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Prevalence Survey of Overweight, Obesity and Central Obesity among Community-living Residents in Beijing's Pinggu District

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【Abstract】 **Background** Overweight and obesity have been proved to be important risk factors of chronic diseases such as diabetes, hypertension, arteriosclerotic cardiovascular disease and tumor. According to the latest data, the total number of overweight and obesity population in China is close to 1/4 of the total population. Timely knowing the prevalence of overweight and obesity in different regions may provide theoretical basis for formulating prevention and control strategies of obesity and other chronic diseases. **Objective** To investigate the prevalence of overweight, obesity and central obesity in communityliving residents in Pinggu District of Beijing, to provide a science-based strategy for local control of obesity-related diseases as early as possible. **Methods** This study was conducted between June 2013 and September 2014 in a multistage random sample of community-living residents (aged 25-75 years old) from Pinggu District by Pinggu Hospital, Beijing Friendship Hospital, Capital Medical University and Peking University People's Hospital. Data including sex, age, place of residence, overweight ($24 \text{ kg/m}^2 \leq \text{BMI} < 0.05$). The prevalence of overweight, obesity, severe obesity and central obesity differed significantly according to age groups ($P < 0.05$). Urban residence was associated with higher prevalence of overweight obesity and central obesity but lower prevalence of severe obesity ($P < 0.05$). Multivariate Logistic regression analysis showed that age and residence were independent influencing factors of central obesity ($P < 0.05$). **Conclusion** The prevalence of obesity, overweight and central obesity in community-living residents in this district is high, which is higher than that of the national level. Age and residence affect the occurrence of central obesity. As the risk of central obesity increases with age, the prevention of central obesity should be paid more attention in men since young and middle adulthood, and in women since the menopause (over 45 years old). Middle-aged and young people are the key populations for the prevention and control of overweight, obesity and central obesity.

【Key words】 Overweight; Obesity; Obesity, abdominal; Central obesity; Epidemiology; Data collection; Beijing

Overweight and obesity are the accumulation of abnormal or excessive fat in adipose tissue, and obesity has been listed as one of the top 10 risk factors for disease by the World Health Organization^[1]. Overweight and obesity are not only independent chronic diseases, but also major risk factors for hypertension, diabetes, cardiovascular and cerebrovascular diseases and other chronic

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diseases^[2]. In recent years, the incidence of overweight and obesity has increased rapidly in China, which has become the country with the fastest rising incidence of overweight and obesity^[3]. According to the "Nutrition and Health Monitoring Report of Chinese Residents (2010-2013)", 32.4% of adults are overweight, obesity prevalence was 13.2%, the central obesity prevalence was 45.2%^[4], obesity is the result of interaction of many factors such as heredity, behavior, environment. The obesity epidemic characteristics and the impact on the related disease are disparate in different regions and populations. This study was based on the database for the metabolic diseases survey that conducted from June 2013 to September 2014, which invited the residents aged 25-75 years old who had lived in their registered address for more than 5 years. This study was conducted by Beijing Friendship Hospital, Pinggu campus, Capital Medical University. We investigated the prevalence of overweight, obesity and central obesity in community population in Pinggu District of Beijing, to supply an evidence of a scientific strategy for local control of obesity and its related diseases.

1. Research Design and Methods

1.1 The participants

Investigators from Beijing Friendship Hospital Pinggu campus, Capital Medical University and Peking University People's Hospital conducted this study which used a stratified random two-stage cluster of sampling process on community residents in Pinggu District from June 2013 to September 2014.

At the first stage of sampling, 5 villages and 7 neighborhood communities were then randomly drawn from 16 rural towns and 2 streets. Finally, we used Stata software to extract the participants according to the sex and age ratio of the population aged 25-75 years old in Pinggu district, in different sample areas at different ages by using the simple random sampling method^[5]. All participants should have lived in Pinggu district for 5 years or more, and women of childbearing age should exclude pregnant. In this study, the participants who suffering from any sever diseases or those unable to independently complete the relevant questionnaires were excluded.

1.2 Methods

Data were obtained in field by face-to-face. The investigators were uniformly trained and fixed during the investigation, special work manual was made for this study. This study protocol was approved by the Ethics Committee of Peking University Medical Science Center (Approval No.: IRB00001052-12022), All subjects signed informed consent.

1.3 Survey contents

The main contents of the questionnaire includes: general information of the respondents (gender, age and place of residence), measurement of height, body mass and waist circumference, and calculation of body mass index (BMI). Overweight was defined as $24\text{kg/m}^2 \leq \text{BMI} < 28\text{kg/m}^2$, and obesity was defined as $28\text{kg/m}^2 \leq \text{BMI} < 35\text{kg/m}^2$; severely obese was defined as $\text{BMI} \geq 35\text{kg/m}^2$ ^[6]. According to the Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes (2013 Version)^[7], central obesity was diagnosed by waist circumference $\geq 90\text{cm}$ in men and $\geq 85\text{cm}$ in women.

1.4 Statistical analysis

Statistical analysis was performed using SPSS for windows version 25.0 software. All calculations were weighted to represent overall Pinggu population aged 25-75. Because there are different sample representativeness between different gender and age in different sampling proportion in different area. We calculated the total sampling proportion according to different gender and age in Pinggu district population that was from 25 to 75 years old.

Weight coefficients were calculated by sampling proportion reciprocals. The sampling proportion calculation was as below: according to the rural population proportion was about 76%, and the urban population proportion was 24% in Beijing Pinggu district, we calculated the rural population sampling proportion as $76\% \times (5/16) \times (5/\text{the number of villages in the town}) \times (\text{the number of samples required for this age group}/\text{the number of villagers})$. The weight coefficients was equal to sampling proportion reciprocals. Frequency and composition proportion were used to describe the prevalence of overweight and obesity. The categorical data were presented as number and percentage and compared using Chi-square test. A multivariate Logistic regression model was used to analyze the influencing factors of central obesity, and the difference was considered significant if $P < 0.05$.

2. Results

2.1 Prevalence of overweight and obesity

A total of 4 002 questionnaires were handed out and 4 002 valid questionnaires were received, with an effective response rate was 100.00%. Among the 4 002 participants, 1 962 were male (49.03%), 2 039 were female (50.95%), and one case (0.02%) lacked gender information. The age ranged from 25 to 75 years, including 201 cases (5.02%) aged from 25 to 29, 294 cases (7.35%) aged from 30 to 34, 333 cases (8.32%) aged from 35 to 39, 523 cases (13.07%) aged from 40 to 44, and 45 to 44 560 cases (13.99%) aged 55-59 years, 449 cases (11.22%) aged 60-64 years, 253 cases (6.32%) aged 65-69 years, 183 cases (4.58%) aged ≥ 70 years, and 2 cases (0.05%) lacked age information. Among all the participants 1 805 cases (45.10%) lived in cities and 2 197 cases (54.90%) in lived in rural areas. After weighting, there were 436 519 community residents in Pinggu District of Beijing, and 173 023 were overweight, with an overweight prevalence was 39.64% [95% CI (39.40%, 39.70%)]. There were 114 808 cases of obesity, and the prevalence of obesity was 26.30% [95% CI (26.16%, 26.43%)]. There were 8 180 cases of severe obesity, and the prevalence of severe obesity was 1.87% [95% CI (1.82%, 1.91%)]. There were 205 140 cases of central obesity, and the prevalence of central obesity was 47.00% [95% CI (46.85%, 47.14%)].

2.2 Comparison of the prevalence of overweight and obesity in different gender.

The weighted prevalence of overweight, obesity and severe obesity in men was 40.36% [95% CI (40.21%, 40.51%)], 25.99% [95% CI (25.86%, 26.12%)] and 1.39% [95% CI (1.35%, 1.42%)] respectively. The prevalence of central obesity in men was 46.82% (95% CI (46.67%, 46.97%)). The prevalence of overweight, obesity and severe obesity in women was 38.94% [95% CI (38.79%, 39.08%)], 26.60% [95% CI (26.46%, 26.73%)] and 2.34% [95% CI (2.33%, severe obesity, respectively). The prevalence of central obesity in women was 47.17% (95% CI (47.02%, 47.31%)). The prevalence of overweight in male is higher than that in female community residence, and the prevalence of obesity, severe obesity and central obesity in female was higher than that in male, and the differences are statistically significant ($P < 0.05$, Table 1)

Table 1 Sex-based prevalence of overweight and obesity among community-living residents in Pinggu District

| Gender | Number | Overweight | Obesity | severe obesity | Central obesity |
|------------|---------|----------------|----------------|----------------|-----------------|
| Male | 214 004 | 86 376 (40.36) | 55 629 (25.99) | 2 980 (1.39) | 100 19 (46.82) |
| Female | 222 515 | 86 647 (38.94) | 59 179 (26.60) | 5 200 (2.34) | 104 95 (47.17) |
| $\times 2$ | | 91.932 | 20.459 | 529.255 | 5.479 |
| P | | <0.001 | <0.001 | <0.001 | 0.019 |

2.3 Comparison of the prevalence of overweight and obesity in different age

After weighting, the prevalence of overweight, obesity, severe obesity and central obesity according to age was statistically significant ($P < 0.05$). The prevalence of overweight in community residents aged 30~34, 35~39, 40~44, 45~49, 50~54, 55~59, 60~64, 65~69, ≥ 70 was higher than that in community residents aged 25~29, and the difference was statistically significant ($P < 0.001$). The prevalence of overweight in community residents aged 40-44, 45-49, 50-54, 55-59, 60-64, 65-69 and ≥ 70 was higher than that of 30-34, with statistically significant ($P < 0.001$). The prevalence of overweight in community residents aged 40-44, 45-49, 50-54, 55-59, 60-64 and 65-69 was higher than that of 35-39, with statistical significance ($P < 0.001$). The prevalence of overweight in community residents aged 45-49, 50-54 and 60-64 was higher than that of 40-44, and the prevalence of overweight in community residents aged ≥ 70 was lower than that of participants aged from 40 to 44 years old, with statistical significance ($P < 0.001$). The prevalence of overweight in community residents aged 50-54, 55-59, 65-69 and ≥ 70 years was lower than that of participants aged 45-49, with statistical significance ($P < 0.001$). The prevalence of overweight in community residents aged 55-59, 65-69 and ≥ 70 years was lower than that of 50-54 years old, and the prevalence of overweight in community residents aged 60-64 was higher than that of 50-54 years old ($P < 0.001$). The prevalence of overweight in community residents aged 60-64 was higher than that of 55-59, and that of community residents aged ≥ 70 was lower than that of 55-59, with significant difference ($P < 0.001$). The prevalence of overweight in community residents aged 65-69 years and ≥ 70 years was lower than that of 60-64 years, and the difference was statistically significant ($P < 0.001$, Table 2).

The prevalence of obesity in community residents aged from 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69 was higher than that in community residents aged from 25-29, 30-34, and the prevalence of obesity in community residents aged ≥ 70 was lower than that in community residents aged from 25-29, 30-34, the differences were all statistically significant ($P < 0.001$). The prevalence of obesity in community residents aged 45-49, 50-54, 55-59, 60-64, 65-69, ≥ 70 was lower than that in 35-39 and 40-44, and the differences were statistically significant ($P < 0.001$). The prevalence of obesity in community residents aged ≥ 70 years was lower than that in aged 45-49, 50-54, 55-59, 60-64, and 65-69, and the differences were statistically significant ($P < 0.001$, Table 2).

The prevalence of severe obesity in community residents aged 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, ≥ 70 was lower than that in community residents aged 25-29 and 30-34, and the differences were statistically significant ($P < 0.001$). The prevalence of severe obesity in community residents aged 40-44, 45-49, 50-54, 55-59, 60-64, 65-69 was higher than that in community residents aged 35-39, and the prevalence of overweight in community residents aged ≥ 70 was lower than that in community residents aged 35~39, the differences were statistically significant ($P < 0.001$). The prevalence of severe obesity in community residents aged 50~54 and ≥ 70 years was lower than that in community residents aged 40-44 and 45-49, and the prevalence of severe obesity in community residents aged 55~59 and 65~69 was higher than that in community residents aged 40-44 and 45-49, the differences were statistically significant ($P < 0.001$). The prevalence of severe obesity in community residents aged 55-59, 60-64 and 65-69 was higher than that in community residents aged 50~54, and the prevalence of severe obesity in community residents aged ≥ 70 years was lower than that in community residents aged 50~54, the differences were statistically significant ($P < 0.001$). The prevalence of severe obesity in community residents aged 60-64 years and ≥ 70 years was lower than that in community residents aged 55-59 years, and the differences were statistically significant ($P < 0.001$). The prevalence of severe obesity in community residents aged 65-69 years was higher than that in community residents aged 60-64 years,

and the prevalence of severe obesity in community residents aged ≥ 70 years was lower than that in community residents aged 60-64 years. The differences were statistically significant ($P < 0.001$). The prevalence of severe obesity in community residents aged ≥ 70 years was lower than that in those aged 65-69 years, and the difference was statistically significant ($P < 0.001$, Table 2).

The prevalence of central obesity in community residents aged 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, ≥ 70 was higher than that in community residents aged 25-29, and the differences were statistically significant ($P < 0.001$). The prevalence of central obesity in community residents aged 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69 was higher than that in community residents aged 30-34, and the differences were statistically significant ($P < 0.001$). The prevalence of central obesity in community residents aged 45-49, 50-54, 55-59, 60-64, 65-69 was higher than that in 35-39, and the prevalence of central obesity in community residents aged ≥ 70 years was lower than that in 35-39, The differences were statistically significant ($P < 0.001$). The prevalence of central obesity in community residents aged 45-49, 50-54, 55-59, 60-64, 65-69 was higher than that in community residents aged 40-44, with statistically significant differences ($P < 0.001$). The prevalence of central obesity in community residents aged 50-54, 55-59, 60-64, 65-69 was higher than that in community residents aged 45-49, and the prevalence of central obesity in community residents aged ≥ 70 was lower than that in community residents aged 45-49, the differences were statistically significant ($P < 0.001$). The prevalence of central obesity in community residents aged 55-59, 60-64 and 65-69 was higher than that in 50-54 years, and the prevalence of central obesity in community residents aged ≥ 70 years was lower than that in 50-54 years, and the differences were statistically significant ($P < 0.001$). The prevalence of central obesity in community residents aged 60-64 years and ≥ 70 years was lower than that in community residents aged 55-59 years, and the difference were statistically significant ($P < 0.001$). The prevalence of central obesity in community residents aged 65-69 years was higher than that in community residents aged 60-64 years, and the prevalence of central obesity in community residents aged ≥ 70 years was lower than that in community residents aged 60-64 years, and the differences were statistically significant ($P < 0.001$). The prevalence of central obesity in community residents aged ≥ 70 years was lower than that in those aged 65-69 years, and the differences were statistically significant ($P < 0.001$, as shown in Table 2).

Table 2 Age-based prevalence of overweight and obesity among community-living residents in Pinggu District

| Age | number | overweight | obesity | severe obesity | central obesity |
|-----------|-----------|------------------------|-------------------------|-----------------------------------|------------------------|
| 25~29 | 23 719 | 6 622 (27.92) | 5 603 (23.62) | 978 (4.12) | 7 864 (33.15) |
| 30~34 | 37 891 | 13 055 (34.45) a | 9 049 (23.88) | 1 455 (3.84) | 15 398 (40.64) a |
| 35~39 | 30 365 | 10 713 (35.28) a | 9 384 (30.90) ab | 146 (0.48) ab | 13 250 (43.64) ab |
| 40~44 | 57 686 | 21 918 (38.00) abc | 17 366 (30.10) ab | 981 (1.70) abc | 24 860 (43.10) ab |
| 45~49 | 60 650 | 27 613 (45.53) abcd | 16 034 (26.44) abcd | 1 024 (1.69) abc | 28 468 (46.94) abcd |
| 50~54 | 64 262 | 27 878 (43.38) abcde | 16 605 (25.84) abcd | 605 (0.94) abcde | 31 353 (48.79) abcde |
| 55~59 | 60 769 | 23 371 (38.46) abcef | 15 906 (26.17) abcd | 1 478 (2.43) abcdef | 32 787 (53.95) abcdef |
| 60~64 | 52 811 | 23 934 (45.32) abcdfg | 14 016 (26.54) abcd | 790 (1.50) abcfg | 27 199 (51.50) abcdefg |
| 65~69 | 29 462 | 11 061 (37.54) abcefh | 7 688 (26.09) abcd | 723 (2.45) abcdefh | 16 064 (54.52) abcdefh |
| ≥ 70 | 18 904 | 6 858 (36.28) abcdefgh | 3 157 (16.70) abcdefghi | 0 abcdefghi 7 897 (41.77) acefghi | |
| x 2 | 4 240.166 | | 1 861.930 | 2 653.160 | 5 500.835 |
| P | <0.001 | | <0.001 | <0.001 | <0.001 |

Note: compare with 25-29, ^a $P < 0.001$; compare with 30-34, ^b $P < 0.001$; compare with 35-39, ^c $P < 0.001$; compare with 40-44, ^d $P < 0.001$; compare with 45-49, ^e $P < 0.001$; compare with 50-54, ^f $P < 0.001$; compare with 55-59, ^g $P < 0.001$; compare with 60-64, ^h $P < 0.001$; compare with 65-69, ⁱ $P < 0.001$.

2.4 Comparison of the prevalence of overweight and obesity among community-living residents in Pinggu District by residence

After weighting, the prevalence of overweight, obesity, severe obesity and central obesity in cities was 43.26% [95% CI (43.11%, 43.41%)], 28.69% [95% CI (28.56%, 28.82%)], 1.77% [95% CI, (48.46%, 48.76%)] and 48.61% [95% CI (48.46%, 48.76%)] respectively. The prevalence of overweight patients in rural areas was 38.16% [95% CI (38.02%, 38.30%)], the prevalence of obesity was 25.33% [95% CI (25.21%, 25.46%)], the prevalence of severe obesity was 1.92% [95% CI (1.88%, 1.96%)], and the prevalence of central obesity was 46.34% [95% CI (46.19%, 46.49%)]. The prevalence of overweight, obesity and central obesity in urban communities were higher than that in rural areas, and the prevalence of severe obesity in rural communities was higher than that in urban areas, the differences were statistically significant ($P < 0.05$, Table 3).

Table 3 Comparison of the prevalence of overweight and obesity among community-living residents in Pinggu District by residence

| District | number | Overweight | Obesity | Severe obesity | Central obesity |
|----------|---------|----------------|---------------|----------------|-----------------|
| urban | 126 399 | 54684 (43.26) | 36266 (28.69) | 2 233 (1.77) | 61 443 (48.61) |
| rural | 310 120 | 118339 (38.16) | 78542 (25.33) | 5 947 (1.92) | 143697 (46.34) |
| χ^2 | | 976.550 | 523.957 | 11.158 | 185.851 |
| P | | <0.001 | <0.001 | <0.001 | <0.001 |

2.5 The different prevalence of central obesity in community residents according to gender and age
The prevalence of central obesity in male aged 25-59 years is more than 40%, the prevalence of central obesity in female aged 30-45 years is more than 50%, and that in female aged over 50 years is high, especially that in female aged 55-69 years is more than 60% (Table 4).

Table 4 Sex- and age-based prevalence of central obesity among community-living residents in Pinggu District

| Age | Male | Female | Total |
|-----------|-----------------|-----------------|-----------------|
| 25-29 | 5 500 (41.75) | 2 364 (22.43) | 7 864 (33.15) |
| 30-34 | 10 612 (54.95) | 4 786 (25.76) | 15 398 (40.64) |
| 35-39 | 8 968 (62.48) | 4 282 (26.74) | 13 250 (43.64) |
| 40-44 | 16 072 (56.27) | 8 788 (30.18) | 24 860 (43.10) |
| 45-49 | 13 250 (47.46) | 15 218 (46.50) | 28 468 (46.94) |
| 50-54 | 14 763 (46.58) | 16 590 (50.94) | 31 353 (48.79) |
| 55-59 | 12 821 (41.78) | 19 966 (66.37) | 32 787 (53.95) |
| 60-64 | 9 927 (37.33) | 17 272 (65.89) | 27 199 (51.50) |
| 65-69 | 5 266 (41.59) | 10 798 (64.28) | 16 064 (54.52) |
| ≥ 70 | 3 012 (33.33) | 4 885 (49.51) | 7 897 (41.77) |
| Total | 100 191 (46.82) | 104 949 (47.17) | 205 140 (47.00) |

2.6 The influence of gender, age and region on the prevalence of central obesity

The variable was dependent on whether there was central obesity (recode: yes =1 , no =0), gender (recode: male =1, female =2), age (recode: 25~29 =1, 30~34 =2, 35~39 = 3,40 ~44 = 4,45 ~49 = 5,50 ~54 = 6,55 ~59 = 7,60 ~64 =9, ≥ 70 =10), and residence (recode:Urban =1, rural =2) were used as independent variables to conduct multivariate Logistic regression analysis. The results showed that age and residence were independent factors influencing the prevalence of central obesity among community residents ($P < 0.05$, Table 5).

Table 5 Multivariate Logistic regression analysis of the influence of gender , age and residence on the prevalence of central obesity in community-living residents in Pinggu District

| variable | β | SE | Wald \times 2 value | df | P | OR | 95%CI |
|----------|---------|-------|-----------------------|----|--------|-------|----------------|
| gender | -0.003 | 0.006 | 0.266 | 1 | 0.606 | 0.997 | (0.985, 1.009) |
| Age | | | | | | | |
| 25~29 | - | - | 5 555.749 | 9 | <0.001 | - | - |
| 30~24 | 0.315 | 0.017 | 331.108 | 1 | <0.001 | 1.371 | (1.325, 1.418) |
| 35~39 | 0.435 | 0.018 | 581.162 | 1 | <0.001 | 1.544 | (1.491, 1.600) |
| 40~44 | 0.411 | 0.016 | 646.430 | 1 | <0.001 | 1.509 | (1.462, 1.557) |
| 45~49 | 0.583 | 0.016 | 1 320.356 | 1 | <0.001 | 1.791 | (1.735, 1.848) |
| 50~54 | 0.655 | 0.016 | 1 696.058 | 1 | <0.001 | 1.925 | (1.866, 1.986) |
| 55~59 | 0.862 | 0.016 | 2 891.405 | 1 | <0.001 | 2.367 | (2.294, 2.443) |
| 60~64 | 0.763 | 0.016 | 2 183.174 | 1 | <0.001 | 2.144 | (2.076, 2.213) |
| 65~69 | 0.889 | 0.018 | 2 407.120 | 1 | <0.001 | 2.432 | (2.347, 2.520) |
| 70~ | 0.376 | 0.020 | 345.419 | 1 | <0.001 | 1.456 | (1.399, 1.515) |
| District | 0.121 | 0.007 | 318.652 | 1 | <0.001 | 1.128 | (1.114, 1.144) |

Note: “-” means the data without reference.

3. Discussion

Previous studies have shown that obesity has become the fifth cause of death worldwide [\[8\]](#). A large number of epidemiological data showed that obese patients often accompanied with hypertension, dyslipidemia and abnormal glucose tolerance which were called high risk factors of cardiovascular diseases, as well as gallbladder disease, asthma, obstructive of breathing and sleep apnea syndrome, osteoarthritis, hyperuricemia and gout, fatty liver, polycystic ovary syndrome and other diseases [\[9-10\]](#). It will make a foundation on chronic disease prevention and control to explore the status of overweight and obesity epidemic in different areas.

This study was based on the existing metabolic disease cohort database in Pinggu District of Beijing [\[5\]](#), further to analyzed the prevalence of overweight, obesity and central obesity in this area, and found that the prevalence of overweight, obesity and central obesity were 39.64%, 26.30% and 47.00%, respectively, which were all higher than the national prevalence levels which was 32.40%, 13.40% and 45.20% respectively [\[4\]](#). This suggests that the prevalence of overweight and obesity in this region is not optimistic. In recent years, it is rarely reported on the prevalence of overweight and obesity based on general population in Beijing.

Previously, Pinggu District reported a preliminary investigation of metabolic syndrome in a community population and compared it with Dongcheng District of Beijing, showed that the prevalence of obesity in this area was higher than that in Dongcheng District of Beijing [\[11\]](#).

The recently published result of prevalence of diabetes in this Pinggu district also suggested that the prevalence of diabetes is higher than that of the national level [\[5\]](#). The economic level of Pinggu district in Beijing is undeveloped, and in the economic transition stage, these may indicate that people do not yet establish a healthy lifestyle in the process of economic development, these lead to the increment of the prevalence of obesity, diabetes. These findings suggest that it is needed to further explore the mechanism of being overweight, obesity and other risk factors for chronic diseases in this area. We analyzed the prevalence of overweight, obesity and central obesity in different genders and residential communities, and found that the prevalence of overweight in male was higher than that in female and the prevalence of obesity, severe obesity and central obesity in female was higher than that in male. The prevalence of overweight, obesity and central obesity in urban is higher than that in rural areas, and the prevalence of severe obesity in rural is higher than that in urban. The results of different ages showed that the prevalence of overweight among community residents aged 25-29 years was the lowest, and the overall trend was that the prevalence of overweight increased with age, and the prevalence of overweight among community residents aged 45-54 years was more than 40%. The prevalence rate of obesity in community residents aged 35-44 years was more than 30%, the prevalence of obesity in community residents aged 25-39 years increased with age, the prevalence of obesity in community residents aged 45-54 years decreased slightly, and the prevalence of obesity in community residents aged ≥ 70 years decreased significantly. This study also found that the prevalence of severe obesity in community residents aged 25 to 34 was significantly increased. The young and the middle-aged people should concern the body mass to avoid further increase of body mass with age increment according to the characteristics of age distribution by BMI. Reports showed that central obese patients have higher risk of disease than those systemic obese people, when BMI is moderately elevated and waist circumference is higher, the prevalence of coronary heart disease and mortality will increase [\[7\]](#). Other studies have shown that abdominal fat and cardiovascular disease and the risk of diabetes were positively correlated, and the lower distribution of fat is a protective factor of cardiovascular disease and diabetes [\[12-13\]](#). Based on the above situation, this study further analyzed the prevalence of centrality obesity according to gender and age, we found that the prevalence of central obesity in total population is 47.00%, before the age of 50, the prevalence of central obesity in men residents was higher than that in women, but after the age of 50 the prevalence of central obesity was higher in women. The prevalence of central obesity was more than 50% and it was the highest in men residents who was 30-40 years old, which was the lowest in that was more than 70 years old. The prevalence of central obesity in women increased with the increase of age, which was significantly increased in those aged 45~69, all of which were above 50%. The prevalence of central obesity in women aged 25~39 was significantly lower than those aged 45 and more. The possible reasons are as follows: the peak period of male central obesity is between 30 and 44 years old. At this age, they have great pressure of work and less time for physical exercise. Secondly, men have unhealthy diet habit, and generally go out more for dinner than women. This indicated that we should do more education on them. The prevalence of central obesity in women aged 45 and above was significantly increased, especially in women aged 50 and above. Considering that women in this age was menopause, the abnormal proportion of body fat distribution in women after menopause was increased, which may due to the decrement of sex hormone level. Further analysis of the

risk factors of central obesity, we found that increasing age and residence affected the occurrence of central obesity.

A study previously analyzed the global trends of BMI and the relevant of the risk of all-cause death which was published in the *Lancet* in 2016, and the main results showed that the rate of all-cause mortality increased with the increment of BMI, and the risk of all-cause death in the population began to increase in whose BMI were more than 25.0kg/m², and doubled increased in the population whose BMI were more than 30.0kg/m²^[14]. Recently, Chinese researchers published the results of the burden of disease and risk factors of death in China from 1990 to 2017, suggesting that the leading cause of death in China is stroke and ischemic cerebrovascular disease. However, due to the analysis, high BMI is the most rapidly increased risk factor of the top ten diseases^[15], it was showed again that the prevention and treatment of overweight and obesity was urgent. Recently, the State Council of China central committee of the communist party released the advice on the Chinese action of implementation of healthy strategy, which clearly put forward the implementation of disease prevention and health promotion in the medium-long term action, by the year 2022 and 2030, the growth rate of adult obesity should be slowed gradually^[16], the health action call on all regional government should know the prevalence of obesity in their own region, and make plan to precise control according to regional characteristics of obesity.

This study investigated the prevalent of overweight, obesity and central obesity in Beijing Pinggu district, whose sample was large in Beijing and based on the natural population of overweight, obesity and central obesity prevalence survey. The result can make a reference for the status of overweight and obesity epidemic characteristics for Pinggu district of Beijing and even the whole Beijing region, and also make the basic strategy on prevention and control of overweight and obesity subsequently. The limitations of this study are as follows. First, this study is a cross-sectional study, which cannot understand the causal association and possible mechanism of the occurrence of overweight, obesity and central obesity. A prospective follow-up cohort should be further established to study the risk factors and possible mechanisms of overweight, obesity and central obesity. Second, the data of this study was collected from 2013 to 2014, there are some limitations due to retrospective analysis. However, this study based on a procedure of strict sampling and the weighted statistical method, and the region is located in the northeast of Beijing, surrounded by mountains on three sides, the population mobility was small, there is little change in the number of population and the age as well as the proportion of gender during the recent 5 years, the results of this study are well representative for the epidemic status of overweight and obesity in this region. Next, the research group will follow up the study cohort through questionnaire, physical examination, laboratory measurement and other methods, so as to understand the changes of the prevalence of overweight and obesity in Pinggu region in time, and make reasonable strategies for the prevention and control of obesity and its related diseases in this region.

To sum up, the prevalence of obesity, overweight and central obesity is higher in the residents aged more than 25 years old in Pinggu District, which is higher than the national average. The prevalence of severe obesity is high especially in the population aged from 25 to 34 years old, the situation of overweight and obesity epidemic is not optimistic, it is need to make the strategies for prevention and control for obesity according to local characteristics. It should be paid more attention on prevention of central obesity in men since young and middle age, whereas in women should be since the menopause (after 45 years old). The young-middle aged people are the key populations for the prevention and control of overweight, obesity and central obesity.

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Author's contribution

Zhao Zihou carried out the conception and design of the paper, statistical processing, analysis and interpretation of the results. Li Yufeng carried out the implementation and feasibility analysis of the study, and revised the paper. Kong Xiangshuang, Wang Lianying and Guo Guangxia collected field data; Zihou Zhao and Yufeng Li wrote the paper.

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