

## Supplementary Material

### The effects of time-restricted eating vs. standard dietary advice on weight, metabolic health and the consumption of processed food: A pragmatic randomised controlled trial in community-based adults

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**Table S1. Limited overlap of different food and drink categories**

| Categories | NOVA1 (%) | NOVA2 (%) | NOVA3 (%) | NOVA4 (%) | NOVA-A (%) | NOVA-C (%) | NOVA-S (%) | NOVA-D (%) |
|------------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|
| NOVA1      | 100       | 0.1       | 0.4       | 0.2       | 0          | 28         | 0          | 7.6        |
| NOVA2      | 0.3       | 100       | 0.7       | 0.1       | 0          | 7.7        | 6.9        | 0          |
| NOVA3      | 1.0       | 0.5       | 100       | 0.3       | 19         | 0          | 0.3        | 0.4        |
| NOVA4      | 0.4       | 0.1       | 0.2       | 100       | 1.6        | 6.9        | 9.7        | 1.7        |
| NOVA-A     | 0         | 0         | 90        | 9.7       | 100        | 0          | 6.8        | 0          |
| NOVA-C     | 83        | 7         | 0         | 11        | 0          | 100        | 9          | 0          |
| NOVA-S     | 0.2       | 28        | 1.9       | 70        | 8.1        | 40         | 100        | 0          |
| NOVA-D     | 87        | 0.1       | 2.1       | 10        | 0          | 0          | 0          | 100        |

*Footnotes: For each row, all ingestion events are filtered according to the category in the row name. Each column value represents the percentage of other categories that are present after filtering on the row name. Categories follow and extend the NOVA classification: NOVA1: "Unprocessed or minimally processed foods," NOVA2: "Processed culinary ingredients," NOVA3: "Processed foods," NOVA4: "Ultra-processed foods," NOVA-A: "Alcohol-containing drinks," NOVA-C: "Caffeinated drinks," NOVA-S: "Sweet drinks," NOVA-D: "Other drinks."*

**Table S2. Effects of TRE and SDA on eating behaviour**

| Mean (SD) <sup>a</sup>              | Time-restricted eating (TRE) |                   |  | Standard dietary advice (SDA) |                   |  | Between-group difference (95% confidence interval) <sup>c</sup> | P for comparison of pre-post changes between TRE and SDA <sup>b</sup> |
|-------------------------------------|------------------------------|-------------------|--|-------------------------------|-------------------|--|---|---|
|                                     | Pre-intervention             | Post-intervention | P for comparison (pre-post) <sup>b</sup> | Pre-intervention              | Post-intervention | P for comparison (pre-post) <sup>b</sup> |   |   |
| NOVA1, %                            | 43.5 (13.0)                  | 41.9 (13.9)       | 0.35                                     | 37.8 (12.5)                   | 44.8 (13.2)       | < 0.01                                   | -8.6 (-14.1; -3.2)  | < 0.01  |
| NOVA2, %                            | 14.7 (6.0)                   | 15.8 (6.4)        | 0.37                                     | 12.4 (5.8)                    | 13.9 (5.3)        | 0.09                                     | -0.5 (-3.3; 2.4)  | 0.76  |
| NOVA3, %                            | 17.5 (7.9)                   | 19.3 (8.7)        | 0.10                                     | 18.0 (7.1)                    | 17.1 (5.4)        | 0.40                                     | 2.7 (-0.2; 5.6)   | 0.08  |
| NOVA4, %                            | 24.2 (11.1)                  | 23.0 (9.0)        | 0.48                                     | 31.9 (11.4)                   | 24.2 (11.8)       | < 0.01                                   | 6.4 (0.4; 12.4)   | 0.04  |
| NOVA-A, %                           | 4.4 (5.3)                    | 3.9 (4.8)         | 0.17                                     | 4.4 (4.5)                     | 3.2 (3.4)         | < 0.01                                   | 0.6 (-0.5; 1.7)   | 0.27  |
| NOVA-C, %                           | 19.6 (11.4)                  | 17.9 (11.7)       | 0.28                                     | 17.4 (6.8)                    | 13.9 (8.7)        | 0.07                                     | 1.8 (-2.8; 6.5)   | 0.44  |
| NOVA-S, %                           | 4.5 (7.3)                    | 3.0 (4.6)         | 0.08                                     | 4.4 (4.7)                     | 4.6 (6.8)         | 0.74                                     | -1.8 (-3.9; 0.3)  | 0.12  |
| NOVA-D, %                           | 3.9 (4.3)                    | 2.2 (2.5)         | 0.02                                     | 3.9 (3.2)                     | 3.8 (3.5)         | 0.85                                     | -1.6 (-3.2; -0.0)   | 0.06  |
| Eating duration, hours <sup>d</sup> | 15.48 (1.14)                 | 12.50 (1.29)      | < 0.01                                   | 15.17 (0.96)                  | 14.89 (1.21)      | 0.16                                     | -2.70 (-3.47; -1.93)  | < 0.01  |
| Eating start, hours <sup>d</sup>    | 6.83 (0.67)                  | 8.36 (1.00)       | < 0.01                                   | 6.96 (0.99)                   | 6.86 (1.08)       | 0.40                                     | 1.63 (1.12; 2.13)   | < 0.01  |
| Eating midpoint, hours <sup>d</sup> | 13.84 (1.44)                 | 13.64 (1.31)      | 0.59                                     | 13.88 (1.18)                  | 13.05 (0.88)      | < 0.01                                   | 0.62 (-0.24; 1.47)  | 0.18  |
| Eating end, hours <sup>d</sup>      | 22.31 (1.17)                 | 20.86 (1.03)      | < 0.01                                   | 22.13 (0.95)                  | 21.76 (1.10)      | 0.01                                     | -1.07 (-1.62, -0.53)  | < 0.01  |

Footnotes: <sup>a</sup> Categories follow and extend the NOVA classification: NOVA1: "Unprocessed or minimally processed foods," NOVA2: "Processed culinary ingredients," NOVA3: "Processed foods," NOVA4: "Ultra-processed foods," NOVA-A: "Alcohol-containing drinks", NOVA-C: "Caffeinated drinks," NOVA-S: "Sweet drinks," NOVA-D: "Other drinks." <sup>b</sup> All p for comparisons were calculated with the Student t-test. <sup>c</sup> Mean difference comparing pre-post change between the TRE and SDA groups (n = 25 and 20, respectively). <sup>d</sup> Eating duration, the start of the eating interval, the median of the eating interval, and the end of the eating interval, presented as fractional hours, i.e. 1.33h = 1 hour and 20 minutes.

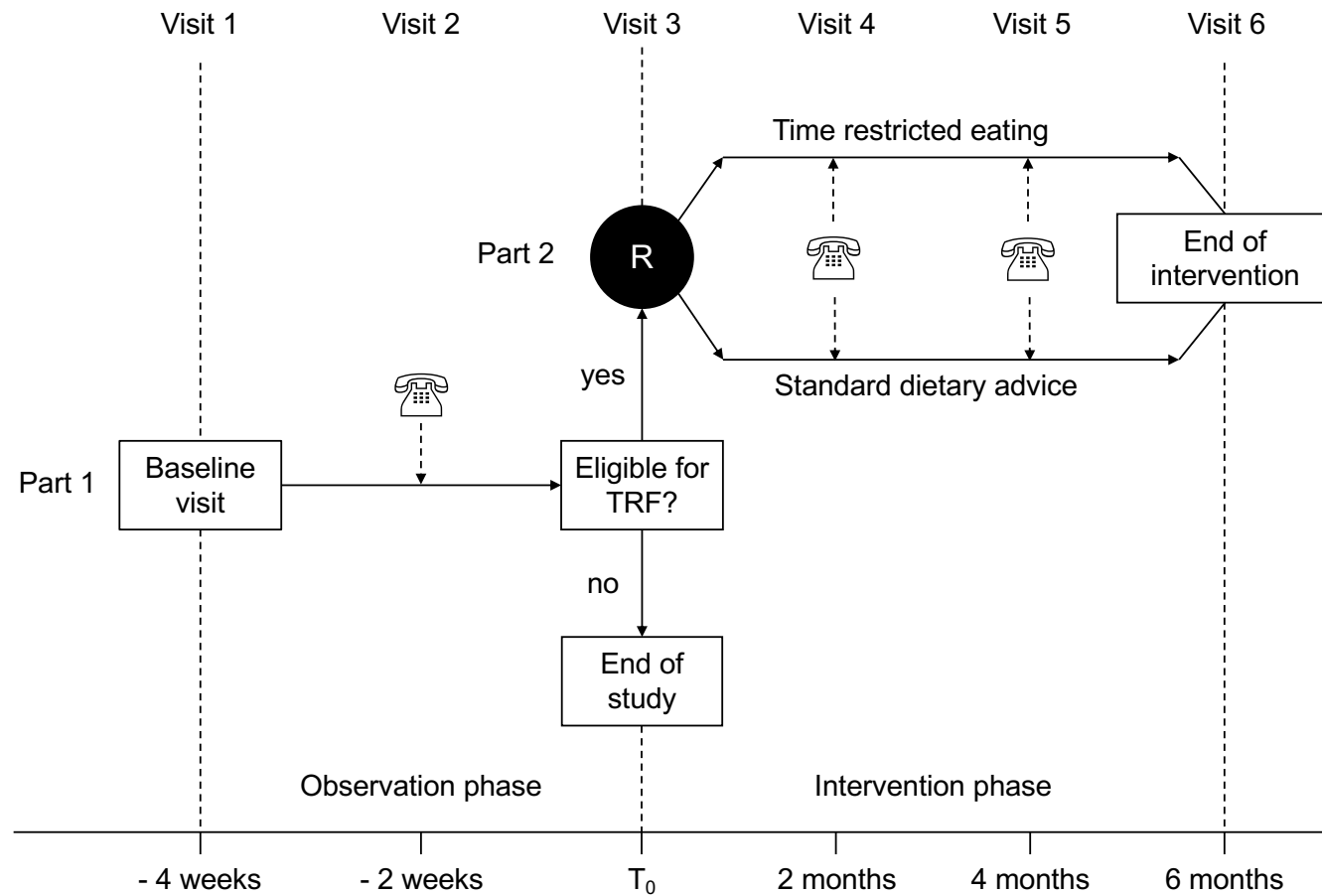
**Table S3. Baseline characteristics by randomisation group**

|   | <b>SDA<br/>(n = 26)</b> | <b>TRE<br/>(n = 28)</b> | <b>Both arms<br/>(n = 54)</b> |
|---|-------------------------|-------------------------|-------------------------------|
| <b>Demographics</b>                     |                         |                         |                               |
| Age, mean (SD)                          | 42.5 (14.0)             | 44.3 (12.8)             | 43.4 (13.3)                   |
| Marital status <sup>a</sup> , n (%)     |                         |                         |                               |
| Married, partnership                    | 17 (68%)                | 23 (92%)                | 40 (80%)                      |
| Single, separated, widow-er             | 8 (32%)                 | 2 (8%)                  | 10 (20%)                      |
| Education, n (%)                        |                         |                         |                               |
| Primary, secondary                      | 4 (15%)                 | 2 (7%)                  | 6 (11%)                       |
| Apprenticeship, vocational              | 5 (19%)                 | 7 (25%)                 | 12 (22%)                      |
| Professional school                     | 2 (8%)                  | 5 (18%)                 | 7 (13%)                       |
| University, or higher degree            | 15 (58%)                | 14 (50%)                | 29 (54%)                      |
| Born in Switzerland, n (%)              | 21 (81%)                | 19 (68%)                | 40 (74%)                      |
| <b>Clinical characteristics</b>         |                         |                         |                               |
| Weight, kg, median (IQR)                | 75.2 (67.9–83.6)        | 79.3 (68.5–85.2)        | 77.5 (68.0–84.7)              |
| BMI, kg/m <sup>2</sup> , median (IQR)   | 27.7 (23.8–30.3)        | 28.3 (25.2–31.6)        | 28.3 (24.6–30.5)              |
| BMI < 25.0 kg/m <sup>2</sup> , n (%)    | 8 (30%)                 | 6 (21%)                 | 14 (26%)                      |
| BMI 25.0–29.9 kg/m <sup>2</sup> , n (%) | 9 (35%)                 | 13 (46%)                | 22 (41%)                      |
| BMI ≥ 30.0 kg/m <sup>2</sup> , n (%)    | 9 (35%)                 | 9 (32%)                 | 18 (33%)                      |
| WC, cm, median (IQR)                    | 87.5 (81.0–100.0)       | 92.0 (86.0–99.0)        | 90.3 (84.0–100.0)             |
| Current smokers, n (%)                  | 2 (8%)                  | 3 (11%)                 | 5 (9%)                        |

|  |                 |                 |                 |
|--|-----------------|-----------------|-----------------|
| Cardiovascular disease <sup>b</sup> , n (%)    | 1 (4%)          | 2 (7%)          | 3 (6%)          |
| Endocrine disorder <sup>c</sup> , n (%)        | 1 (4%)          | 2 (7%)          | 3 (6%)          |
| Respiratory disorder, n (%)                    | 4 (15%)         | 5 (18%)         | 9 (17%)         |
| <b>Metabolic syndrome (MS) <sup>d</sup></b>    |                 |                 |                 |
| MS components, n (%)                           |                 |                 |                 |
| 1. Central obesity                             | 20 (77%)        | 23 (82%)        | 43 (80%)        |
| 2. Hypertension                                | 12 (46%)        | 11 (39%)        | 23 (43%)        |
| 3. Impaired fasting glucose                    | 6 (23%)         | 6 (21%)         | 12 (22%)        |
| 4. High triglycerides                          | 6 (23%)         | 6 (21%)         | 12 (22%)        |
| 5. Low HDL-cholesterol                         | 7 (27%)         | 8 (29%)         | 15 (28%)        |
| MS by the IDF definition, n (%)                | 6 (23%)         | 7 (25%)         | 13 (24%)        |
| <b>Lifestyle</b>                               |                 |                 |                 |
| Sleep duration <sup>e</sup> , hours, mean (SD) | 7.15 (1.01)     | 7.23 (0.93)     | 7.19 (0.96)     |
| Sleep quality <sup>f</sup> , mean (SD)         | 5.1 (2.4)       | 5.4 (2.8)       | 5.2 (2.6)       |
| Physical activity <sup>g</sup> , median (IQR)  | 1053 (678–2226) | 1346 (570–1907) | 1191 (594–1920) |

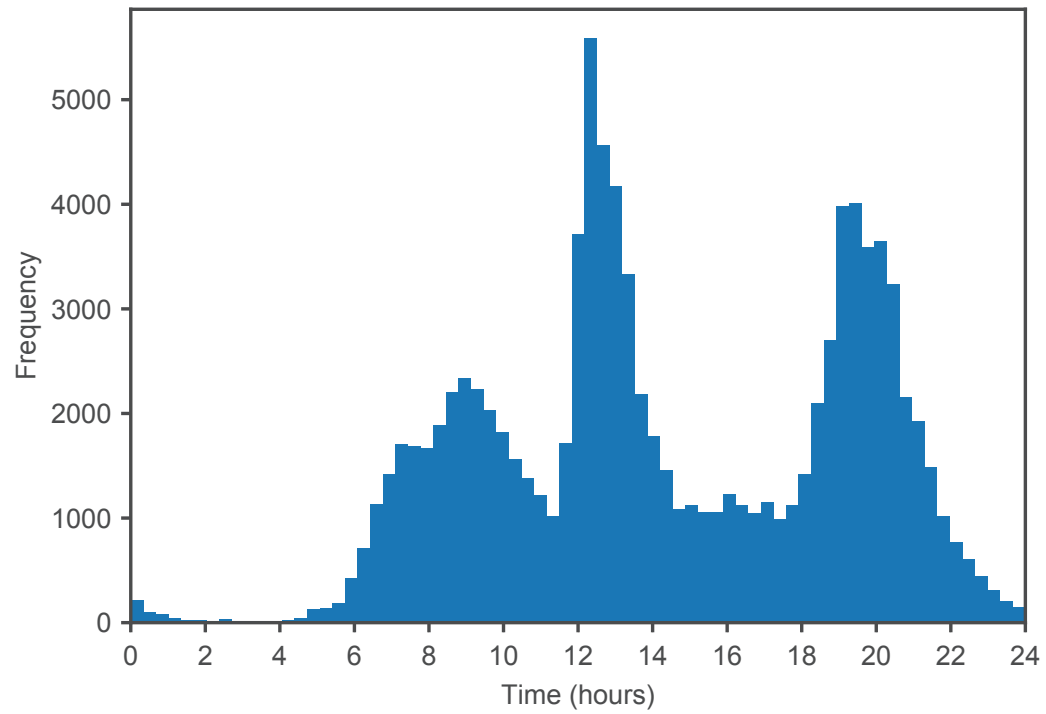
Footnotes: Related to Table 1. <sup>a</sup> The data on marital status were available for 50 individuals. <sup>b</sup> Cardiovascular disease prior to the inclusion in the study, e.g. coronary heart disease, cerebrovascular disease, peripheral artery disease. <sup>c</sup> Mostly hypothyroidism with thyroxine replacement at a stable dosage. <sup>d</sup> The metabolic syndrome (MS) and its components were defined as follows: Central obesity was defined as body mass index (BMI)  $\geq 30$  kg/m<sup>2</sup> or waist circumference (WC)  $\geq 80$  cm (women) or WC  $\geq 94$  cm (men); hypertension as systolic blood pressure (BP)  $\geq 130$  mmHg and/or diastolic BP  $\geq 85$  mmHg; impaired fasting glucose for plasma levels  $\geq 5.6$  mmol/L (100 mg/dL); high triglycerides if  $\geq 1.7$  mmol/L (150 mg/dL); and low HDL cholesterol if  $< 1.29$  mmol/L (50 mg/dL, women) or  $< 1.03$  mmol/L (40 mg/dL, men). <sup>e</sup> Weighted average of sleep duration between work days and off days. <sup>f</sup> Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI), ranging from 0 (no issues) to 21 points (extreme disturbance of sleep quality). <sup>g</sup> Physical activity was assessed among 51 individuals with the International Physical Activity Questionnaire (IPAQ), expressed as MET-minutes per week.

Figure S1. Study design



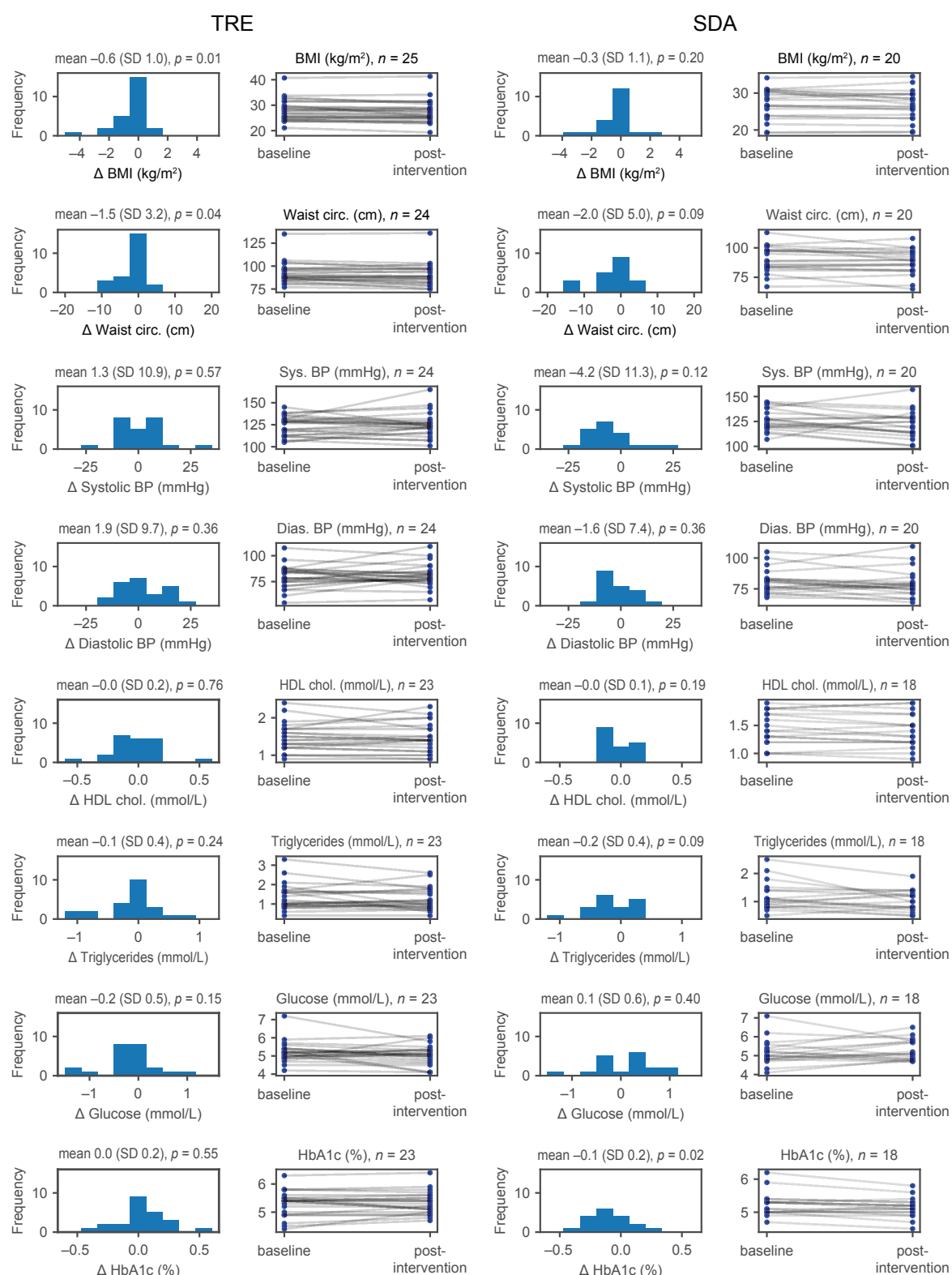
*Legend: Related to the Methods, section 2.1. Study design and flow of participants through the 4-week observation phase, followed by a 6-month intervention phase if they were eligible (see text). In addition to the 3 encounters in person (visits 1, 3, and 6), interim contacts were made over the phone or via email to ensure compliance to the study protocol (visit 2) and record weight measured at home (visits 4 and 5).*

**Figure S2. The time profile of ingestion events**



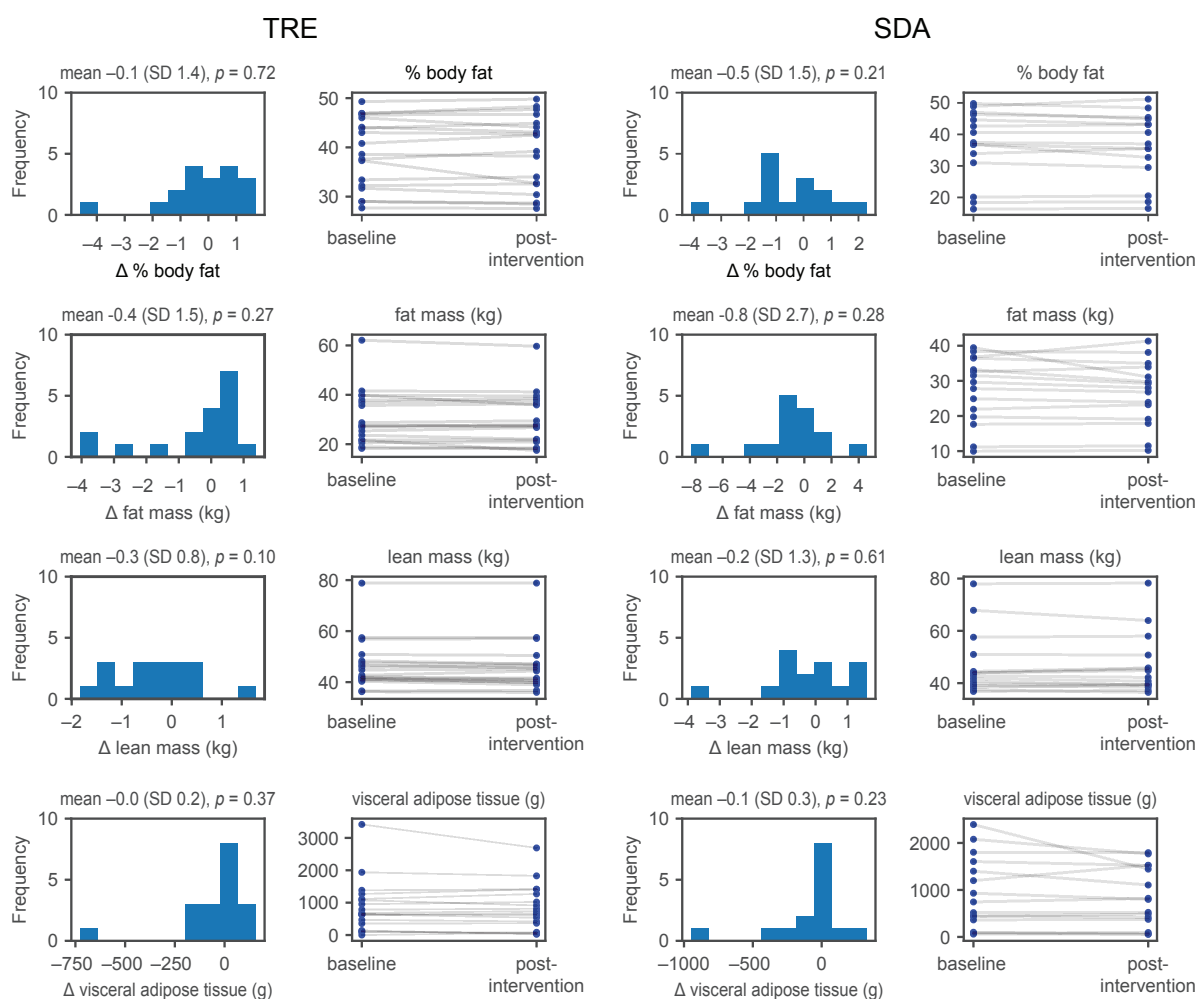
*Legend: Related to the Methods, section 2.2. The number of recorded ingestion events across all participants as a function of clock time.*

**Figure S3. Changes in secondary clinical outcomes after TRE and SDA interventions**



**Legend:** Related to Table 2 & Figure 4. Changes in body mass index (BMI), waist circumference, systolic and diastolic blood pressure (BP), HDL cholesterol, triglycerides, fasting plasma glucose and glycated haemoglobin (HbA1c) after time-restricted eating (TRE, left columns) and standard dietary advice (SDA, right columns). Data are presented as histograms (changes in % from baseline) and individual trajectories pre-/post-intervention. Numbers above each histogram represent the changes (unit on the x-axis) as mean, standard deviation, and p-value.



**Figure S4. Changes in body composition after TRE and SDA interventions**

**Legend:** Related to Figure 4. Changes in body composition by dual energy X-ray absorptiometry, expressed as the body fat percentage (in % points), fat mass (in kg), lean mass (in kg), and visceral adipose tissue (in grams), after time-restricted eating (TRE, left columns,  $n = 18$ ) and standard dietary advice (SDA, right columns,  $n = 15$ ). Data are presented as histograms (changes in % from baseline) and individual trajectories pre-/post-intervention. Numbers above each histogram represent the changes (unit on the x-axis) as mean, standard deviation, and p-value.