**Supplementary methods-GC-MS conditions as well as method performance**

**1. Standard solutions preparation and method validation**

Stock solutions of the 11 fatty acids and an internal standards (heptadecanoic acid) were prepared at 1000.00 μg/mL in methanol. Working solutions were prepared with methanol at concentrations of 1.10–1000.00 μg/mL. All standard solutions were stored at −20℃ until required. Calibration samples were prepared by spiking with 11 different concentrations of fatty acids standards. Limit of detection (LOD) were defined as lowest concentrations with signal-to-noise (S/N) ratios of 10. Repeatability of calibration samples was expressed as coefficients of variation (CV%) and percentage biases (bias%), respectively. The CV was 2.97%-7.73% and the bias was 83.40%-103.80%.

**2. Sample preparation**

Briefly, aliquots (200 μL) of serum were spiked with internal standard (I.S.) working solution (200 μL heptadecanoic acid C17:0 200 μg/mL), and 1 mL 0.05% H2SO4 was then added to deposit protein. The FFA was extracted using 3 mL ethyl acetate and shaking with a vortex mixer for 60 s, then centrifuged at 4,000 × g for 10 min at room temperature. The ethyl acetate phase was evaporated to dryness under N2. Following the addition of 2 mL 10% H2SO4–CH3OH and incubation in a 62℃ water bath for 2 h, 2 mL saturated sodium chloride and 2 mL hexane were sequentially added andmixedfor 60 s to obtain the fatty acidmethyl esters. Samples were evaporated to dryness under N2 gas, and 100 μL hexane was added to each tube prior to analysis

**3. Gas chromatography–mass spectrometry**

GC–MS analysis was performed using a TRACE gas chromatograph with a Polaris Q mass spectrometer (Thermo Finnigan, Austin, TX, USA). Helium was used as the carrier gas. A split injector (the split ratio being 1:10) at 230℃ was used to add the sample (1.0 μL) onto a J&W DB-WAX (30 m × 0.25 mm I.D., 0.25 mm film thickness) capillary column. Fatty acid methyl esters were separated at constant flow with the following oven program: (a) initially 50℃ for 2 min; (b) temperature was increased at a rate of 10℃/min up to 200℃; (c) maintained at 200℃ for 10 min; (d) increased at a rate of 10℃/min up to 220◦C; (e) maintained at 220℃ for 15 min. The transfer line was maintained at 230℃. The ion trap mass spectrometer was operated under electron bomb ionization (EI) mode. Mass spectra of m/z 30–450 were collected by full scan mode with 0.58 s/scan velocity. Solvent delay time was 5 min. The source temperature was 230℃ with the electron energy at 70 eV.

**Table S1** **Composition of diets (g/1000g diets)**

|  |  |  |  |
| --- | --- | --- | --- |
| Ingredient | ND | HSF | LSF |
| Casein | 200 | 200 | 200 |
| L-Cystine | 3 | 3 | 3 |
| Corn Starch | 397.485 | 287.485 | 287.485 |
| Maltodextrin | 132 | 132 | 132 |
| Sucrose | 100 | 100 | 100 |
| Cellulose | 50 | 50 | 50 |
| Soybean Oil | 70 | 30 | 30 |
| Palm oil | 0 | 0 | 150 |
| Lard | 0 | 150 | 0 |
| Mineral Mix | 35 | 35 | 35 |
| Vitamin Mix | 10 | 10 | 10 |
| Choline Bitartrate | 2.5 | 2.5 | 2.5 |
| Antioxidant | 0.015 | 0.015 | 0.015 |
| Total amount | 1000 | 1000 | 1000 |
| Total energy (kJ) | 16558.86 | 18841.34 | 18841.34 |
| Energy from fat (%) | 15 | 36 | 36 |

**Table S2. The changes in the body weight of mice among groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Weeks | NFD | LSF | HSF |
| 0 | 23.03±0.58 | 23.47±0.97 | 23.02±0.73 |
| 1 | 23.02±0.73 | 23.83±0.66 | 23.83±0.87 |
| 2 | 23.57±1.29 | 25.20±0.89 | 25.00±0.66 |
| 3 | 24.35±1.34 | 27.48±1.58\* | 26.73±1.57\* |
| 4 | 25.85±1.23 | 29.83±1.38\* | 29.43±2.43\* |
| 5 | 27.22±1.38 | 31.72±2.06\* | 32.68±2.29\* |
| 6 | 28.33±1.54 | 33.75±1.56\* | 35.43±2.44\*# |
| 7 | 29.62±1.49 | 35.13±1.46\* | 37.15±2.57\*# |
| 8 | 30.73±1.43 | 37.21±1.16\* | 38.95±1.96\*# |
| 9 | 32.10±1.73 | 38.65±0.90\* | 41.33±1.78\*# |
| 10 | 32.90±1.27 | 39.80±1.03\* | 42.09±1.41\*# |

All values are presented as mean ± SEM (n=10). NFD, normal fat diet group; HSF, high stearic acid diet group (C18:0/ C16:0=1:2); LSF, low stearic acid diet group (C18:0/ C16:0=1:8). \* Compared with the NFD group, *P* < 0.05. # Compared with LSF group, *P* < 0.05.

**Table S3 Comparisons of mice body composition among groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Body composition (g) | NFD | LSF | HSF |
| Body weight | 33.34±0.82 | 40.45±1.07\* | 43.6±1.62\*# |
| Muscle mass | 11.38±0.52 | 13.11±0.48 | 13.55±0.45 |
| Fat mass | 1.19±0.45 | 9.13±0.46\* | 11.98±0.52\*# |
| Viceral fat mass | 0.53±0.06 | 4.23±0.08\* | 5.62±0.12\*# |
| Subcutaneous fat mass | 0.66±0.04 | 4.9±0.12\* | 6.35±0.48\*# |

All values are presented as mean ± SEM (n=10). NFD, normal fat diet group; HSF, high stearic acid diet group (C18:0/ C16:0=1:2); LSF, low stearic acid diet group (C18:0/ C16:0=1:8). \* Compared with the NFD group, *P* < 0.05. # Compared with LSF group, *P* < 0.05.

**Table S4 The total body fat ratio and liver fat ratio among groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Fat ratio (%) | NFD | LSF | HSF |
| Total fat ratio | 9.45±0.41 | 41.05±0.52\* | 46.92±0.7\*# |
| Liver fat ratio | 9.38±0.35 | 15.87±0.56\* | 18.34±0.63\*# |

All values are presented as mean ± SEM (n=10). NFD, normal fat diet group; HSF, high stearic acid diet group (C18:0/ C16:0=1:2); LSF, low stearic acid diet group (C18:0/ C16:0=1:8). \* Compared with the NFD group, *P* < 0.05. # Compared with LSF group, *P* < 0.05.

**Table S5 The levels of fasting serum indices in mice among groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Indices | NFD | LSF | HSF |
| Glucose (mmol/L) | 4.5±0.46 | 7.24±1.19\* | 9.35±1.32\*# |
| Insulin (mmol/L) | 11.58±0.39 | 23.96±5.4\* | 33.54±1.8\*# |
| HOMA-IR | 2.27±0.22 | 6.2±0.1\* | 13.53±1.56\*# |
| TC (mmol/L) | 3.21±0.28 | 4.87±0.38\* | 4.91±0.28\* |
| TG (mmol/L) | 0.58±0.1 | 0.71±0.12\* | 0.8±0.14\*# |
| HDL-c (mmol/L) | 2.61±0.2 | 3.65±0.21\* | 3.43±0.25\* |
| LDL-c (mmol/L) | 0.26±0.08 | 0.64±0.11\* | 0.69±0.07\* |
| HDL/LDL | 10.59±0.76 | 5.83±0.75\* | 5.02±0.34\*# |
| TNF-α (pg/mL) | 1.75±0.23 | 2.75±0.11\* | 2.85±0.18\* |
| IL-6 (pg/mL) | 2.91±0.24 | 4.13±0.11\* | 4.48±0.17\*# |

All values are presented as mean ± SEM (n=10). All of the parameters were mesured and calculated in the fasting state. HOMA-IR, Homeostasis model assessment-insulin resistence; TC, total cholesterol; TG, triglyceride; HDL-c: High density lipoprotein cholesterol; LDL-c: Low density lipoprotein cholesterol; IL-6: Interleukin-6; TNF-α: Tumor necrosis factor-α; NFD, normal fat diet group; HSF, high stearic acid diet group (C18:0/ C16:0=1:2); LSF, low stearic acid diet group (C18:0/ C16:0=1:8). *\* P* < 0.05, compared with NFD group; *# P* < 0.05, compared with LSF group.

**Table S6 Liver fatty acids profile in mice among groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Fatty acids (μg/ml) | NFD | LSF | HSF |
| C14:0 | 22.36±7.39 | 31.59±2.01 | 44.63±5.49 |
| C16:0 | 1260.45±141.31 | 2057.52±37.34\* | 2375.92±44.24\*# |
| C16:1 | 291.08±132.97 | 534.38±54.29\* | 615.8±113.6\* |
| C18:0 | 263.65±176.61 | 246.95±12.8\* | 422.27±56.22\*# |
| C18:1 | 924.93±272.74 | 2430.89±59.88\* | 3053.13±327.72\*# |
| C18:2 | 1705.99±246.38 | 1468.52±43.62\* | 1649.87±116.15 |
| γ- C18:3 | 117.19±18.11 | 130±32.39 | 138.43±31.64 |
| C18:3 | 1779.34±379.37 | 528.51±42.73\* | 1046.36±62.25\*# |
| C20:2 | 10.59±1.81 | 7.17±4.59 | 15.84±4.31 |
| C20:4 | 317.03±50.04 | 441.88±4.37\* | 394.99±54.89\* |
| C20:5 | 51.21±15.89 | 23.23±1.02 | 51.62±1.74 |
| saturated fatty acid | 1546.46±496.44 | 2336.06±50.13\* | 2842.82±6.48\*# |
| unsaturated fatty acid | 5197.36±1087.71 | 5564.58±103.18\* | 6966.05±179.44\*# |
| total free fatty acids | 6452.74±1431.13 | 7366.27±1.24\* | 9083.07±59.36\*# |

All values are presented as mean ± SEM (n=10). NFD, normal fat diet group; HSF, high stearic acid diet group (C18:0/ C16:0=1:2); LSF, low stearic acid diet group (C18:0/ C16:0=1:8). \* Compared with the NFD group, *P* < 0.05. # Compared with LSF group, *P* < 0.05.

Fig.S1

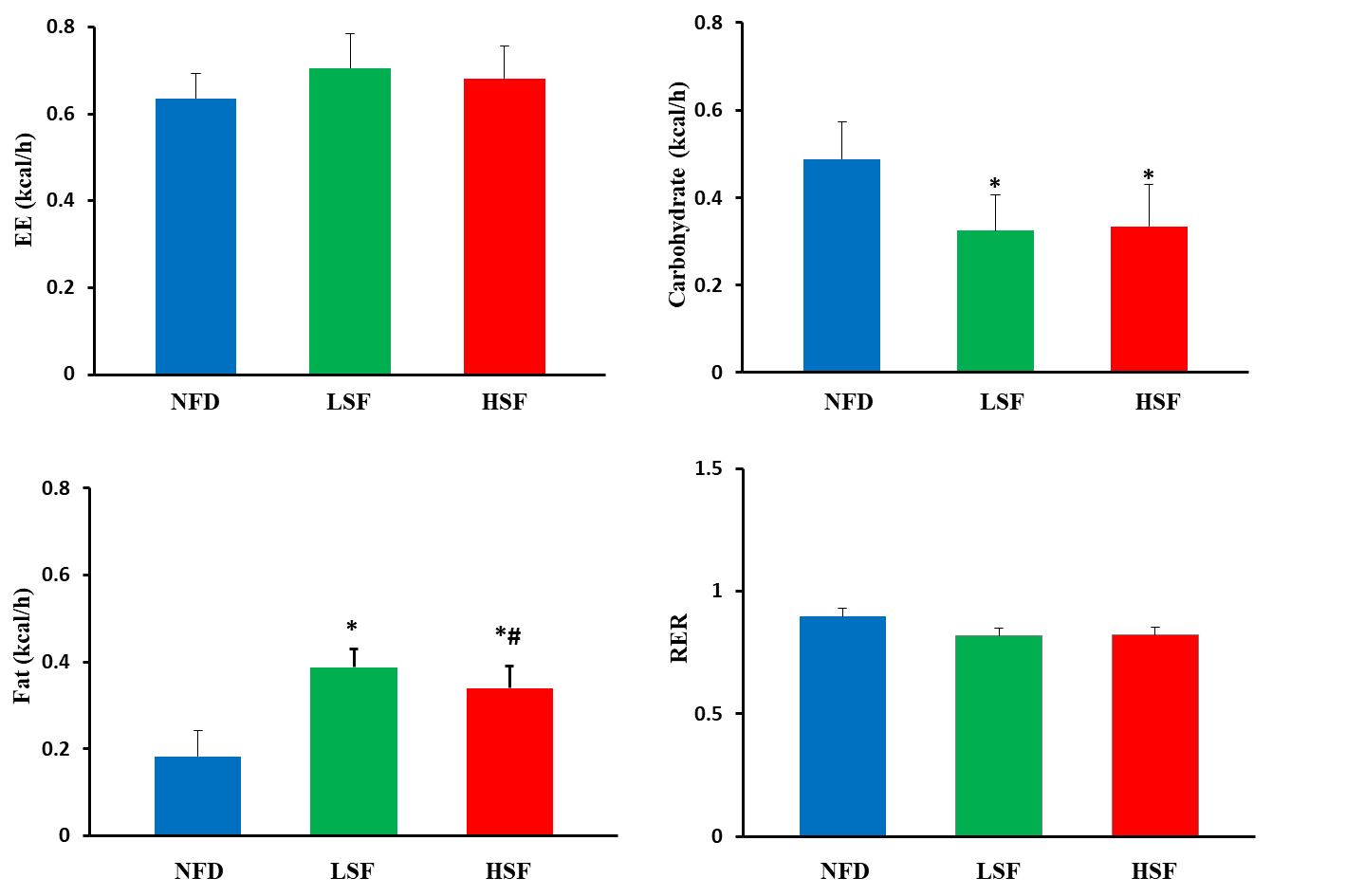


Fig. S2

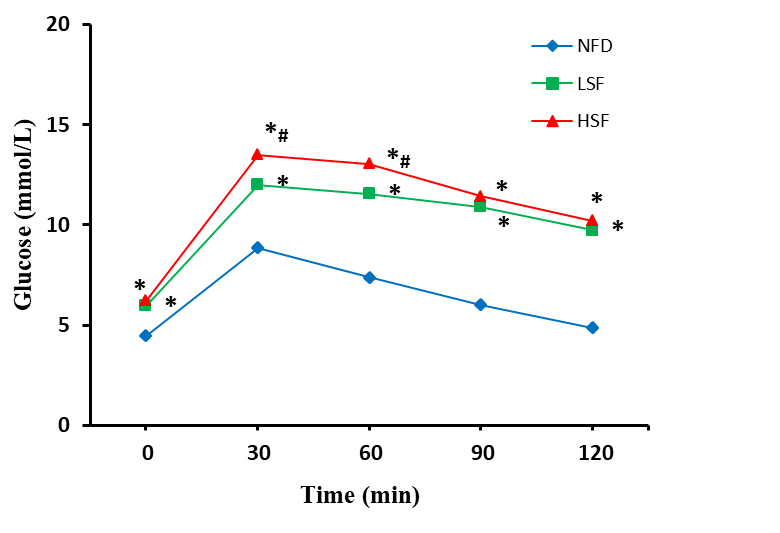


Fig. S3

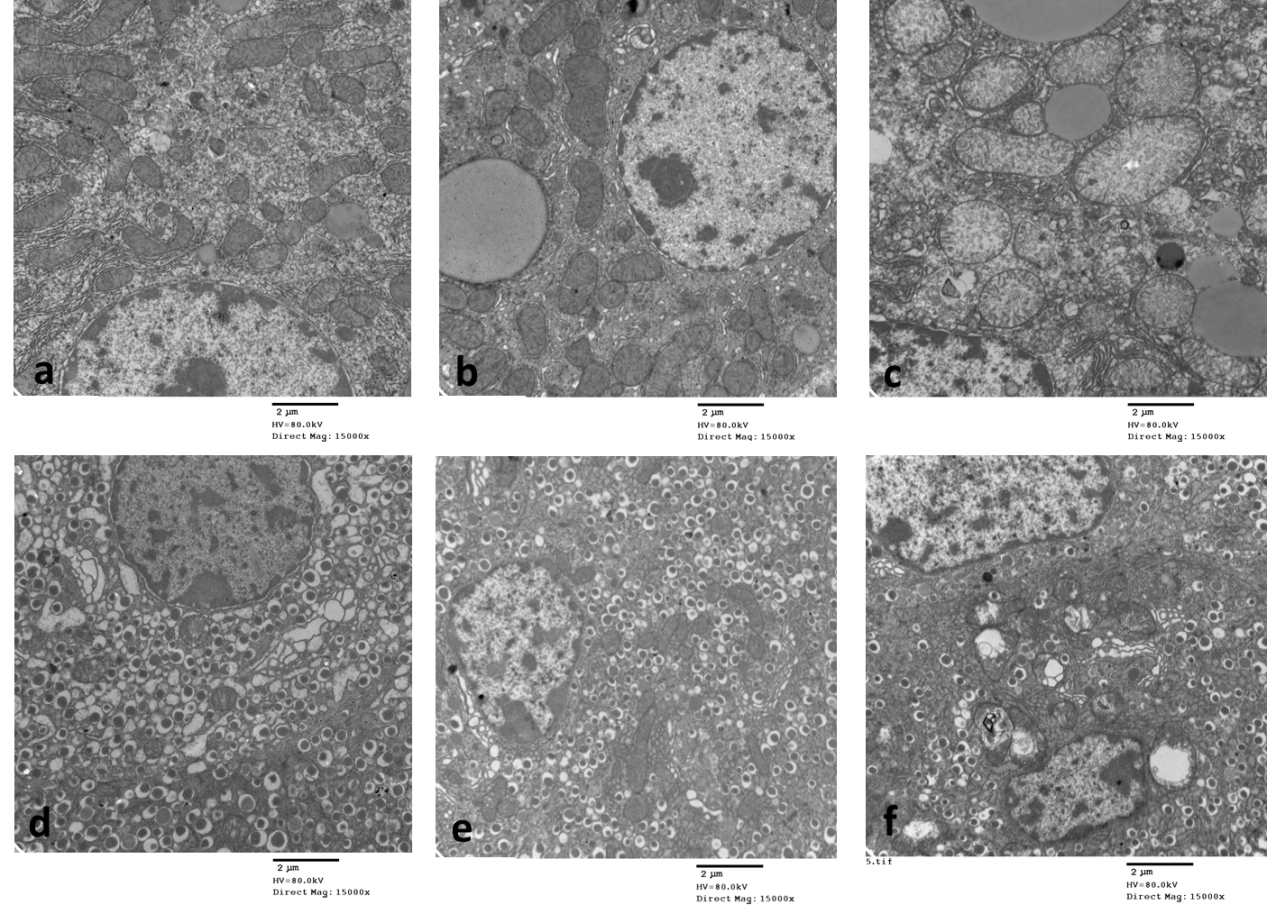


Fig.4S

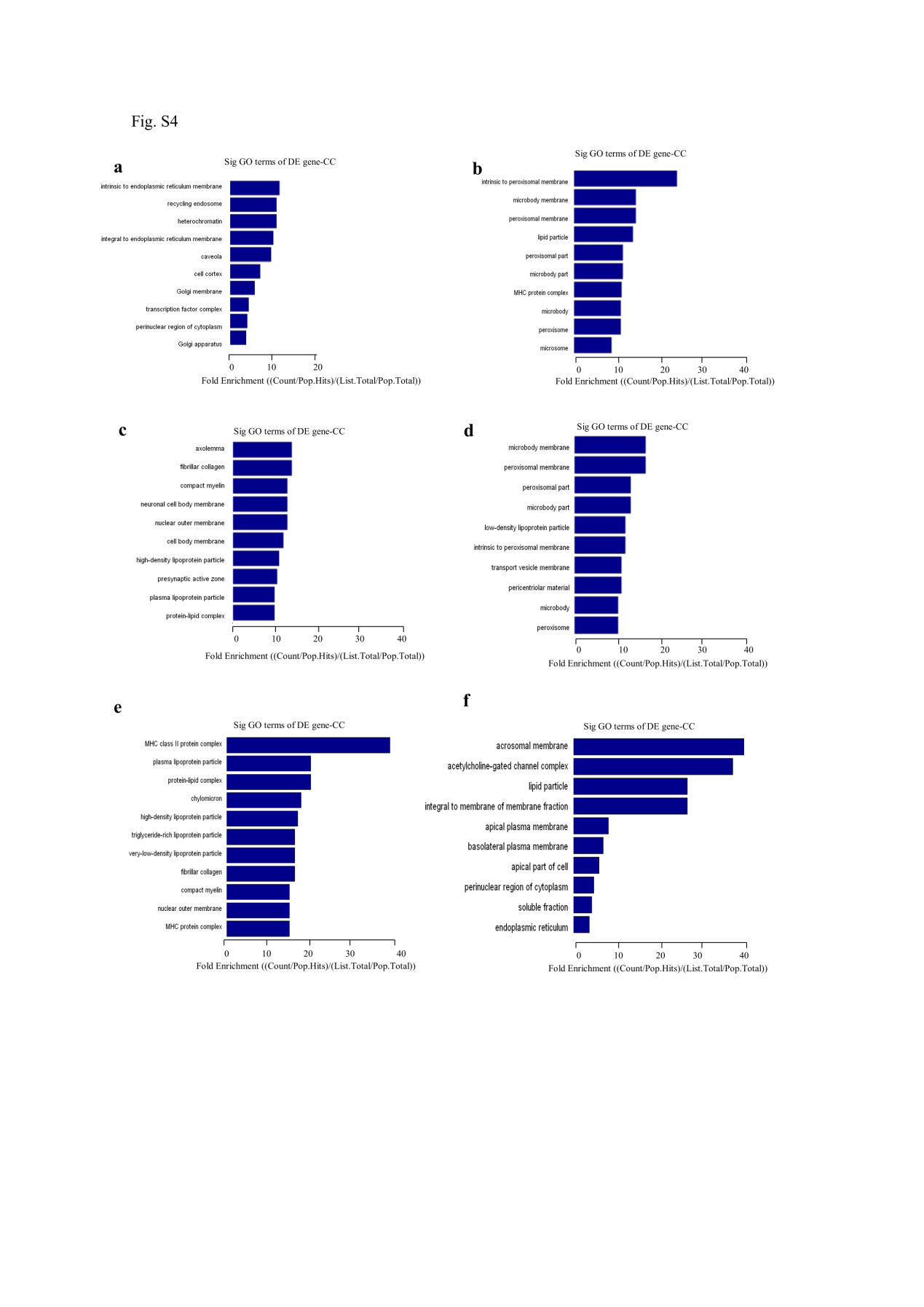


Fig.5S

