Diet Quality Index and Obesity among Chinese Adults

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Obesity, or excess adiposity, is a leading public health problem worldwide that results in significant medical burdens. Diet quality scores designed based on Western-style dietary patterns were demonstrated to be good indicators of obesity in developed but not developing countries. This entry shows that diet quality scores tailored to the Chinese diet demonstrate a strong relationship with both undernutrition and overnutrition, as well as being underweight and obese in Chinese adults.

diet quality obesity body weight Chinese

1. Introduction

Obesity, or excess adiposity, is a leading public health problem worldwide that results in significant medical burdens [1]. A U.S. based study estimates that individuals who are obese spend 76% more on healthcare compared to those of normal weight [2]. Studies have documented a link between obesity and various chronic diseases such as type 2 diabetes [3], cardiovascular diseases [4], cancer [5], and chronic kidney disease [6].

Obesity is a complex disease that results from the interactions of various risk factors that influence the balance of energy intake and output, such as genetics [7], physical activity [8], gut microbial composition [9], dietary intake, and the obesogenic food environment, where the modern food system makes nutrient-poor, ultra-processed food more accessible and affordable [10][11]. The socioeconomic and sociocultural characteristics of people affect their vulnerability to the obesogenic risk factors [12]. Different policies have been established or proposed to curb the obesity epidemic, such as taxation on unhealthy food purchases [13], food pricing strategies [14], and nutrition education within food assistance programs [15].

One of the cornerstones to address the obesity epidemic is through dietary intervention. Food groups such as whole-grain, fruit, nut, legume, and fish were found to be associated with a reduced risk of obesity, whereas refined grains, red meat, and sugar-sweetened beverages were associated with increased risk [16]. Diet quality scores are developed to guide food consumption behaviors and assess the quality of the overall diet in the population. A systematic review by Ashgari et al. examined studies that assessed the relationship between diet quality scores and body mass index (BMI) and other indicators of obesity [17]. They found that diet quality assessed using different scores were, in general, inversely associated with BMI in developed countries, yet results were much more variable in developing countries.

The complex relationship between diet quality scores and BMI in developing countries is likely related to the dual burden of both undernutrition and overnutrition in these countries. Likewise, China has been under a drastic transition in dietary habits during economic growth and development in recent decades, leading to rapid increases in the consumption of edible oils, animal source foods, sugar-sweetened beverages, and food away from home [18]. Accordingly, the prevalence of overweight and obesity rose rapidly in the country in the past several decades [19]. Meanwhile, undernutrition is still a concern for vulnerable groups, such as older adults in China [20]. Diet quality scores may provide a convenient tool to screen for those at risk of under- or over- nutrition. However, diet quality scores used internationally were designed mainly based on Western-style dietary patterns, which are substantially different from traditional dietary patterns in Chinese populations [21][22].

2. Current Insights

This work systemically analyzed existing studies that explored the relationship between diet quality scores and obesity-related outcomes in Chinese populations. As adherence to a priori high-quality dietary pattern is increasingly recommended to improve overall healthfulness during the drastic nutrition transition in China, this work evaluated whether the quality of a diet, independent of calorie content, has implications in weight management and obesity reduction. Both internationally accepted, non-culture-specific diet quality scores or tailored scores to the Chinese diet were tested in several cohorts of Chinese participants, mainly with a cross-sectional design, yet the relationships between these scores and obesity-related outcomes varied. The inconsistencies may be attributed in part to the heterogeneity of the cohorts and the need for tailored diet quality assessment according to the characteristics of specific populations.

A significant source of heterogeneity lies in the geo-economic and cultural differences among cohorts, specifically, between Chinese adults within versus outside mainland China. Three out of four studies that used AHEI or HEI in Chinese populations outside mainland China demonstrated an inverse association between the dietary index and BMI [23][24][25], consistent with the concern of an obesogenic environment typical for developed countries and regions.

Consistently, the systematic review by Asghari et al. has previously demonstrated that HEI reflected a reduced risk of obesity in studies conducted in developed but not in developing countries [17]. In cohorts within mainland China, the diet quality has a divergent relationship with weight status, with the diet quality scores being associated with both underweight and overweight/obesity in different studies [26][27][28]. This is typical for developing countries during drastic nutrition transitions. The dual burden of undernutrition and overnutrition was clearly reflected in studies using data from the CHNS, which included waves of cross-sectional cohorts ranging from 1990 to 2015 that coincided with the rapid economic development and nutrition transition of China. Both underweight and overweight/obesity were associated with worse dietary scores (e.g., China DQI, DBI-07, CHEI) in studies based on different waves of CHNS data. The dichotomized association of dietary scores with both under- and overnutrition observed in different waves of participants also suggests that the drastic nutrition transition in China may have altered the relationship between diet quality and obesity over time.

The nutrition transition in China is a result of rapid economic development after the reform and opening policy was implemented in the late 1970s. The rapid economic growth in China fuels the modernization of the food system and enhances the purchasing power of people in China. Accompanying with the increased affordability and accessibility of food, people in China experienced Westernization of dietary intake, characterized by significant increases in edible oil and meat consumption, snacking behavior and sugar-sweetened beverage consumption, and decreases in cereal grains and legumes that are emphasized in the traditional Chinese diet [29][30][31]. However, the nutrition transition is not identical for everyone, and several factors influence the level of adoption. Older adults have greater adherence to the traditional Chinese dietary pattern (e.g., cereal-rich and limited in meat) [32]. This may partly explain the higher risk of undernutrition of this group associated with lower diet quality scores. Rural versus urban areas have different levels of nutrition transition partly attributable to the different levels of economic development. The more economically developed urban areas had greater levels of nutrition transition as demonstrated by changes such as increased snacking behavior and fried food consumption [31][33]. Overnutrition and obesity become the main concerns in those areas. However, it should be noted that the gap between rural and urban areas has gradually narrowed. The Scientific Research Report on DGC 2021 demonstrates that the dietary structure of rural residents has been greatly altered with carbohydrate-derived caloric intakes decreasing from 70.1% in 1992 to 55.3% in 2015, and the protein provided by animal food increasing from 12.4% to 31.4% [34]. The Chinese Centers for Disease Control and Prevention (CDC) research data show that the obesity rate in rural areas was about half of that in urban areas (12.2% versus 6.3%) in 2002; by 2012, the rural obesity rate grew to 10.4%, which was very close to the 13.2% in urban areas [35]. At the individual level, those with a higher socioeconomic status (SES) have accelerated nutrition transition and obesity becomes the primary concern. In contrast, those with a lower SES have a slower change and a higher risk of undernutrition and being underweight [18][36]. These differences in nutrition transition among different groups suggest the need to choose an appropriate diet score according to its sensitivity to either under- or over-nutrition.

A potential concern of using internationally used, non-culture-specific dietary scores such as HEI was that those scores were not developed based on the DGC. There were substantial differences between the Chinese and Western diets. These differences were also reflected in their dietary guidelines, such as a higher recommended amount of soy and a lower recommended amount of dairy in the CDG versus the DGA [37]. An HEI-based score showed inconsistent relationships with weight status in different Chinese cohorts, as mentioned above. Several studies also used DASH and aMED to assess diet quality. These scores were not based on the official dietary guidelines of specific countries, but rather on two well-accepted high-quality diets, the DASH and Mediterranean diets. Previous studies have shown that adopting these diets improved cardiometabolic outcomes and in non-Chinese populations [38][39][40][41][42]. However, the results were inconsistent among the few studies that assessed how these indices were associated with BMI in Chinese cohorts, suggesting that a tailored score to the Chinese diet may have better sensitivity to serve as an indicator of weight status in Chinese.

Several indices tailored to the Chinese diet were developed according to the CDG and CHFP, such as the CHEI, CHFP score, China DBI, and DDS. DBI was developed with a set of scores (LBS, HBS, TS, and DQD) that make it convenient to assess both under and over nutrition [43]. Indeed, in some Chinese populations, such as among older adults, undernutrition was the main concern, such as what Xu et al. reported regarding the worse DBI in

underweight elders [32]. Zhang et al. also showed in a cohort with late middle-aged and older adults in the Yunnan province of China that DBI was related to the risk of being underweight [44]. A study conducted on the second wave of the nationally-representative Chinese Health and Retirement Longitudinal Study (CHARLS) estimated that the prevalence of malnutrition among elderlies in China was 12.6%, or over 20 million elderlies [20]. Malnutrition in older adults has been associated with adverse functional and mortality outcomes [45]. Therefore, using a diet quality score to assess and predict malnutrition and weight loss in older adults may help identify those that need intervention and assistance. However, two other studies that enrolled Chinese adults of different ages showed that the more imbalanced the diet was, as assessed by the DQD score, the higher the BMI and risk of obesity [46][47]. Therefore, the DBI may be a good indicator of malnutrition (both under- and over- nutrition) in Chinese adults, yet its specific relationship with weight status may depend on characteristics of the cohorts (e.g., age, health status, socioeconomic status).

Besides the DBI, the China DQI was another index that consistently demonstrated an association with overweight in two Chinese cohorts, suggesting the potential use of this index to assess overnutrition in Chinese populations [27][48].

Food diversity is differentially defined in different studies and may be a double-edged sword for weight control. Food diversity was demonstrated to be positively associated with BMI in studies of non-Chinese populations and summarized in the Asghari et al. review [17]. A potential explanation was that diversity could be attributed to both varieties of healthy and unhealthy foods. It is also possible that people tend to eat more when there is a greater variety of food, leading to a higher total energy intake [49]. The one study that we reviewed used a similar food diversity score to those used in other studies, which included the variety of both healthy and unhealthy food. Consistent with previous findings, it showed that food diversity was positively associated with overweight though only in men [50]. The other study developed a score that assessed the variety of healthy food specifically (HFD) and did not observe an association between HFD and weight while observing a negative association between the index and WC [51]. These studies corroborate the notion that not just the variety of foods eaten, but also what is being consumed matters for obesity reduction.

Overall, diet quality scores tailored to the Chinese population are associated with either being underweight or overweight/obese in Chinese adults. With the dual burden of undernutrition and the rising obesity epidemic, the Chinese government has implemented various policies and programs to reduce both underweight and obesity. For example, the Ministry of Health released the Nutrition Improvement Work Management Approach to promote nutrition and health of Chinese residents [52]. The General Office of the State Council released the National Nutrition Plan (2017–2030) in 2017 [53] and the Department of Planning released the Health China Action in 2019 [54] which propose rational dietary behaviors and strengthening dietary and nutrition guidance for the whole population. These initiatives focus on encouraging the reduction of salt, oil, and sugar intakes in every sector, including the food industry, the cafeteria of enterprises and institutions, and families. They also require governmental departments to develop and implement relevant regulations and standards, and implement nutrition interventions for vulnerable populations in impoverished areas. Although this work did not include studies conducted in children, it should be noted that the obesity rate of children and adolescents in China is rising

alarmingly [55]. Several policies have been proposed to address this significant public health concern such as accelerating the development of standards to limit production and sale of high-sugar foods, revising the general rules for nutrition labeling to include mandatory labeling of sugar in prepackaged foods, and enhancing the nutrition education about added sugar intake restriction [56].

The establishment of the DGC/CHFP and the Chinese Dietary Reference Intakes (DRIs) specifies daily food and nutrient intake goals for Chinese people. Diet quality scores may be used as a tool to assess and promote adherence to the guidelines and indicate the risk of deviation from normal body weight. The shared principles of different scoring systems suggest that a diet is considered of high quality when composed of fruits and non-starchy vegetables, whole grains, legumes, high-quality proteins, and limiting processed foods and the added sugar, trans fat, empty calories, and sodium associated with them. However, due to the heterogeneity of Chinese populations, there needs to be a careful selection of suitable diet quality scores based on the characteristics of the specific population.

3. Conclusions

In conclusion, diet quality scores are associated with weight status and obesity-related outcomes in many studies among Chinese populations. Diet quality scores tailored to the Chinese diet may be more suitable to reflect both undernutrition and obesity risk for Chinese adults in China during a significant nutrition transition.

References

1. Afshin, A.; Forouzanfar, M.H.; Reitsma, M.B.; Sur, P.; Estep, K.; Lee, A.; Marczak, L.; Mokdad, A.H.; Moradi-Lakeh, M.; Naghavi, M.; et al. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. N. Engl. J. Med. 2017, 377, 13–27.
2. Biener, A.I.; Decker, S.L. Medical care use and expenditures associated with adult obesity in the United States. JAMA 2018, 319, 218.
3. Barnes, A.S. The epidemic of obesity and diabetes: Trends and treatments. Tex. Heart Inst. J. 2011, 38, 142–144.
4. Dwivedi, A.K.; Dubey, P.; Cistola, D.P.; Reddy, S.Y. Association between obesity and cardiovascular outcomes: Updated Evidence from Meta-analysis Studies. Curr. Cardiol. Rep. 2020, 22, 25.
5. Roberts, D.L.; Dive, C.; Renehan, A.G. Biological mechanisms linking obesity and cancer risk: New perspectives. Annu. Rev. Med. 2010, 61, 301–316.
6. Kovesdy, C.P.; Furth, S.L.; Zoccali, C.; Committee, W.K.D.S. Obesity and kidney disease: Hidden consequences of the epidemic. Am. J. Nephrol. 2017, 45, 283–291.

7. Qasim, A.; Turcotte, M.; de Souza, R.J.; Samaan, M.C.; Champredon, D.; Dushoff, J.; Speakman, J.R.; Meyre, D. On the origin of obesity: Identifying the biological, environmental and cultural drivers of genetic risk among human populations. Obes. Rev. 2018, 19, 121–149.
8. Chin, S.H.; Kahathuduwa, C.N.; Binks, M. Physical activity and obesity: What we know and what we need to know. Obes. Rev. 2016, 17, 1226–1244.
9. Komaroff, A.L. The microbiome and risk for obesity and diabetes. JAMA 2017, 317, 355–356.
10. Dhakal, C.K.; Khadka, S. Heterogeneities in consumer diet quality and health outcomes of consumers by store choice and income. Nutrients 2021, 13, 1046.
11. Ferretti, F.; Mariani, M.; Sarti, E. Is the development of obesogenic food environments a self-reinforcing process? Evidence from soft drink consumption. Glob. Health 2021, 17, 91.
12. McLaren, L. Socioeconomic status and obesity. Epidemiol. Rev. 2007, 29, 29–48.
13. Teng, A.M.; Jones, A.C.; Mizdrak, A.; Signal, L.; Genç, M.; Wilson, N. Impact of sugar-sweetened beverage taxes on purchases and dietary intake: Systematic review and meta-analysis. Obes. Rev. 2019, 20, 1187–1204.
14. Ng, S.W.; Zhai, F.; Popkin, B.M. Impacts of China's edible oil pricing policy on nutrition. Soc. Sci. Med. 2008, 66, 414–426.
15. Rivera, R.L.; Maulding, M.K.; Eicher-Miller, H.A. Effect of Supplemental Nutrition Assistance Program-Education (SNAP-Ed) on food security and dietary outcomes. Nutr. Rev. 2019, 77, 903–921.
16. Schlesinger, S.; Neuenschwander, M.; Schwedhelm, C.; Hoffmann, G.; Bechthold, A.; Boeing, H.; Schwingshackl, L. Food groups and risk of overweight, obesity, and weight gain: A wystematic review and dose-response meta-analysis of prospective studies. Adv. Nutr. 2019, 10, 205–218.
17. Asghari, G.; Mirmiran, P.; Yuzbashian, E.; Azizi, F. A systematic review of diet quality indices in relation to obesity. Br. J. Nutr. 2017, 117, 1055–1065.
18. Popkin, B.M. Synthesis and implications: China's nutrition transition in the context of changes across other low- and middle-income countries. Obes. Rev. 2014, 15, 60–67.
19. Ma, S.; Xi, B.; Yang, L.; Sun, J.; Zhao, M.; Bovet, P. Trends in the prevalence of overweight, obesity, and abdominal obesity among Chinese adults between 1993 and 2015. Int. J. Obes. 2021, 45, 427–437.
20. Wei, J.M.; Li, S.; Claytor, L.; Partridge, J.; Goates, S. Prevalence and predictors of malnutrition in elderly Chinese adults: Results from the China Health and Retirement Longitudinal Study. Public Health Nutr. 2018, 21, 3129–3134.

21. Kennedy, E.T.; Ohls, J.; Carlson, S.; Fleming, K. The healthy eating index: Design and applications. J. Am. Diet. Assoc. 1995, 95, 1103–1108.
22. Fung, T.T.; McCullough, M.L.; Newby, P.K.; Manson, J.E.; Meigs, J.B.; Rifai, N.; Willett, W.C.; Hu, F.B. Diet-quality scores and plasma concentrations of markers of inflammation and endothelial dysfunction. Am. J. Clin. Nutr. 2005, 82, 163–173.
23. Cheung, L.T.F.; Chan, R.S.M.; Ko, G.T.C.; Lau, E.S.H.; Chow, F.C.C.; Kong, A.P.S. Diet quality is inversely associated with obesity in Chinese adults with type 2 diabetes. Nutr. J. 2018, 17, 63.
24. Whitton, C.; Rebello, S.A.; Lee, J.; Tai, E.S.; van Dam, R.M. A healthy asian a posteriori dietary pattern correlates with a priori dietary patterns and is associated with cardiovascular disease risk factors in a multiethnic Asian population. J. Nutr. 2018, 148, 616–623.
25. Gao, S.K.; Beresford, S.A.A.; Frank, L.L.; Schreiner, P.J.; Burke, G.L.; Fitzpatrick, A.L. Modifications to the healthy eating index and its ability to predict obesity: The multi-ethnic study of atherosclerosis. Am. J. Clin. Nutr. 2008, 88, 64–69.
26. Yuan, Y.Q.; Li, F.; Dong, R.H.; Chen, J.S.; He, G.S.; Li, S.G.; Chen, B. The development of a Chinese healthy eating index and its application in the general population. Nutrients 2017, 9, 977.
27. Stookey, J.D.; Wang, Y.; Ge, K.; Lin, H.; Popkin, B.M. Measuring diet quality in China: The INFH-UNC-CH diet quality index. Eur. J. Clin. Nutr. 2000, 54, 811–821.
28. Xu, X.; Hall, J.; Byles, J.; Shi, Z. Dietary pattern is associated with obesity in older people in China: Data from China health and nutrition survey (CHNS). Nutrients 2015, 7, 5386.
29. Popkin, B.M. The nutrition transition and obesity in the developing world. J. Nutr. 2001, 131, 871S–873S.
30. Popkin, B.M. Nutrition in transition: The changing global nutrition challenge. Asia Pac. J. Clin. Nutr. 2001, 10, S13–S18.
31. Wang, Z.; Zhai, F.; Du, S.; Popkin, B. Dynamic shifts in Chinese eating behaviors. Asia Pac. J. Clin. Nutr. 2008, 17, 123–130.
32. Xu, X.; Hall, J.; Byles, J.; Shi, Z. Assessing dietary quality of older Chinese people using the Chinese Diet Balance Index (DBI). PLoS ONE 2015, 10, e0121618.
33. Dearth-Wesley, T.; Wang, H.; Popkin, B.M. Under- and overnutrition dynamics in Chinese children and adults (1991–2004). Eur. J. Clin. Nutr. 2008, 62, 1302–1307.
34. Chinese Nutrition Society. Scientific Research Report on the Dietary Guidelines for Chinese Residents 2021; Chinese Nutrition Society: Beijing, China, 2021.
35. Wang, L.; Zhou, B.; Zhao, Z.; Yang, L.; Zhang, M.; Jiang, Y.; Li, Y.; Zhou, M.; Huang, Z.; Zhang, X.; et al. Body-mass index and obesity in urban and rural China: Findings from consecutive

nationally representative surveys during 2004–2018. Lancet 2021, 398, 53–63.

36. Jones-Smith, J.C.; Gordon-Larsen, P.; Siddiqi, A.; Popkin, B.M. Emerging disparities in overweight by educational attainment in Chinese adults (1989–2006). Int. J. Obes. 2012, 36, 866–875.
37. Wang, S.S.; Lay, S.; Yu, H.N.; Shen, S.R. Dietary Guidelines for Chinese Residents (2016): Comments and comparisons. J. Zhejiang Univ. Sci. B 2016, 17, 649–656.
38. Couch, S.C.; Saelens, B.E.; Khoury, P.R.; Dart, K.B.; Hinn, K.; Mitsnefes, M.M.; Daniels, S.R.; Urbina, E.M. Dietary approaches to stop hypertension dietary intervention improves blood pressure and vascular health in youth with elevated blood pressure. Hypertension 2021, 77, 241–251.
39. Blumenthal, J.A.; Babyak, M.A.; Hinderliter, A.; Watkins, L.L.; Craighead, L.; Lin, P.H.; Caccia, C.; Johnson, J.; Waugh, R.; Sherwood, A. Effects of the DASH diet alone and in combination with exercise and weight loss on blood pressure and cardiovascular biomarkers in men and women with high blood pressure: The ENCORE study. Arch. Intern. Med. 2010, 170, 126–135.
40. Azadbakht, L.; Fard, N.R.; Karimi, M.; Baghaei, M.H.; Surkan, P.J.; Rahimi, M.; Esmaillzadeh, A.; Willett, W.C. Effects of the Dietary Approaches to Stop Hypertension (DASH) eating plan on cardiovascular risks among type 2 diabetic patients: A randomized crossover clinical trial. Diabetes Care 2011, 34, 55–57.
41. Estruch, R.; Ros, E.; Salas-Salvadó, J.; Covas, M.I.; Corella, D.; Arós, F.; Gómez-Gracia, E.; Ruiz-Gutiérrez, V.; Fiol, M.; Lapetra, J.; et al. Primary prevention of cardiovascular disease with a Mediterranean diet supplemented with extra-virgin olive oil or nuts. N. Engl. J. Med. 2018, 378, e34.
42. D’Innocenzo, S.; Biagi, C.; Lanari, M. Obesity and the Mediterranean diet: A review of evidence of the role and sustainability of the Mediterranean diet. Nutrients 2019, 11, 1306.
43. He, Y.; Zhai, F.; Yang, X.; Ge, K. The Chinese Diet Balance Index revised. Acta Nutr. Sin. 2009, 31, 532–536.
44. Zhang, Q.; Qin, G.; Liu, Z.; Li, Z.; Li, J.; Varma, D.S.; Wan, Q.; Zhao, J.; Min, X.; Han, X.; et al. Dietary Balance Index-07 and the risk of anemia in middle aged and elderly people in southwest China: A cross sectional study. Nutrients 2018, 10, 162.
45. Wei, K.; Nyunt, M.S.; Gao, Q.; Wee, S.L.; Yap, K.B.; Ng, T.P. Association of frailty and malnutrition with long-term functional and mortality outcomes among community-dwelling older adults: Results from the Singapore longitudinal aging study 1. JAMA Netw. Open 2018, 1, e180650.
46. Zang, J.; Yu, H.; Zhu, Z.; Lu, Y.; Liu, C.; Yao, C.; Bai, P.; Guo, C.; Jia, X.; Zou, S.; et al. Does the dietary pattern of Shanghai residents change across seasons andarea of residence: Assessing dietary quality using the Chinese Diet Balance Index (DBI). Nutrients 2017, 9, 251.

47. Zhou, J.; Leepromrath, S.; Tian, X.; Zhou, D. Dynamics of Chinese diet divergence from Chinese food pagoda and its association with adiposity and influential factors: 2004–2011. Int. J. Environ. Res. Public Health 2020, 17, 507.
48. Huang, Y.; Wang, H.; Tian, X. Changing diet quality in China during 2004–2011. Int. J. Environ. Res. Public Health 2016, 14, 13.
49. Jayawardena, R.; Byrne, N.M.; Soares, M.J.; Katulanda, P.; Yadav, B.; Hills, A.P. High dietary diversity is associated with obesity in Sri Lankan adults: An evaluation of three dietary scores. BMC Public Health 2013, 13, 314.
50. Tian, X.; Wu, M.; Zang, J.; Zhu, Y.; Wang, H. Dietary diversity and adiposity in Chinese men and women: An analysis of four waves of cross-sectional survey data. Eur. J. Clin. Nutr. 2017, 71, 506–511.
51. Zhao, W.; Zhang, J.; Zhao, A.; Wang, M.; Wu, W.; Tan, S.; Guo, M.; Zhang, Y. Using an introduced index to assess the association between food diversity and metabolic syndrome and its components in Chinese adults. BMC Cardiovasc. Disord. 2018, 18, 189.
52. Wang, H.; Zhai, F. Programme and policy options for preventing obesity in China. Obes. Rev. 2013, 14, 134–140.
53. The State Council of China. National Nutrition Program 2017–2030; The State Council of China: Beijing, China, 2017.
54. Development and Information Technology. Action for a Healthy China (2019–2030); The State Council of China: Beijing, China, 2019.
55. Pan, X.F.; Wang, L.; Pan, A. Epidemiology and determinants of obesity in China. Lancet Diabetes Endocrinol. 2021, 9, 373–392.
56. Wang, Y.; Zhao, L.; Gao, L.; Pan, A.; Xue, H. Health policy and public health implications of obesity in China. Lancet Diabetes Endocrinol. 2021, 9, 446–461.