.

\*\*Adjusted for sex and age.

∞ Average of two 24-hour dietary recalls.

© One 24-hour dietary recall.

**Table S2:** The association between number of eating occasions (EOs) and cardiometabolic risk factors in 825 Iranian adults.

|  |  |
| --- | --- |
|  | Number of Eating Occasion (EOs) (n/day)(Rang, 1-11; median, 6.33) |
| Outcomes | **Model¤** | **Less EOs ≤ 6.33** | **More EOs > 6.33** | **PFDR\*** | **Pinteraction** **BMI \*\*** | **Pinteraction** **Age \*\*\*** |
|  |  | **(n = 465)** | **(n = 360)** |  |  |  |
| SBP | **Adjusted β (95% CI)** | -9.26 (-18.54 – 1.78) | References | 0.32 | 0.03 | 0.36 |
| DBP | **Adjusted β (95% CI)** | -5.93 (-13.65 – 2.71) | References | 0.30 | 0.04 | 0.24 |
| LAP Index  | **Adjusted β (95% CI)** | -7.42 (-32.03 - 17.65) | References | 0.28 | 0.54 | 0.58 |
| $$\frac{TC}{HDL-C}$$ | **Adjusted β (95% CI)** | 0.81 (0.02 -1.76) | References | 0.50 | 0.21 | 0.52 |
| $$\frac{LDL-C}{HDL-C}$$ | **Adjusted β (95% CI)** | 0.93 (0.09 -1.92) | References | 0.20 | 0.42 | 0.71 |
| Uric Acid (mg.dl) | **Adjusted β (95% CI)** | -0.22 (-1.34 – 0.87) | References | 0.30 | 0.78 | 0.64 |
| HOMA-IR | **Adjusted β (95% CI)** | -0.25 (-2.84 – 2.42) | References | 0.59 | 0.92 | 0.42 |
| HOMA-IS | **Adjusted β (95% CI)** | -0.35 (-2.76 – 1.46) | References | 0.85 | 0.67 | 0.83 |
| CRP ( µg.dl) | **Adjusted β (95% CI)** | 0.12 (-0.04 – 0.28) | References | 0.78 | 0.06 | 0.69 |
| TyG- index  | **Adjusted β (95% CI)** | -0.07 (-0.18 – 0.03) | References | 0.26 | 0.34 | 0.15 |

Abbreviations:

 EOs, eating occasion; SBP, systolic blood pressure; DBP, diastolic blood pressure; LAP, lipid accumulation product; $\frac{TC}{HDL-C}, \frac{total cholesterol}{high-density lipoprotein}$; $\frac{LDL-C}{HDL-C}, \frac{low-density lipoprotein}{high-density lipoprotein}$; HOMA-IR, Homeostatic Model Assessment for Insulin Resistance; HOMA-IS, Homeostatic Model Assessment for Insulin sensitivity; CRP, C- Reactive protein; TyG- index, triglyceride-glucose index.

 **¤** General linear regression was used and the model was adjusted for age, sex, education, energy intake, physical activity, sleep duration, fasting window, supplement intake, menopausal status, smoking, MEQ, and body mass index, values are beta (95% confidence interval).

\* P(FDR) refers to P values obtained in linear regression models, Multiple testing adjustments were performed using the false discovery rate at 5%.

\*\*Interaction by BMI (BMI < 25 (n = 328) vs, BMI ≥ 25 (n = 497)) was performed, with the model adjusted for all confounders except BMI.

\*\*\*Interaction by age (aged < 41 years (n = 409) and ≥ 41 years (n = 416))was performed, with the model adjusted for all confounders except age.

**Table S3:** The association between the time of main meals and cardiometabolic risk factors in 825 Iranian adults.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Breakfast time(Median = 8:00 (h:m)) | Lunch time(Median = 1:30 p.m.) | Dinner time(Median = 8:45 p.m.) |
| Outcomes  | **Model¤** | **Earlier-B**  | **Later-B** | **PFDR\*** | **Pinteraction** **BMI \*\*** | **Pinteraction** **Age \*\*\*** | **Earlier-L**  | **Later-L** | **PFDR\*** | **Pinteraction** **BMI \*\*** | **Pinteraction** **Age \*\*\*** | **Earlier-D**  | **Later-D** | **PFDR\*** | **Pinteraction** **BMI \*\*** | **Pinteraction** **Age \*\*\*** |
|  |  | **(Before 8:00 a.m.)** | **(After 8:00 a.m.)** |  |  |  | **(Before 13:30 p.m.)** | **( After 1:30 p.m.)** |  |  |  | **( Before 8:45 p.m.)** | **( After 8:45 p.m.)** |  |  |  |
|  |  | **(n =422)** | **(n = 402)** |  |  |  | **(n = 414)** | **(n = 411)** |  |  |  | **(n = 411)** | **(n = 414)** |  |  |  |
| SBP | **Adjusted** **β (95% CI)** | -0.46 (-11.48 – 10.70) | References | 0.94 | 0.95 | 0.85 | 0.03 (-10.13 – 9.71) | References | 0.63 | 0.75 | 0.68 | 0.21 (-11.65 – 12.05) | References | 0.95 | 0. 96 | 0.85 |
| DBP | **Adjusted** **β (95% CI)** | 0.25 (-7.62 – 8.44) | References | 0.85 | 0.99 | 0.91 | -0.02 (-8.09 – 8.06) | References | 0.99 | 0.86 | 0.39 | -0.14 (-0.49 – 0.15) | References | 0.39 | 0.33 | 0.76 |
| LAP Index  | **Adjusted** **β (95% CI)** | -8.41 (-31.61 - 16.52) | References | 0.61 | 0.55 | 0.63 | -0.17 (-18.20 - 17.87) | References | 0.68 | 0.52 | 0.43 | -1.59 (-28.90 – 25.32) | References | 0.79 | 0.76 | 0.37 |
| $$\frac{TC}{HDL-C}$$ | **Adjusted** **β (95% CI)** | -0.46 (-1.27 - 0.53) | References | 0.23 | 0.23 | 0.73 | -0.22 (-1.01 – 0.64) | References | 0.61 | 0.65 | 0.61 | -0.37 (-1.26 – 0.49) | References | 0.39 | 0.41 | 0.29 |
| $$\frac{LDL-C}{HDL-C}$$ | **Adjusted** **β (95% CI)** | -0.35 (-1.15 - 0.27) | References | 0.41 | 0.41 | 0.68 | --0.28 (-0.96 – 0.39) | References | 0.41 | 0.35 | 0.42 | -0.21 (-0.92 – 0.43) | References | 0.53 | 0.51 | 0.50 |
| Uric Acid (mg.dl) | **Adjusted** **β (95% CI)** | 0.05 (-1.34 –1.42)  | References | 0.31 | 0.24 | 0.35 | 0.19 (-0.86 - 1.21) | References | 0.53 | 0.72 | 0.53 | -0.68 (-1.70 – 0.39) | References | 0.21 | 0.26 | 0.58 |
| HOMA-IR | **Adjusted** **β (95% CI)** | -0.31 (-2.95 – 2.11) | References | 0.08 | **0.04** | 0.64 | -0.26 (-2.03 – -1.46) | References | 0.04 | 0.23 | 0.53 | 1.22 (-1.78 – 4.58) | References | 0.18 | 0.12 | 0.74 |
| HOMA-IS | **Adjusted** **β (95% CI)** | 0,58 (-1.21 – 2.47) | References | 0.53 | 0.36 | 0.22 | 1.51 (-0.06– 3.68) | References | 0.10 | **0.04** | 0.65 | 1.06 (0.09 – 0.35) | References | 0.07 | **0.02** | 0.54 |
| CRP (µg.dl) | **Adjusted** **β (95% CI)** | -0.006 (-0.16 – 0.14) | References | 0.92 | 0.92 | 0.76 | -0.07 (-0.23 – 0.09) | References | 0.37 | 0.46 | 0.49 | -0.18 (-0.43 – 0.04) | References | 0.05 | **0.02** | 0.42 |
| TyG- index  | **Adjusted** **β (95% CI)** | -0.03 (-0.19 – 0.18) | References | 0.33 | 0.49 | 0.37 | -0.09 (-0.12 - -0.09) | References | 0.91 | 0.82 | 0.46 | 0.06 (-0.06 – 0.16) | References | 0.14 | 0.11 | 0.63 |

**Abbreviations:**

B, breakfast; L, lunch; D, dinner; SBP, systolic blood pressure; DBP, diastolic blood pressure; LAP, lipid accumulation product; $\frac{TC}{HDL-C}, \frac{total cholesterol}{high-density lipoprotein}$; $\frac{LDL-C}{HDL-C}, \frac{low-density lipoprotein}{high-density lipoprotein}$; HOMA-IR, Homeostatic Model Assessment for Insulin Resistance; HOMA-IS, Homeostatic Model Assessment for Insulin sensitivity; CRP, C- Reactive protein; TyG- index, triglyceride-glucose index.

**¤** General linear regression was used and model was adjusted for age, sex, education, energy intake, physical activity, sleep duration, supplement intake, menopausal status, smoking, MEQ, fasting window, and body mass index, values are beta (95% confidence interval).

\* P(FDR) refers to Pvalues obtained in linear regression models, Multiple testing adjustments were performed using the false discovery rate at 5%.

\*\*Interaction by BMI (BMI < 25 (n = 328) vs, BMI ≥ 25 (n = 497)) was performed, with the model adjusted for all confounders except BMI.

\*\*\*Interaction by age (aged < 41 years (n = 409) and ≥ 41 years (n = 416))was performed, with the model adjusted for all confounders except age.

**Table S4:** The association betweenmain meal irregularity energy score and cardiometabolic risk factors in 825 Iranian adults.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Breakfast irregularity score(Range, 0.6– 133.4, median , 31.77 ) | Lunch irregularity score(Range, 1.5 – 102.4, median 30.19 ) | Dinner irregularity score( Range,1.4– 133.5, median 34.02 ) |
| Outcomes  | **Model¤** | **Less irregular-B** | **More irregular-B** | **PFDR\*** | **Pinteraction BMI \*\*** | **Pinteraction** **Age \*\*\*** | **Less irregular-L** | **More irregular-L** | **PFDR\*** | **Pinteraction** **BMI \*\*** | **Pinteraction** **Age \*\*\*** | **Less irregular-D** | **More irregular-D** | **PFDR\*** | **Pinteraction** **BMI \*\*** | **Pinteraction** **Age \*\*\*** |
|  |  | **≤ 31.77** | **>31.77** |  |  |  | **≤ 30.19** | **≤ 30.19** |  |  |  | **≤34.02** | **>34.02** |  |  |  |
|  |  | **(n = 412)** | **(n = 413)** |  |  |  | **(n =410)** | **(n = 415)** |  |  |  | **(n = 411)** | **(n = 414)** |  |  |  |
| SBP | **Adjusted** **β (95% CI)** | -1.67 (-13.17 – 10.41) | References | 0.74 | 0.78 | 0.27 | 0.53 (-11.63 – 12.01) | References | 0.98 | 0.82 | 0.67 | -4.81 (-18.51 – 7.35) | References | 0.96 | 0.53 | 0.40 |
| DBP | **Adjusted** **β (95% CI)** | 0.93 (-6.82 – 8.68) | References | 0.83 | 0.53 | 0.43 | -1.23 (-9.01 – 6.54) | References | 0.92 | 0.83 | 0.32 | -0.65 (-8.79 – 7.09) | References | 0.79 | 0.98 | 0.28 |
| LAP Index  | **Adjusted** **β (95% CI)** | -8.41 (-15.71 - 6.71) | References | 0.95 | 0.31 | 0.85 | -13.7 (-28.20 - -1.07) | References | 0.21 | 0.79 | 0.36 | -11.29 (-31.90 – 12.4) | References | 0.78 | 0.42 | 0.85 |
| $$\frac{TC}{HDL-C}$$ | **Adjusted** **β (95% CI)** | -0.27 (-1.47 - 1.01) | References | 0.76 | **0.04** | 0.79 | 0.08 (-0.91 – 0.74) | References | 0.99 | 0.79 | 0.24 | -0.62 (-1.72 – 0.25) | References | 0.98 | 0.22 | 0.91 |
| $$\frac{LDL-C}{HDL-C}$$ | **Adjusted** **β (95% CI)** | -0.29 (-1.79 - 1.27) | References | 0.83 | 0.09 | 0.63 | 0.02 (-0.76 – 0.79) | References | 0.99 | 0.85 | 0.58 | -0.27 (-1.02 – 0.51) | References | 0.79 | 0.42 | 0.63 |
| Uric Acid (mg.dl) | **Adjusted** **β (95% CI)** | -0.31 (-1.51 – 0.71)  | References | 0.95 | 0.56 | 0.73 | 0.53 (-0.75 - - 1.12) | References | 0.99 | 0.45 | 0.52 | -0.28 (-1.29 – 0.67) | References | 0.98 | 0.79 | 0.73 |
| HOMA-IR | **Adjusted** **β (95% CI)** | -0.08 (-3.65 – 2.19) | References | 0.98 | 0.72 | 0.68 | -0.26 (-2.43 – 2.06) | References | 0.23 | **0.04** | 0.71 | 1.22 (-2.29 – 3.38) | References | 0.97 | 0.36 | 0.68 |
| HOMA-IS | **Adjusted** **β (95% CI)** | 0.79 (-1.21 – 2.63) | References | 0.81 | 0.53 | 0.61 | 0.81 (-1.01 – 2.09) | References | 0.83 | 0.28 | 0.64 | 0.52 (-1.29 – 2.34) | References | 0.81 | 0.60 | 0.73 |
| CRP (µg.dl) | **Adjusted** **β (95% CI)** | 0.07 (-0.19 – 0.24) | References | 0.76 | 0.61 | 0.38 | 0.006 (-0.13 – 0.16) | References | 0.97 | 0.69 | 0.75 | -0.12 (-0.29 – 0.04) | References | 0.97 | 0.16 | 0.27 |
| TyG- index  | **Adjusted** **β (95% CI)** | 0.02 (-0.61 – 0.97) | References | 0.95 | 0.51 | 0.47 | -0.19 (-0.45 - -0.11) | References | 0.21 | 0.07 | 0.63 | 0.07 (-0.36 – 0.12) | References | 0.72 | 0.34 | 0.42 |

**Abbreviations:**

B, breakfast; L, lunch; D, dinner; SBP, systolic blood pressure; DBP, diastolic blood pressure; LAP, lipid accumulation product; $\frac{TC}{HDL-C}, \frac{total cholesterol}{high-density lipoprotein}$; $\frac{LDL-C}{HDL-C}, \frac{low-density lipoprotein}{high-density lipoprotein}$; HOMA-IR, Homeostatic Model Assessment for Insulin Resistance; HOMA-IS, Homeostatic Model Assessment for Insulin sensitivity; CRP, C- Reactive protein; TyG- index, triglyceride-glucose index.

**¤**General linear regression was used and model was adjusted for age, sex, education, energy intake, physical activity, sleep duration, supplement intake, menopausal status, smoking, fasting window, and MEQ, values are Beta (95% confidence interval) of outcomes.

\* P(FDR) refers to pvalues obtained in linear regression models. Multiple testing adjustments were performed using the false discovery rate at 5%.

\*\*The cutoff of 25 was used to categorize BMI (Body Mass Index) into two main groups: BMI < 25 as normal weight and BMI ≥ 25 as overweight/obese.

\*\*\*Interaction by age (aged < 41 years (n = 409) and ≥ 41 years (n = 416))was performed, with the model adjusted for all confounders except age.