

**Supplementary Table S1.** Association of metabolic risk factors and serum vitamin A in Logistic regression analysis in 7-17 years males

| Cardiovascular risk factors | Vitamin A quantiles |                    |                    |                     | <i>p</i> for trend |
|-----------------------------|---------------------|--------------------|--------------------|---------------------|--------------------|
|                             | Q1                  | Q2                 | Q3                 | Q4                  |                    |
| Metabolic syndrome          |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 0.984(0.405-2.392) | 2.238(1.033-4.849) | 5.984(2.997-11.951) | <0.001             |
| Model 2                     | 1(reference)        | 0.939(0.385-2.288) | 2.014(0.912-4.448) | 5.321(2.560-11.060) | <0.001             |
| Central obesity             |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.407(0.938-2.112) | 2.124(1.434-3.147) | 4.014(2.771-5.807)  | <0.001             |
| Model 2                     | 1(reference)        | 1.446(0.959-2.181) | 2.482(1.648-3.738) | 5.357(3.569-8.039)  | <0.001             |
| Elevated blood pressure     |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.179(0.886-1.570) | 1.069(0.797-1.435) | 1.199(0.900-1.598)  | 0.332              |
| Model 2                     | 1(reference)        | 1.285(0.961-1.720) | 1.370(1.005-1.869) | 1.736(1.266-2.382)  | 0.001              |
| Elevated FBG                |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 0.876(0.448-1.711) | 1.396(0.751-2.595) | 0.727(0.359-1.472)  | 0.741              |
| Model 2                     | 1(reference)        | 0.803(0.409-1.579) | 1.058(0.552-2.028) | 0.507(0.239-1.076)  | 0.152              |
| Low HDL                     |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 0.476(0.235-0.967) | 0.526(0.259-1.069) | 1.000(0.559-1.794)  | 0.927              |
| Model 2                     | 1(reference)        | 0.444(0.216-0.912) | 0.389(0.184-0.820) | 0.621(0.324-1.190)  | 0.184              |
| High TG                     |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.200(0.723-1.991) | 1.717(1.056-2.793) | 4.434(2.871-6.850)  | <0.001             |
| Model 2                     | 1(reference)        | 1.253(0.752-2.086) | 1.836(1.111-3.033) | 4.868(2.935-7.480)  | <0.001             |
| General Obesity             |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.037(0.659-1.631) | 1.809(1.185-2.762) | 2.863(1.926-4.257)  | <0.001             |
| Model 2                     | 1(reference)        | 1.112(0.704-1.758) | 2.346(1.510-3.647) | 4.336(2.801-6.713)  | <0.001             |
| High LDL                    |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.810(0.824-3.972) | 1.654(0.733-3.731) | 2.716(1.291-5.712)  | 0.012              |
| Model 2                     | 1(reference)        | 0.915(0.868-4.224) | 2.083(0.904-4.800) | 4.024(1.813-8.931)  | 0.001              |
| High TC                     |                     |                    |                    |                     |                    |

|               |              |                    |                    |                      |        |
|---------------|--------------|--------------------|--------------------|----------------------|--------|
| Model 1       | 1(reference) | 1.575(0.827-2.999) | 1.232(0.618-2.454) | 2.234(1.211-4.119)   | 0.020  |
| Model 2       | 1(reference) | 1.675(0.874-3.211) | 1.600(0.786-3.257) | 3.500(1.800-6.807)   | <0.001 |
| Hyperuricemia |              |                    |                    |                      |        |
| Model 1       | 1(reference) | 1.797(1.282-2.519) | 4.101(2.945-5.710) | 10.076(7.198-14.106) | <0.001 |
| Model 2       | 1(reference) | 1.583(1.086-2.305) | 2.426(1.667-3.530) | 4.924(3.376-7.181)   | <0.001 |

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Model 1 not adjusted; Model 2 adjusted by age, area, screen time, physical activity time. FBG: fast blood glucose, HDL: high-density lipoprotein, TG: triglyceride, LDL: low-density lipoprotein, TC: total cholesterol.

**Supplementary Table S2.** Association of metabolic risk factors and serum vitamin A in Logistic regression analysis in 7-17 years females

| Cardiovascular risk factors | Vitamin A quantiles |                    |                    |                     | <i>p</i> for trend |
|-----------------------------|---------------------|--------------------|--------------------|---------------------|--------------------|
|                             | Q1                  | Q2                 | Q3                 | Q4                  |                    |
| Metabolic syndrome          |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 2.420(0.920-6.367) | 2.489(0.963-6.430) | 4.667(1.897-11.478) | <0.001             |
| Model 2                     | 1(reference)        | 2.488(0.941-6.576) | 2.598(0.995-6.781) | 5.022(1.991-12.671) | <0.001             |
| Central obesity             |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.396(0.887-2.197) | 1.843(1.202-2.825) | 2.576(1.693-3.920)  | <0.001             |
| Model 2                     | 1(reference)        | 1.451(0.918-2.293) | 2.009(1.300-3.106) | 3.041(1.959-4.720)  | <0.001             |
| Elevated blood pressure     |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 0.957(0.713-1.283) | 0.959(0.721-1.277) | 0.929(0.692-1.247)  | 0.646              |
| Model 2                     | 1(reference)        | 1.029(0.763-1.387) | 1.100(0.820-1.477) | 1.167(0.856-1.590)  | 0.290              |
| Elevated FBG                |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.014(0.324-3.173) | 1.219(0.419-3.548) | 2.247(0.845-2.977)  | 0.077              |
| Model 2                     | 1(reference)        | 0.912(0.290-2.873) | 1.057(0.358-3.122) | 1.792(0.651-4.930)  | 0.195              |
| Low HDL                     |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 0.882(0.424-1.835) | 0.790(0.380-1.642) | 0.497(0.210-1.177)  | 0.116              |
| Model 2                     | 1(reference)        | 0.865(0.412-1.816) | 0.770(0.364-1.630) | 0.469(0.192-1.144)  | 0.101              |
| High TG                     |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.786(1.083-2.948) | 2.290(1.422-3.686) | 5.013(3.186-7.889)  | <0.001             |
| Model 2                     | 1(reference)        | 1.825(1.102-3.022) | 2.357(1.453-3.823) | 5.195(3.246-8.314)  | <0.001             |
| General Obesity             |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.396(0.733-2.660) | 1.837(1.005-3.357) | 2.708(1.511-4.853)  | <0.001             |
| Model 2                     | 1(reference)        | 1.493(0.779-2.862) | 2.133(1.151-3.943) | 3.663(1.986-6.756)  | <0.001             |
| High LDL                    |                     |                    |                    |                     |                    |
| Model 1                     | 1(reference)        | 1.867(0.850-4.102) | 1.964(0.912-4.227) | 2.884(1.375-6.049)  | 0.005              |
| Model 2                     | 1(reference)        | 1.968(0.892-4.339) | 2.228(1.025-4.844) | 3.604(1.673-7.763)  | 0.001              |
| High TC                     |                     |                    |                    |                     |                    |

|               |              |                    |                    |                    |        |
|---------------|--------------|--------------------|--------------------|--------------------|--------|
| Model 1       | 1(reference) | 2.197(1.165-4.142) | 2.658(1.446-4.889) | 3.339(1.826-6.105) | <0.001 |
| Model 2       | 1(reference) | 2.183(1.154-4.129) | 2.695(1.455-4.993) | 3.460(1.858-6.443) | <0.001 |
| Hyperuricemia |              |                    |                    |                    |        |
| Model 1       | 1(reference) | 1.718(1.046-2.820) | 3.186(2.024-5.017) | 5.429(3.479-8.471) | <0.001 |
| Model 2       | 1(reference) | 1.599(0.970-2.637) | 2.760(1.741-4.375) | 4.353(2.758-6.869) | <0.001 |

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Model 1 not adjusted; Model 2 adjusted by age, area, screen time, physical activity time. FBG: fast blood glucose, HDL: high-density lipoprotein, TG: triglyceride, LDL: low-density lipoprotein, TC: total cholesterol.