**Supplementary File 1.** Characteristics of included studies in meta-analysis for zinc

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author. year | Country | Study  Type | Group | N | Mean level | SD | Data unit | Sample Type | Treatment | Age(Years/Months,  Mean±SD) | Match |
| Mohamed  et al.2018(7) | Egypt | CS | Atopic asthma\*\* | 30 | 54.94 | 10.38 | μg/dL | Serum | No | 45.23±6.58y |  |
|  |  | Non-atopic asthma\*\* | 30 | 95.77 | 6.81 |  |  |  | 44.9±6.5y |  |
|  |  | Control | 30 | 96.2 | 7.37 |  |  |  |  |  |
| Elevli  et al.2018(14) | Turkey | CS | Asthma | 50 | 81.17 | 26.04 | nmol/L | Serum | NA | 8.66±2.88 y | Age gender |
|  |  | Control | 70 | 87.62 | 32.76 |  |  |  | 9.57±3.09 y |  |
| AbdulWahab  et al.2018(15) | Qatar | CS | Asthma | 40 | 12.69 | 1.8 | μmol/L | Serum | Yes | 7-12y | Age gender |
|  |  | Control | 40 | 13 | 1.52 |  |  |  |  |  |
| Yousef  et al.2017(8) | Egypt | CC | Asthma | 46 | 56.8 | 6 | μg/dL | Serum | Yes | 47±3y |  |
|  |  | Control | 30 | 82.1 | 5.9 |  |  |  | 45±2.3y |  |
| Johnkennedy et al.2017(12) | Nigeria | CC | Asthma | 36 | 81.62 | 39.62 | μg/dL | Serum | No | 10-30y |  |
|  |  | Control | 36 | 87.03 | 21.59 |  |  |  |  |  |
| Bishopp  et al.2017(5) | England | CC | Mild asthma\* | 15 | 0.85 | 0.12 | μg/100mL | Serum | Yes | 34.6y |  |
|  |  | Severe asthma\* | 30 | 0.85 | 0.28 |  |  |  | 41.4y |  |
|  |  | Control | 15 | 0.85 | 0.12 |  |  |  | 37.6y |  |
| Ariaee  et al.2016(16) | Iran | CC | Asthma | 49 | 831 | 120 | μg/L | Serum | NA | 35.6±10y |  |
|  |  | Control | 24 | 910 | 116 |  |  |  | 37.3±11y |  |
| Uysalol  et al.2014(17) | Turkey | CS | Asthma | 73 | 1.3 | 0.28 | NA | Serum | No | 17.4±2.36m |  |
|  |  | Control | 75 | 0.73 | 0.15 |  |  |  | 18.0±2.44m |  |
| Oluwole  et al.2014(13) | Nigeria | CC | Asthma | 37 | 100.6 | 22.8 | μg/mL | Serum | No | 13-14y | Age gender school location |
|  |  | Control | 30 | 106.3 | 24.7 |  |  |  | 13-14y |
| Khanbabaee  et al.2014(30) | Iran | CC | Asthma | 100 | 70.5 | 22.6 | μg/mL | Serum | No | 65±3m | Age sex |
|  |  | Control | 100 | 80.9 | 16.9 |  |  |  | 64±3.1m |  |
| Sagdic  et al.2011(27) | Turkey | CC | Allergic asthma\*\* | 19 | 8.04 | 1.06 | μg/mL | Plasma | Yes | 40.21±12.26y |  |
|  |  | Non-Allergic asthma\*\* | 17 | 7.58 | 1.11 |  |  |  | 38.18±18.10y |  |
|  |  | Control | 36 | 7.75 | 1.2 |  |  |  |  |  |
| Guo  et al.2011(10) | China | CC | Asthma | 25 | 0.68 | 0.09 | μg/mL | Plasma | No | 35±7y | Age and gender |
|  |  | Control | 25 | 0.83 | 0.14 |  |  |  | 38±10y |
| Razi  et al.2011(37) | Turkey | CS | Asthma | 100 | 69.4 | 16.5 | mg/dL | Serum | NA | 27.5±13.4m | Age sex |
|  |  | Control | 116 | 78.9 | 29.9 |  |  |  | 30.5±12.2m |  |
| Urushidate  et al.2010(25) | Japan | CS | Asthma Males | 21 | 10 | 1.8 | ×102 g/L | Serum | NA | 56.5±14.5y |  |
|  |  | Control Males | 364 | 10.1 | 1.9 |  |  |  | 56.5±14.5y |  |
|  |  | Asthma Females | 27 | 10.8 | 1.6 |  |  |  | 57.2±14.0y |  |
|  |  | Control Females | 613 | 9.9 | 2.5 |  |  |  | 57.2±14.0y |  |
| Hussein  et al.2008(38) | Sudan | CC | Asthma | 100 | 1.2 | 0.51 | g/L | Serum | NA | 20-65y | Age sex |
|  |  | Control | 170 | 0.94 | 0.254 |  |  |  | 20-65y |  |
| Kocyigit  et al.2004(31) | Turkey | CC | Asthma | 44 | 765.72 | 167.16 | μg/L | Plasma | Yes | 8.2±4.3y |  |
|  |  | Control | 32 | 775.74 | 106.38 |  |  |  | 7.3±3.3y |  |
| Anetor  et al.2003(26) | Nigeria | CC | Asthma(all) | 50 | 18.4 | 29.7 | μmol/L | Serum | NA | 45±3.0 y | Age |
|  |  | Moderate\* | 36 | 18 | 31.2 |  |  |  |  |  |
|  |  | Severe\* | 14 | 16 | 11.97 |  |  |  |  |  |
|  |  | Males | 19 | 17.2 | 21.66 |  |  |  |  |  |
|  |  | Female | 31 | 18.3 | 33.41 |  |  |  |  |  |
|  |  | Control | 25 | 17.5 | 42 |  |  |  |  |  |
| Picado  et al.2001(32) | Spain | CC | Asthma(all) | 118 | 78 | 173.8 | mg/dL | Serum | Yes | 41.6±15.2y |  |
|  |  | Intermittent\* | 30 | 84 | 76.68 |  |  |  | Na |  |
|  |  | Mild\* | 40 | 77 | 113.84 |  |  |  | Na |  |
|  |  | Moderate\* | 24 | 77 | 78.38 |  |  |  | Na |  |
|  |  | Severe \* | 24 | 75 | 53.89 |  |  |  | Na |  |
|  |  | Control | 121 | 80 | 143 |  |  |  | Na |  |
| Vural  et al.2000(33) | Turkey | CC | Asthma | 40 | 707 | 92.3 | μg/L | Serum | NA | 37.8±14.2y |  |
|  |  | Control | 43 | 816.5 | 164.4 |  |  |  | 36.2±11.7y |  |
| Kadrabova  et al.1996(34) | Slovak | CC | Asthma | 22 | 0.8 | 0.05 | mg/L | Plasma | Yes | 18-70y |  |
|  |  | Control | 33 | 0.89 | 0.11 |  |  |  | 23-70y |  |
| Malvy  et al.1993(35) | France | CC | Asthma Males | 6 | 11.5 | 2.1 | μmol/L | Plasma | Yes | 6-12y | Age |
|  |  | Control Males | 12 | 14.1 | 2.7 |  |  |  | 6-12y |  |
| Di Toro  et al.1987(36) | Italy | CC | Asthma | 11 | 16.2 | 1.7 | μmol/L | Serum | No | 83±32.8m | Age |
|  |  | Control | 19 | 16.2 | 3.5 |  |  |  | 92±34.9m |  |

\*Severe, Mild/Moderate: on behalf of the severity of asthma;

\*\*Asthma classification;

Abbreviation: CC: case-control study; CS: cross-sectional study; SD: standard deviation; NA: not available.