

Supplementary Material

1 Supplementary Tables and Figures

1.1 Supplementary Tables

Supplementary Table S1. Characteristics and key findings of the included studies for systematic review (n=39) and meta-analysis (n=37).

| References | Country/area | Study setting and survey year | Study subjects | Study outcome assessment | Overweight/obesity (%) | Hypertension (%) | Diabetes (%) | Study quality* |
|--|---|--|---|----------------------------------|--|---|--|----------------|
| A Studies reported prevalence of all three outcomes | | | | | | | | |
| 1.Meng QT, 2018 | Sichuan | Community- and Buddhist institute based; 2016-2017 | n=2182 Buddhists n=1384 M (664, 48.0), F (720, 52.0) Age: 45.1±15.6 Adult residents n=798 M (367, 46.0), F (431, 54.0) Age: 45.8±15.4 | Ov/ob: Chinese criteria; HTN; DM | Ov/ob: Buddhists (All 51.4, M 52.6, F 50.3); Adult residents (All 49.3, M 53.7, F 45.6) | Buddhists (All 23.3, M 26.2, F 20.6); Adult residents (All 41.0, M 47.1, F 35.7) | Buddhists (All 1.7, M 1.6); Adult residents (All 8.7, M 10.7, F 7.6) | Good |
| 2.Peng Y, 2018 | Changdu, TAR; Alt: 3500m | Hospital-based; 2016-2017 | n=1253 Tibetans adults M (597, 47.6), F (656, 52.4) Age: mean 52, range 30-94 | Ov/ob: Chinese criteria; HTN; DM | Ov/ob: 53.6 | All 49.8, M 51.2, F 48.5; | 27.0 | Fair |
| 3.Xu SP, 2015 | Changdu, TAR; Alt: 3200-4500m | Community- and Buddhist institute-based; 2010-2011 | n=1659 U (395, 23.8), R (936, 56.4), Buddhist institute (328, 19.8) M (822, 49.5), F (837, 50.5) Age ≥ 18 | Ov/ob: Chinese criteria; HTN; DM | Ov/ob: All 35.6, M 41.1, F 30.1; By Alt <3500m 42.6; ≥3500m 27.1; By residence U 50.4; R 25.5; Buddhist institute 46.9 | All 64.6, M 64.1, F 65.1; By Alt <3500m 68.7; ≥3500m 59.7; By residence U 70.1; R 67.2; Buddhist institute 50.6 | All 6.8, M 7.7, F 5.9; Good By Alt <3500m 8.4; ≥3500m 5.0; By residence U 12.5; R 5.7; Buddhist institute 2.6; | Good |
| 4.Okumiya K, 2015 | Qinghai, China and Ladakh, India; Alt: 2900-4800m | Community-based; 2008-2011 | n=1258 U (632, 50.2), R (626, 49.8) M (541, 43.0), F (717, 57.0) | Ov/ob: WHO criteria; HTN; DM | Ov/ob: All 40.1, M 36.6, F 42.8; By residence U 55.6; R 24.6 | All 40.4, M 42.7, F 38.7; By residence | All 8.9; By residence U 9.5; R 8.3 | Fair |

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|---|---|---|--|---|--------------------------|-----------------------|------|
| Age: 58.0±11.5, 40-87 | | | U 48.8; R 31.9 | | | | |
| 5.Sherpa LY, 2013 | Lhasa, TAR; Alt: 3700m | Community-based; n=692 2010 R residents (623, 90.0) M (317, 45.8), F (375, 54.2) Age: ≥ 30 | Central ob: IDF criteria; HTN; DM | Central ob (All 46.0, M 25.0, F 64.3) | All 32.5, M 32.8, F 32.2 | All 3.9, M 2.5, F 5.0 | Fair |
| 6.Chen W, 2010 | Lhasa and Dangxiong, TAR; NR Alt: 3658-4200m | Community-based; n=1289 Tibetans adults Age: 43.7±14.3 | Ov/ob: Chinese criteria; Central ob: IDF criteria; HTN; DM | Ob (All 16.7, M 19.3, F 14.2) Central ob (All 41.2, M 30.6, F 51.7) | All 38.8, M 45.1, F 32.1 | All 2.9, M 3.1, F 2.5 | Fair |
| B Studies reported prevalence of two types of outcomes | | | | | | | |
| 7.Chen YM, 2020 | Gannan, Gansu; Alt: 3000-4900m | Kindergartens-based; 2018-2019 n=2364 Preschoolers M (1226, 51.9), F (1138, 48.1) Age: 3.9±1.2 | Ov/ob: WHO criteria in 2006; HTN | Ov/ob (All 2.3, M 2.7, F 1.8) | All 4.6, M 6.1, F 2.9 | NR | Fair |
| 8.Deng, RD, 2020 | TAR | Based on the 2018 Sixth National Health Service Survey of TAR; 2018 n=10493 Tibetans adults U (2186, 20.8), R (8307, 79.2) M (4921, 46.9), F (5572, 53.1) Age: 44.1±15.7 | HTN; DM | NR | 14.4 | 0.9 | Fair |
| 9.Ci RWM, 2020 | Lhasa, TAR | Community-based; 2016-2017 n=1798 U (1390, 77.3), R (408, 22.7) M (582, 32.4), F (1216, 67.6) Age: ≥18 | Ov/ob: Chinese criteria; Central ob: WGOC criteria; HTN | Ov/ob (All 60.9, M 76.2, F 53.6) Central ob (All 41.8, M 51.7, F 37.0) | All 25.7, M 35.1, F 21.2 | NR | Fair |
| 10.Zhang H, 2020 | Lhasa, TAR | Community-based; 2017 n=1053 Tibetans adults M: (390, 37.0), F: (663, 63.0) Age: 47.9±13.5, ≥18 | Ob: Chinese criteria; HTN | Ob (All 31.4, M 31.5, F 31.4) | All 30.7, M 37.9, F 26.4 | NR | Fair |
| 11.Huang YS, 2019 | Diqing, Yunnan | Community-based; 2012-2013 n=1379 Tibetans adults | Ov/ob: Chinese criteria; Central ob: WGOC criteria; HTN | Ov/ob 45.6 Central ob 39.4 | 35.0 | NR | Poor |

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|-------------------|--|---|--|---|---|--|-----|------|
| 12.Sun PF, 2019 | Lhasa, TAR | Community-based; n=1486 NR | Tibetans adults M (548, 36.9), F (938, 63.1) Age: ≥18 | HTN; DM | NR | 27.0 | 3.3 | Fair |
| 13.Ye ZZ, 2018 | Tianzhu and Gannan, Gansu; Alt: 1100-4900m; Lhasa and Shigatse, TAR; Alt: 3650-3860m | Community-based; n=916 2014-2016 | Ob: Chinese criteria; HTN U (322, 35.2), R (594, 64.8) M (469, 51.2), F(447, 48.8) Age: 46.2±12.1, 18-82 Alt: ≥3000m (407, 44.4), <3000m (509, 55.6) | | Ob 30.7 | All 45.0, M 41.4, F 48.8; By Alt ≥3000m 41.4; <3000m 39.9; By residence U 75.5; R 28.5 | NR | Fair |
| 14.Liu K, 2018 | Ganzi, Sichuan | Buddhist institute-based; 2013-2014 | n=594 Buddhists M (310, 52.2), F (284, 47.8) Age: 41.9±15.5, >18 | HTN; DM | NR | 19.4 | 2.7 | Good |
| 15.Li K, 2017 | Lhasa, TAR | Hospital-based; 2009-2011 | n=5478 Tibetans undergoing check-up M (3296, 60.2), F (2182, 39.8) Age: 41.9±13.9 | Ov/ob: CDS Criteria; HTN | Ov/ob (All 40.2, M 45.0, F 33.8) | All 24.4, M 28.0, F 18.9 | NR | Poor |
| 16.Huang XB, 2016 | Sichuan; Alt: 2500–4000m | Community-based; 2013-2014 | n=3230 U (2174, 67.3), R (1056, 32.7) M (1503, 46.5), F (1727, 53.5) Age: mean 43.78, range 15-92 | Ov/ob: WHO criteria; Central WGOC criteria; HTN | Ov/ob 17.8 Central ob 13.9 | All 45.7, M 47.4, F 45.7; By residence U 48.0; R 41.0 | NR | Fair |
| 17.Zhuoma C, 2015 | Xiahe, Gansu; Alt: 3700m | Community-based; 2012-2013 | n=1069 U (293, 27.4), R (776, 72.6) M (407, 38.1), F (662, 61.9) Age: ≥18 | Ov/ob: WHO criteria; HTN | Ov/ob 40.0 | All 34.1, M 45.5, F 27.0; By residence U 26.3; R 37.0 | NR | Fair |
| 18.Li XH, 2015 | Gannan Tibetan Autonomous Prefecture, Gansu; Alt: 3000m. | Community- and Buddhist institute-based; 2014 | n=2026 Buddhists n=984 Age: 41.7±9.2, 18-70 Adult residents n=1042 Age: 42.0±8.8, 18-70 | Ov/ob: Chinese criteria; HTN | Ov/ob: Buddhists 21.5 Adult residents 34.8 | Buddhists 19.3 Adult residents 34.1 | NR | Fair |

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|---------------------------------------|---------------------------|---|---|--|--|--|------|------|
| 19. Zhu CK, 2014 | Yushu and Guoluo, Qinghai | Hospital-based; 2009-2011 | n=25491 R residents (Pastoralists) M (15230, 59.7), Age: 18-77, 49.4±6.8 F (10261, 40.3), Age: 18-81, 54.2±8.7 | HTN; DM | NR | All 38.6, M 42.6, F 32.7 | 22.4 | Fair |
| 20. Zheng X, 2013 | Lhasa, TAR; Alt: 3650m | Community-based; 2010 | n=1370 U (875, 63.9), R (495, 36.1) M (545, 39.8), F (825, 60.2) Age: ≥18 | Ov/ob: WHO criteria; HTN | Ov/ob 20.1 | All 51.2, M 56.0, F 48.0; | NR | Good |
| 21. Lai SR, 2011 | Nyingchi, TAR; Alt: 3000m | School-based; 2010 | n=2777 Tibetan students M (1302, 46.9), F (1475, 53.1) Age: 7-18 | Ov/ob: WGOC criteria in 2005; HTN | Ov/ob: All 13.9, M 7.2, F 19.8 | By residence U 55.1; R 44.2 All (n=1712) 2.9, M (n=871) 3.4, F (n=841) 2.3 | NR | Poor |
| C Studies reported one outcome | | | | | | | | |
| (a) Obesity | | | | | | | | |
| 22. Chen XM, 2020 | Lhasa, TAR | School-based; 2019 | n=1246 Middle school students M (642, 51.5), F (604, 48.5) Age: 14.2±1.7 | Ov/ob: WGOC criteria in 2004 | Ov/ob (All 15.9, M 20.4, F 11.3) | NR | NR | Good |
| 23. Li TX, 2020 | Aba, Sichuan | Community-based; 2018-2019 | n=2216 U (1102, 49.7), R (1114, 50.3) M (1307, 59.0), F (909, 41.0) Age: 45.0±14.0, 18-80 | Ov/ob: NR; Central ob: IDF criteria | Ov/ob 37.7 Central ob: All 46.3, M 59.6, F 27.2; By residence U 44.8; R 49.2 | NR | NR | Fair |
| 24. Shi CL, 2020 | Aba and Ganzi, Sichuan | School-based; 2018 | n=1921 Tibetan students Age: 7-18 | Ov/ob: WGOC criteria in 2004 | Ov/ob (All 16.6, M 15.4, F 17.8) | NR | NR | Poor |
| 25. Peng W, 2020 | Golmud, Qinghai | Urbanized settled Tibetan community- and school-based; 2018 | n=1431 Adults n=927 M (422, 45.5), F (505, 54.5) Age: 43.3±13.9, 18-90 Children n=504 M (244, 48.4), F (260, 51.6) | Ov/ob: For child: WHO criteria in 2007 For Adult: Chinese criteria Central ob for Adult: WGOC criteria | Ov/ob: Children (All 24.0, M 23.4, F 24.6); Adults (All 61.4, M 61.6, F 61.2) Central ob: Adults (All 62.0, M 59.2, F 64.4) | NR | NR | Fair |

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|-------------------------|---|--|--|---|---------------------------------------|--|----|------|
| Age: 9.4±2.2, 5.8-15.9 | | | | | | | | |
| 26.Zhang ML, 2019 | Changdu, TAR; Alt: 3000-4000m | School-based; 2015 | n=979 Tibetan students M (530, 54.1), F (449, 45.9) Age: 6-14 | Ov/ob: WHO criteria in 2007 | Ov/ob (All 21.8, M 21.9, F 21.7) | NR | NR | Fair |
| 27.Xu RB, 2017 | Lhasa, TAR | School-based: data from six waves of CNSSCH; Latest 2014 | n=2418 Tibetan Students M (1214, 50.2), F (1204, 49.8) Age: 7-18 | Ov/ob: Chinese criteria for child in 1985 | Ov/ob (All 16.4, M 18.5, F 14.2) | NR | NR | Poor |
| 28.Yao YL, 2010 | Yushu, Qinghai | Hospital-based; NR | n=690 Tibetan civil servants M (458, 66.4), F (232, 33.6) Age: 38.0±14.0, 17-75 | Central ob: IDF criteria | Central ob (All 40.6, M 32.9, F 55.6) | NR | NR | Fair |
| (b) Hypertension | | | | | | | | |
| 29.Lu CL, 2020 | Nagqu, TAR; Alt: 4700-5100m | Community-based; 2020 | n=729 R residents (Pastoralists) M (290, 39.8), F (439, 60.2) Age: 18-87 | HTN | NR | All 13.6, M 18.7, F 10.2 | NR | Poor |
| 30.Song C, 2020 | TAR: Bomi, Nyingchi; Alt: 2700-3035m; Dagze, Lhasa; Alt: 3719-3970m; Nagarze, Lhokha; Alt: 4462-4505m | Community-based; 2017 | n=1631 R residents M (614, 37.6), F (1017, 62.4) Age: 20-80 Alt 2700-3035m (542, 33.2), 3719-3970m (543, 33.3), 4462-4505m (546, 33.5) | HTN | NR | All 40.3; By Alt 2700-3035m 53.0; 3719-3970m 42.0; 4462-4505m 26.2 | NR | Good |
| 31.Xu T, 2016 | Sichuan and Yunnan | Community-based; 2007-2011 | n=885 Tibetans adults Age: 18-79 | HTN | NR | 15.6 | NR | Fair |

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|---------------------|---|--|---------------|----|---|---|------|
| 32.Liao AX, 2015 | Qiongjie, TAR; Alt: 3700m | Community-based; n=15243 2014 R residents (Farmers) M (7432, 48.8), F (7811, 51.2) Age: ≥18 | HTN | NR | All 9.7, M 13.0, F 6.6 | NR | Fair |
| 33.Xu T, 2015 | Sichuan and Yunnan | Community-based; n=867 2007-2011 Tibetans children and adolescents Age: 8-18 | HTN | NR | 1.5 | NR | Fair |
| 34.Pan MQ, 2014 | Liangshan, Sichuan; Low Alt: 1500-2500m, High Alt: 3000-4000m | Community-based; n=2590 NR Low Alt (1261, 48.7), high Alt (1329, 51.3) Age: 30-70 | HTN | NR | All 8.4; By Alt Low Alt 14.3; High Alt 2.2 | NR | Fair |
| 35.Li XH, 2012 | Gannan, Gansu; Altitude: 3000 m | Community-based; n=6948 2010 U (3340, 48.1), R (3608, 51.9) M (4246, 61.1), F (2702, 38.9) Age: ≥18 | HTN | NR | All 24.6, M 25.0, F 23.9; By residence U 25.3; R 23.8 | NR | Good |
| (c) Diabetes | | | | | | | |
| 36.Li YZ, 2020 | China | Community-based, n=2034 national representative survey (TIDE study); 2015-2017 Tibetans adults Age: ≥18 | DM and Pre-DM | NR | NR | DM 6.5 Pre-DM 34.4 | Fair |
| 37.Zhang ZX, 2019 | Lhasa, TAR; Altitude: 3680m | Community-based; n=2603 2017-2018 U (1816, 69.8), R (787, 30.2) M (951, 36.5), F (1652, 63.5) Age: 42.9±15.8 | DM and Pre-DM | NR | NR | DM 4.4 By residence U 4.2; R 4.8 Pre-DM 7.0 By residence U 5.6; R 10.2 | Fair |
| 38.Chen N, 2019 | Lhasa, TAR | Community-based; n=1379 NR Tibetans adults M (899, 65.2), F (480, 34.8) Age: 43.9± 15.0, 18-75 | Pre-DM | NR | NR | Pre-DM (All 8.1, M 5.1, F 13.7) | Fair |

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|---------------------------|--|--|---------------|----|----|--|
| 39.Wang LM, China 2017 | Community-based, n=3103 national representative survey (CCDRFS study); 2013 | Tibetans adults M (1328, 42.8), F (1775, 57.2) Age: ≥18 | DM and Pre-DM | NR | NR | DM (All 4.3, M 4.7, Fair F 3.9) Pre-DM (All 31.3, M 31.8, F 30.9) |
|---------------------------|--|--|---------------|----|----|--|

Abbreviations: ADA: American Diabetes Association; Alt: Altitude; BAZ: z-scores of body mass index-for-age; BMI: Body mass index; CCDRFS: China Chronic Disease and Risk Factors Surveillance; CDS: Chinese Diabetes Society; CNSSCH: Chinese National Survey on Students Constitution and Health; DBP: Diastolic blood pressure; ESC: European Society of Cardiology; ESH: European Society of Hypertension; F: Female; FPG: Fasting plasma glucose; IDF: International Diabetes Federation; JNC: Joint National Committee; M: Male; NR: Not report; Ob: Obesity; OGTT: Oral Glucose Tolerance Test; Ov: Overweight; R: Rural; SD: Standard deviation; SBP: Systolic blood pressure; TAR: Tibet Autonomous Region; TIDE: Thyroid disorders, Iodine status and Diabetes Epidemiological; U: Urban; WC: Waist circumference; WGOC: Working Group on Obesity in China; WHO: World Health Organization.

Classification of overweight and obesity: Chinese criteria: overweight ($24.0 \leq \text{BMI} < 28.0 \text{ kg/m}^2$), obesity ($\text{BMI} \geq 28.0 \text{ kg/m}^2$); WHO criteria: overweight ($25.0 \leq \text{BMI} < 30.0 \text{ kg/m}^2$), obesity ($\text{BMI} \geq 30.0 \text{ kg/m}^2$); CDS Criteria: overweight and/or obesity ($\text{BMI} \geq 25.0 \text{ kg/m}^2$); WGOC criteria in 2004/2005 for child: Chinese sex-age-specific BMI cutoff points for individuals aged 7–17 years; WHO criteria in 2006 for child: overweight (85th percentile of sex-age-specific BMI $\leq \text{BMI} < 95$ th percentile of sex-age-specific BMI, Obesity (≥ 95 th percentile of sex-age-specific BMI); WHO criteria in 2007 for child: overweight ($1 < \text{BAZ} \leq 2$), obesity ($\text{BAZ} > 2$); Chinese criteria for child in 1985: Take the 80th percentile weight of the same height group as the standard weight, overweight ($10\% \leq \text{the standard weight} \leq 20\%$), obesity ($\geq 20\%$ of the standard weight).

Classification of central obesity: IDF criteria: men ($\text{WC} \geq 90 \text{ cm}$), women ($\text{WC} \geq 80 \text{ cm}$); WGOC criteria: men ($\text{WC} \geq 85 \text{ cm}$), women ($\text{WC} \geq 80 \text{ cm}$).

Classification of hypertension: Chinese Guidelines for the Management of Hypertension (2009 Basic Edition/ 2010/2018 revised edition) ;The JNC 7 criteria/The JNC 8 criteria; ESH/ESC guidelines; CDS Criteria; 2007 European Society of Cardiology guidelines for the management of arterial hypertension: $\text{SBP} \geq 140 \text{ mmHg}$ and/or $\text{DBP} \geq 90 \text{ mmHg}$, or use of antihypertensive medication or self-reported diagnosis of high blood pressure and use of antihypertensive medication; Chinese criteria for Adolescents: average SBP and/or DBP levels $\geq 95\%$ of the same sex, age and height.

Classification of diabetes and pre-diabetes: Chinese Guidelines for the Management of Type 2 Diabetes; ADA criteria; WHO criteria: diabetes (self-reported diabetes and/or $\text{FPG} \geq 7.0 \text{ mmol/L}$ and/or two-hour plasma glucose $\geq 11.1 \text{ mmol/L}$), pre-diabetes (among participants without diabetes: $\text{FPG} 5.6 \text{ mmol/L}$ to 6.9 mmol/L and/or OGTT: two-hour plasma glucose 7.8 mmol/L to 11.0 mmol/L).

*: Quality assessment for studies is shown in Supplementary Table 2.

Supplementary Table S2. Study quality assessment for the included 39 studies.

| Studies | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Total | Quality rating |
|--------------------|-----|-----|-----|-----|-----|----|----|-----|-----|----|-----|----|----|-----|-------|----------------|
| 1. Meng QT; 2018 | Yes | Yes | Yes | Yes | No | No | No | NA | Yes | No | Yes | NA | NA | Yes | 7 | Good |
| 2. Peng Y; 2018 | Yes | Yes | NR | Yes | No | No | No | NA | Yes | No | Yes | NA | NA | No | 5 | Fair |
| 3. Xu, SP; 2015 | Yes | Yes | Yes | Yes | No | No | No | Yes | Yes | No | Yes | NA | NA | Yes | 8 | Good |
| 4. Okumiya K; 2015 | Yes | Yes | NR | No | No | No | No | Yes | Yes | No | Yes | NA | NA | Yes | 6 | Fair |
| 5. Sherpa LY; 2013 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |
| 6. Chen W; 2010 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |
| 7. Chen YM; 2020 | Yes | Yes | NR | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 4 | Fair |
| 8. Deng, RD; 2020 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | No | NA | NA | No | 4 | Fair |
| 9. Ci RWM; 2020 | Yes | Yes | NR | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 4 | Fair |
| 10. Zhang H; 2020 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |
| 11. Huang YS; 2019 | Yes | Yes | NR | No | No | No | No | NA | NA | No | Yes | NA | NA | No | 3 | Poor |
| 12. Sun PF; 2019 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |
| 13. Ye ZZ; 2018 | Yes | Yes | NR | No | No | No | No | NA | Yes | No | Yes | NA | NA | No | 4 | Fair |
| 14. Liu, K; 2018 | Yes | Yes | Yes | Yes | No | No | No | Yes | Yes | No | Yes | NA | NA | Yes | 8 | Good |
| 15. Li K; 2017 | Yes | Yes | NR | No | No | No | No | NA | NA | No | Yes | NA | NA | No | 3 | Poor |
| 16. Huang XB; 2016 | Yes | Yes | Yes | Yes | No | No | No | Yes | No | No | Yes | NA | NA | No | 6 | Fair |
| 17. Zhuoma C; 2015 | Yes | Yes | NR | No | No | No | No | Yes | Yes | No | Yes | NA | NA | No | 5 | Fair |
| 18. Li, XH; 2015 | Yes | Yes | Yes | No | No | No | No | Yes | Yes | No | Yes | NA | NA | No | 6 | Fair |
| 19. Zhu CK; 2014 | Yes | Yes | NR | No | No | No | No | NA | Yes | No | Yes | NA | NA | No | 4 | Fair |
| 20. Zheng X; 2013 | Yes | Yes | Yes | Yes | No | No | No | Yes | Yes | No | Yes | NA | NA | No | 7 | Good |
| 21. Lai SR; 2011 | Yes | Yes | NR | No | No | No | No | NA | NA | No | Yes | NA | NA | No | 3 | Poor |
| 22. Chen XM; 2020 | Yes | Yes | Yes | Yes | No | No | No | Yes | Yes | No | Yes | NA | NA | No | 7 | Good |
| 23. Li TX; 2020 | Yes | Yes | NR | Yes | No | No | No | Yes | Yes | No | Yes | NA | NA | No | 6 | Fair |
| 24. Shi CL; 2020 | Yes | Yes | NR | No | No | No | No | NA | NA | No | Yes | NA | NA | No | 3 | Poor |
| 25. Peng W; 2020 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |
| 26. Zhang ML; 2019 | Yes | Yes | NR | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 4 | Fair |
| 27. Xu RB; 2017 | Yes | Yes | NR | No | No | No | No | NA | NA | No | Yes | NA | NA | No | 3 | Poor |
| 28. Yao YL; 2010 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |
| 29. Lu CL; 2020 | Yes | Yes | Yes | No | No | No | No | NA | NA | No | No | NA | NA | No | 3 | Poor |
| 30. Song C; 2020 | Yes | Yes | Yes | Yes | Yes | No | No | Yes | Yes | No | Yes | NA | NA | Yes | 9 | Good |
| 31. Xu, T; 2016 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |
| 32. Liao AX; 2015 | Yes | Yes | Yes | No | No | No | No | NA | NA | No | Yes | NA | NA | No | 4 | Fair |
| 33. Xu, T; 2015 | Yes | Yes | NR | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 4 | Fair |
| 34. Pan MQ; 2014 | Yes | Yes | NR | No | No | No | No | NA | Yes | No | Yes | NA | NA | No | 4 | Fair |
| 35. Li, XH; 2012 | Yes | Yes | Yes | No | No | No | No | Yes | Yes | No | Yes | NA | NA | Yes | 7 | Good |
| 36. Li YZ; 2020 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | Yes | 6 | Fair |
| 37. Zhang ZX; 2019 | Yes | Yes | NR | Yes | No | No | No | NA | NA | No | Yes | NA | NA | Yes | 5 | Fair |
| 38. Chen N; 2019 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |
| 39. Wang LM; 2017 | Yes | Yes | Yes | Yes | No | No | No | NA | NA | No | Yes | NA | NA | No | 5 | Fair |

Abbreviations: NR: Not report; NA: Not applicable.

Based on the US National Institute of Health (NIH) recommendation, the quality of each study was assessed according to the following 14 questions. The full score was 14. Total score ≥ 7 was rated good; 4-7, fair; and <4 , poor.

1. Was the research question or objective in this paper clearly stated?
2. Was the study population clearly specified and defined?
3. Was the participation rate of eligible persons at least 50%?
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?
5. Was a sample size justification, power description, or variance and effect estimates provided?
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
10. Was the exposure(s) assessed more than once over time?
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
12. Were the outcome assessors blinded to the exposure status of participants?
13. Was loss to follow-up after baseline 20% or less?
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?

Supplementary Table S3. The Egger's test for publication bias of the included studies for overweight/obesity, diabetes and hypertension.

| | Std. eff. | Coef. | Std. err. | <i>t</i> | <i>P> t </i> | 95% CI |
|--|-----------|--------|-----------|----------|-----------------|--------------------|
| Overweight and obesity (Chinese criteria) | Slope | 0.003 | 0.303 | 0.02 | 0.993 | (-0.776, 0.781) |
| | Bias | 38.226 | 25.084 | 1.52 | 0.188 | (-26.255, 102.708) |
| Overweight and obesity (WHO criteria) | Slope | 0.232 | 0.188 | 1.23 | 0.306 | (-0.367, 0.831) |
| | Bias | 7.648 | 21.118 | 0.36 | 0.741 | (-59.559, 74.854) |
| Diabetes | Slope | 0.010 | 0.025 | 0.38 | 0.709 | (-0.045, 0.065) |
| | Bias | 13.315 | 9.106 | 1.46 | 0.172 | (-6.726, 33.356) |
| Hypertension | Slope | 0.139 | 0.042 | 3.32 | 0.003 | (0.052, 0.226) |
| | Bias | 16.514 | 6.466 | 2.55 | 0.018 | (3.137, 29.891) |

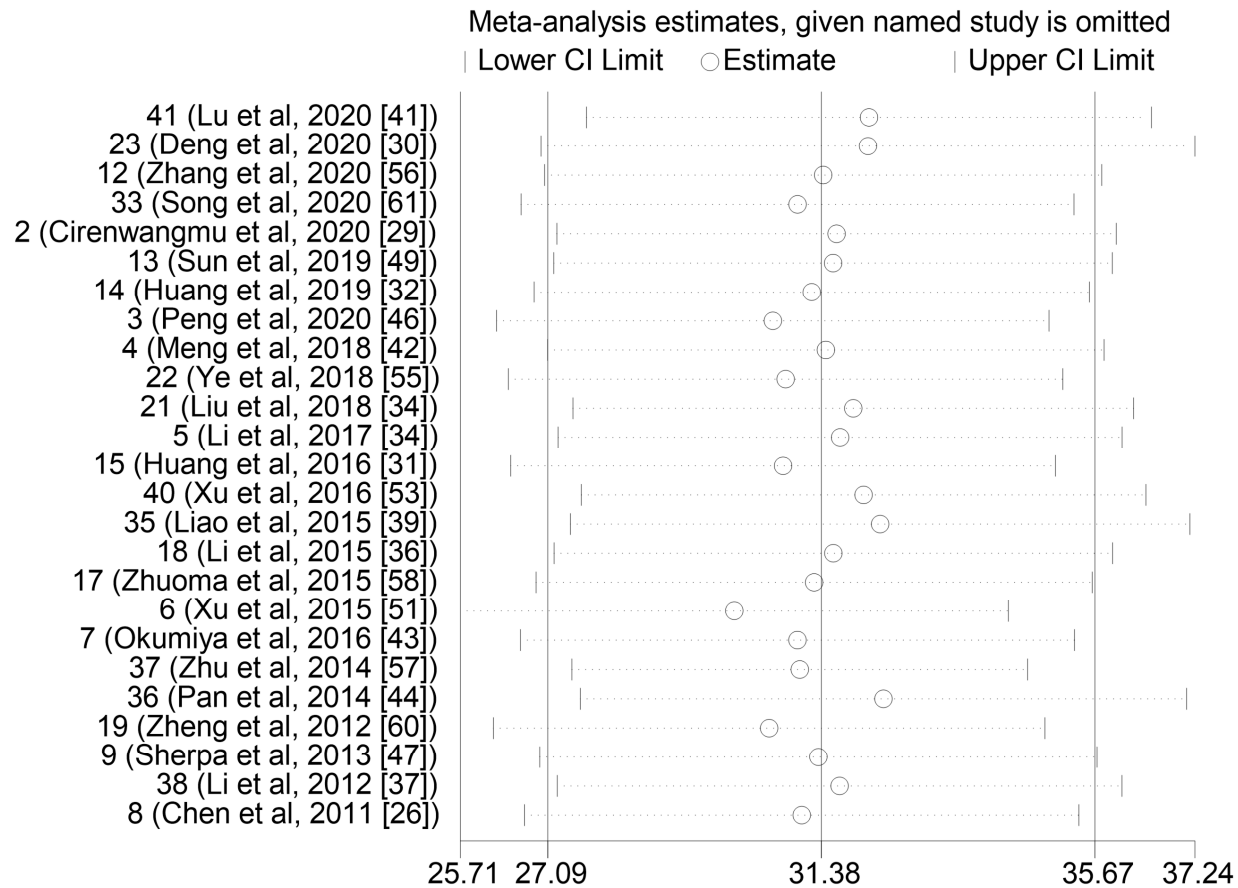
Supplementary Table S4. Subgroup meta-analysis of pooled prevalence (%; 95%CI) estimates of overweight/obesity, hypertension and diabetes among Tibetan population based on the included studies.

| Groups | Overweight and obesity | | | Central obesity | | | Hypertension | | | Diabetes | | |
|---------------------------|------------------------|------------------------|-----------------------|-----------------|------------------------|-----------------------|----------------|------------------------|-----------------------|----------------|------------------------|-----------------------|
| | No. of studies | Prevalence (%; 95% CI) | Heterogeneity P value | No. of studies | Prevalence (%; 95% CI) | Heterogeneity P value | No. of studies | Prevalence (%; 95% CI) | Heterogeneity P value | No. of studies | Prevalence (%; 95% CI) | Heterogeneity P value |
| Adults (≥ 18 years) | | | | | | | | | | | | |
| Men | 4 | 57.7 (44.5, 71.0) | <0.001 | 3 | 39.2 (19.2, 59.1) | <0.001 | 16 | 38.4 (30.7, 46.0) | <0.001 | 4 | 4.9 (3.3, 6.6) | <0.001 |
| Women | 4 | 48.2 (34.5, 62.0) | <0.001 | 3 | 48.9 (22.5, 75.3) | <0.001 | 16 | 32.4 (25.2, 39.6) | <0.001 | 4 | 4.6 (3.8, 5.4) | <0.001 |
| Urban areas | * | * | * | * | * | * | 7 | 49.5 (37.1, 62.0) | <0.001 | 3 | 8.7 (3.8, 13.7) | <0.001 |
| Rural areas | * | * | * | * | * | * | 10 | 33.5 (22.9, 44.1) | <0.001 | 3 | 6.3 (4.6, 7.9) | 0.034 |
| Buddhist institute | * | * | * | * | * | * | 4 | 27.0 (21.5, 32.4) | <0.001 | 3 | 2.3 (1.6, 3.1) | 0.314 |
| Children (<18 years) | | | | | | | | | | | | |
| Boys | 3 | 14.3 (6.5, 22.1) | <0.001 | * | * | * | 2 | * | * | 0 | * | * |
| Girls | 3 | 16.3 (11.0, 21.7) | <0.001 | * | * | * | 2 | * | * | 0 | * | * |

The definition of overweight and obesity used Chinese criteria: BMI ≥ 24 kg/m². The definition of central obesity used International Diabetes Federation (IDF) criteria: male waist circumference (WC) ≥ 90 cm, female waist circumference (WC) ≥ 80 cm.

*: Total and/or subgroup meta-analysis was not performed because of small number of studies.

2.1 Supplementary Figures



Supplementary Figure S1. Sensitivity analysis of the included studies for hypertension.