future

Article

Weight Status Change from Birth to Childhood and High Blood Pressure in Childhood

Ziqi Liu [1], Lili Yang [1], Min Zhao [2], Yongfu Yu [3] and Bo Xi [1,*]

[1] Department of Epidemiology/Department of Maternal, Child, Adolescent Health, School of Public Health, Qilu Hospital, Cheeloo College of Medicine, Shandong University, Jinan 250012, China; liuzq205@163.com (Z.L.)
[2] Department of Nutrition and Food Hygiene, School of Public Health, Cheeloo College of Medicine, Shandong University, Jinan 250012, China
[3] Department of Biostatistics, Key Laboratory of Public Health Safety of Ministry of Education, NHC Key Laboratory for Health Technology Assessment, School of Public Health, Fudan University, Shanghai 200032, China
* Correspondence: xibo2010@sdu.edu.cn; Tel.: +86-0531-88382141

Abstract: Background: While both high birth weight and childhood overweight/obesity have been associated with a heightened risk of high blood pressure (BP) during childhood, the association between weight status change from birth to childhood and the risk of high BP has not been fully explored. This study aimed to investigate how changes in weight status from birth to childhood influence the development of high BP in childhood. Methods: The data for this study were obtained from the baseline survey of the Huantai Childhood Cardiovascular Health Cohort Study, which included 1237 children aged 6 to 11. Children with a birth weight under 2500 g or a body mass index (BMI) below the fifth percentile for their age and sex during childhood were excluded. Based on birth weight (high birth weight [>4000 g] vs. healthy [≤4000 g]) and childhood weight status (overweight [including obesity] vs. healthy weight), participants were categorized into four groups: consistently healthy weight, weight decrease, weight increase, and consistently excess weight. Results: Compared to children who maintained a healthy weight from birth to childhood, higher odds of childhood high BP was observed among those with consistently excess weight (odds ratio [OR] = 2.73, 95% confidence interval [CI] = 1.46–5.12) and those with a weight increase (OR = 2.77, 95% CI = 1.91–4.02). In contrast, children with a weight decrease did not exhibit significantly higher odds of childhood high BP (OR = 0.94, 95% CI = 0.36–2.45). Conclusion: Children who become overweight in childhood or who consistently had excess weight from birth were at higher risk of childhood high BP. However, the risk of high BP in childhood may be mitigated or eliminated in individuals with high birth weight who achieve a healthy weight by childhood.

Keywords: birth weight; overweight; obesity; blood pressure; children

check for updates

Citation: Liu, Z.; Yang, L.; Zhao, M.; Yu, Y.; Xi, B. Weight Status Change from Birth to Childhood and High Blood Pressure in Childhood. *Future* **2024**, *2*, 164–171. https://doi.org/10.3390/future2040013

Academic Editor: Changwei Li

Received: 23 July 2024
Revised: 12 October 2024
Accepted: 4 November 2024
Published: 6 November 2024

1. Introduction

Cardiovascular disease (CVD) is the primary cause of death and a significant contributor to disability worldwide [1]. According to the China Cardiovascular Health and Disease Report 2023, there are currently around 330 million people with CVD in China, including approximately 245 million with hypertension [2]. Evidence suggests that a 10 mmHg reduction in systolic blood pressure (BP) can lower the risk of CVD by roughly 20% to 30% [3]. Therefore, the prevention and control of hypertension is a critical public health strategy for reducing the burden of CVD and decreasing mortality rates.

With the epidemic of overweight/obesity and unhealthy lifestyles, the onset of hypertension is gradually occurring at a younger age, and the prevalence of high BP among children in many countries is increasing in recent years [4,5]. Although childhood high BP often presents without obvious clinical symptoms, numerous studies have shown that it can cause early damage to the structure and function of cardiovascular target organs [6,7]. Additionally, childhood high BP is strongly correlated with hypertension in adulthood [8,9], thereby elevating the lifetime risk of CVD [10,11]. Recognizing and identifying the risk factors for high BP in children is crucial for early prevention and intervention to reduce the risk of CVD later in life.

It is well documented that overweight and obesity are strongly associated with high BP among children [12,13]. Dong et al. reported a sharp increase in the attributable risk of high BP linked to overweight and obesity among Chinese children, rising from 6.3% in 1995 to 19.2% in 2014 [14]. In addition, previous studies have shown that children with high birth weight are prone to high BP [15–17]. However, there has been limited investigation into how changes in weight status from birth to childhood relate to high BP in childhood [18,19]. This study aims to examine the association between changes in weight status from birth to childhood and high BP during childhood.

2. Materials and Methods

2.1. Study Participants

Data were from the baseline of the Huantai Childhood Cardiovascular Health Cohort Study. A convenient cluster sampling method was employed to select students in a public primary school in Huantai county, Shandong province, China. After excluding participants with a birth weight under 2500 g [20] (n = 56), who were underweight (<5th age- and sex-specific BMI percentile) [21] (n = 9), or missing data on questionnaire information, physical examination, or blood biochemical markers (n = 213), a total of 1237 children aged 6 to 11 were included in this study.

2.2. Physical Examination

The birth data on birth weight, breastfeeding, and early delivery were obtained from a questionnaire completed by parents. We also used the mother's hospitalized medical records at the time of delivery to obtain the data of the child's birth weight. Unfortunately, the data were incomplete, so we used these data for a sensitivity analysis. According to the standardized protocols, height, body weight, and BP of the children were measured. Height and body weight were assessed twice using an electronic weighing scale with an automatic range (HGM-300, Shengyuan Co., Ltd., Zhengzhou, China), and the average value of each measurement was used for analyses. Body mass index (BMI, kg/m^2) was calculated with weight in kilograms divided by the square of height in meters. BP was measured in a sitting position using a validated electronic sphygmomanometer (Omron HEM-7012, Matsusaka City, Mie Prefecture, Japan) [22] with appropriate size cuffs, after approximately 10 min of rest in a quiet room. Three measurements were taken and the averages of the last two values were used for data analyses.

2.3. Biochemical Markers and Lifestyles

Fasting venous blood samples were drawn after a minimum fasting period of 10 h, and the fasting blood glucose (FBG), high-density lipoprotein (HDL-C), low-density lipoprotein (LDL-C), and triglycerides (TGs) were measured by an automatic analyzer (Beckman Coulter AU480, Tokyo, Japan). Demographic and lifestyle data were gathered through a self-reported questionnaire, including age, sex, fruit and vegetable consumption, intake of carbonated drinks, physical activity, and sleeping hours.

2.4. Definitions

The definition of high birth weight was birth weight > 4000 g [23]. A childhood overweight status (including obesity) was defined according to the sex- and age-specific BMI cutoff values for an overweight status in Chinese children (Table S1) [24]. Then, children were classified into four groups based on whether they had high birth weight and whether they were overweight (including obesity) during childhood: consistently healthy weight (appropriate birth weight and appropriate childhood BMI), weight decrease (high birth weight but appropriate childhood BMI), weight increase (appropriate birth weight but a childhood overweight status), and consistently excess weight (high birth weight and a childhood overweight status). High BP was determined using the 95th cutoff values by gender, age, and height for Chinese children [25]. Early delivery was defined as a gestational age of less than 37 weeks [26]. According to breastfeeding duration, participants were categorized as more than 6 months vs. less than 6 months [27]. Inadequate fruit and vegetable consumption was characterized by a daily intake totaling <5 servings combined [28]. Physical inactivity was characterized as <1 h per day of combined walking, moderate, and vigorous physical activity [29]. The regular consumption of carbonated drinks was defined as drinking carbonated drinks one or more times per week [30].

2.5. Statistical Analysis

Continuous variables were expressed as the mean (standard deviation), and differences across four weight status groups were compared by variance analyses. Categorical variables were expressed as *n* (%), and differences across four weight status groups were compared by a chi-square test. Covariance analyses were used to compare differences in systolic BP and diastolic BP levels in childhood across the four groups. Model 1 was adjusted for age, sex, early delivery, and breastfeeding status. Model 2 was additionally adjusted for fruit and vegetable consumption, intake of carbonated drinks, physical activity, and sleeping hours in childhood. Model 3 was further adjusted for FBG, TG, HDL-C, and LDL-C in childhood. Multivariable logistic regression analyses were conducted to calculate odds ratios (ORs) with 95% confidence intervals (CIs) of high BP in childhood according to the four weight status groups, with the healthy weight status group serving as a reference. A sensitivity analysis was performed using birth weight data obtained from inpatient medical records, adjusting for the same covariates. SAS 9.4 (SAS Institute, Cary, North Carolina, NC, USA) was used to perform all statistical analyses. A two-sided p value < 0.05 was considered statistically significant.

3. Results

This study included 1237 children aged 6 to 11, with 53.6% of them being boys. Compared with the consistently healthy weight group and weight decrease group, children with a consistently excess weight and weight increase had a higher prevalence of inadequate fruit and vegetable consumption and worse metabolic profiles (elevated levels of FBG, LDL-C, and TG, along with reduced HDL-C) (Table 1).

Table 1. Characteristics of children according to weight status change (n = 1248).

	Consistently Healthy Weight (n = 669)	Weight Decrease (n = 62)	Weight Increase (n = 433)	Consistently Excess Weight (n = 73)	p Value
At birth					
Birth weight (g)	3309 (325)	4206 (267)	3357 (350)	4196 (260)	<0.001
Early delivery (<37 weeks), *n* (%)					
Yes	20 (3.0)	2 (3.2)	19 (4.4)	1 (1.4)	0.465
No	649 (97.0)	60 (96.8)	414 (95.6)	72 (98.6)	
Breastfeeding status					
≥6 months	585 (87.4)	56 (90.3)	385 (88.9)	68 (93.2)	0.467
<6 months	84 (12.6)	6 (9.7)	48 (11.1)	5 (6.8)	
In childhood					
Sex, *n* (%)					
Boys	336 (50.2)	38 (61.3)	233 (53.8)	56 (76.7)	<0.001
Girls	333 (49.8)	24 (38.7)	200 (46.2)	17 (23.3)	
Age (years)	8.8 (1.5)	9.1 (1.6)	8.9 (1.5)	9.3 (1.4)	0.021
Height (cm)	133.9 (10.4)	137.7 (9.9)	138.5 (10.8)	141.9 (10.0)	<0.001
Weight (kg)	28.9 (6.1)	31.8 (5.7)	41.5 (10.4)	45.5 (11.6)	<0.001
BMI (kg/m^2)	15.9 (1.3)	16.6 (1.2)	21.3 (2.8)	22.2 (3.5)	<0.001

Table 1. *Cont.*

	Consistently Healthy Weight (*n* = 669)	Weight Decrease (*n* = 62)	Weight Increase (*n* = 433)	Consistently Excess Weight (*n* = 73)	*p* Value
High BP, *n* (%)					
Yes	608 (90.9)	57 (91.9)	325 (75.1)	55 (75.3)	<0.001
No	61 (9.1)	5 (8.1)	108 (24.9)	18 (24.7)	
Inadequate fruit and vegetable consumption, *n* (%)					0.017
Yes	537 (80.3)	44 (71.0)	356 (82.2)	67 (91.8)	
No	132 (19.7)	18 (29.0)	77 (17.8)	6 (8.2)	
Regular consumption of carbonated drinks, *n* (%)					0.623
Yes	40 (6.0)	6 (9.7)	32 (7.4)	5 (6.8)	
No	629 (94.0)	56 (90.3)	401 (92.6)	68 (93.2)	
Physical inactivity, *n* (%)					
≥1 h/day	403 (60.2)	29 (46.8)	248 (57.3)	42 (57.5)	0.201
<1 h/day	266 (39.8)	33 (53.2)	185 (42.7)	31 (42.5)	
Sleeping hours (h)	9.3 (0.5)	9.4 (0.5)	9.4 (0.5)	9.3 (0.5)	0.403
FBG (mmol/L)	4.7 (0.6)	4.7 (0.5)	4.8 (0.5)	4.9 (0.5)	<0.001
HDL-C (mmol/L)	1.7 (0.4)	1.7 (0.4)	1.4 (0.3)	1.5 (0.4)	<0.001
LDL-C (mmol/L)	2.2 (0.6)	2.3 (0.7)	2.4 (0.8)	2.4 (0.7)	<0.001
TG (mmol/L)	0.7 (0.2)	0.7 (0.3)	0.9 (0.4)	0.9 (0.4)	<0.001

BMI, body mass index; FBG, fasting blood glucose; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TG, triglyceride.

After adjustment for potential covariates, both systolic BP and diastolic BP levels were notably higher in the consistently excess group [systolic BP, 108.4 (8.7) mmHg; diastolic BP, 66.0 (6.6) mmHg] and weight increase group [systolic BP, 109.0 (9.6) mmHg; diastolic BP, 65.4 (7.4) mmHg] than those in the consistently healthy weight group [systolic BP, 104.1 (9.8) mmHg; diastolic BP, 62.0 (7.5) mmHg] (all $p < 0.001$) (Table 2). In contrast, the difference in systolic BP or diastolic BP levels between the weight decrease group [systolic BP, 105.0 (8.3) mmHg; diastolic BP, 62.6 (6.4) mmHg] and consistently healthy weight group was not statistically significant ($p > 0.05$).

Table 2. Association between weight status change and blood pressure levels in childhood.

	Model 1		Model 2		Model 3	
	Mean (SD)	***p* Value ***	**Mean (SD)**	***p* Value ***	**Mean (SD)**	***p* Value ***
Systolic BP (mmHg)						
Consistently healthy weight	104.1 (8.3)	-	104.1 (8.2)	-	104.1 (9.8)	-
Weight decrease	104.9 (8.2)	0.498	104.8 (8.2)	0.511	105.0 (8.3)	0.431
Weight increase	109.7 (8.2)	<0.001	109.6 (8.2)	<0.001	109.0 (9.6)	<0.001
Consistently excess weight	109.2 (8.3)	<0.001	109.1 (8.3)	<0.001	108.4 (8.7)	<0.001
Diastolic BP (mmHg)						
Consistently healthy weight	61.9 (6.3)	-	61.9 (6.3)	-	62.0 (7.5)	-
Weight decrease	62.5 (6.3)	0.523	62.5 (6.3)	0.486	62.6 (6.4)	0.468
Weight increase	65.9 (6.3)	<0.001	65.9 (6.3)	<0.001	65.4 (7.4)	<0.001
Consistently excess weight	66.5 (6.4)	<0.001	66.5 (6.4)	<0.001	66.0 (6.6)	<0.001

* *p* value for difference in systolic BP or diastolic BP levels between consistently healthy weight group and specific group. Model 1: Adjusted for sex, age, early delivery, and breastfeeding. Model 2: Model 1 plus fruit and vegetable consumption, intake of carbonated drinks, physical activity, and sleeping hours in childhood. Model 3: Model 2 plus fasting blood glucose, triglycerides, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol in childhood. BP, blood pressure.

The prevalence of high BP was greater in the consistently excess weight group (24.7%) and weight increase group (24.9%) than the consistently healthy weight group (9.1%) and weight decrease group (8.1%) (Figure 1). Compared to participants with consistently healthy weight, those with consistently excess weight (OR = 2.73, 95% CI: 1.46–5.12) and those with a weight increase (OR = 2.77, 95% CI: 1.91–4.02) had significantly higher odds of high BP as children after adjusting for all potential covariates. In contrast, children with a weight decrease (OR = 0.94, 95% CI: 0.36–2.45) did not show a statistical rise in the odds of high BP in childhood. The sensitivity analyses yielded similar findings (Table 3).

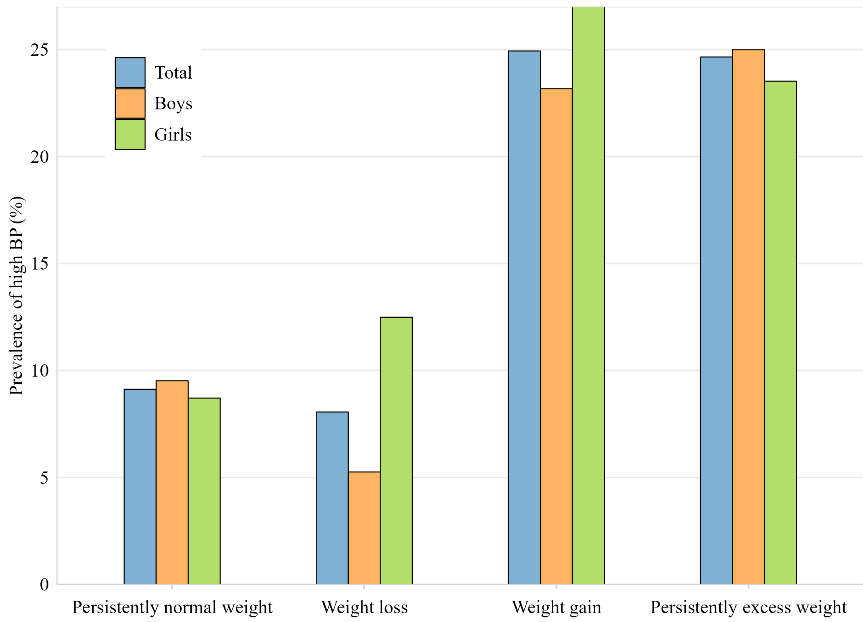

Figure 1. The prevalence of high blood pressure across four weight status change groups by sex.

Table 3. Association between weight status change and high BP in childhood.

Weight Status Change	Model 1		Model 2		Model 3		Sensitivity Analysis *	
	OR (95% CI)	*p* Value	*OR (95% CI)*	*p* Value	*OR (95% CI)*	*p* Value	*OR (95% CI)*	*p* Value
Consistently healthy weight	1.00		1.00		1.00			
Weight decrease	0.89 (0.34, 2.30)	0.801	0.91 (0.35, 2.37)	0.847	0.94 (0.36, 2.45)	0.895	0.60 (0.14, 2.61)	0.497
Weight increase	3.32 (2.36, 4.68)	<0.001	3.31 (2.35, 4.67)	<0.001	2.77 (1.91, 4.02)	<0.001	3.04 (1.95, 4.72)	<0.001
Consistently excess weight	3.40 (1.86, 6.22)	<0.001	3.29 (1.79, 6.04)	<0.001	2.73 (1.46, 5.12)	0.002	2.44 (1.06, 5.60)	0.036

Model 1: Adjusted for sex, age, early delivery, and breastfeeding. Model 2: Model 1 plus fruit and vegetable consumption, intake of carbonated drinks, physical activity, and sleeping hours in childhood. Model 3: Model 2 plus fasting blood glucose, triglycerides, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol in childhood. Sensitivity analysis: Model 2 plus fasting blood glucose, triglycerides, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol in childhood. * A total of 855 participants with birth weight information from hospitalization records were included in the sensitivity analysis.

4. Discussion

Our study suggested that children who consistently had excess weight or with a weight increase from birth to childhood were at higher odds of developing high BP compared to those who maintained a consistently healthy weight. Conversely, children with a high birth weight who attained a healthy weight by childhood did not have an increased risk of high BP.

Previous studies have indicated that a childhood overweight status increases the risk of hypertension in adulthood, but achieving a healthy weight later in life can reduce the risk [31–33]. A meta-analysis [34] indicated that, compared to individuals who maintained a healthy weight from childhood through adulthood, the odds of hypertension in adulthood were 2.69 (95% CI, 2.07–3.49) for those with a weight increase (healthy weight in childhood but overweight in adulthood) and 3.49 (95% CI, 2.21–5.50) for those with consistently excess weight (overweight in both childhood and adulthood). Conversely, individuals who reduced their weight (overweight in childhood but healthy weight in adulthood) did not show a significantly elevated risk of hypertension (OR, 1.25; 95% CI, 0.73–2.13). These studies suggested that individuals who were overweight or obese in childhood but manage to achieve a healthy weight by adulthood can lower the risk of hypertension in adulthood.

Notably, our findings indicate that the increased risk of hypertension linked with high birth weight can be mitigated if individuals with a high birth weight attain a healthy weight in childhood. Previous research has indicated that individuals who transition from a high birth weight to healthy weight tend to have better cardiometabolic health in adulthood [35,36]. Participants with a high birth weight have been shown to have higher BP levels in adulthood compared to those with healthy birth weight, and those with high birth weight presenting a weight decrease in childhood exhibited lower BP levels in adulthood [36]. Therefore, preventing and managing overweight and obesity in children are crucial for the prevention of childhood hypertension and future CVD events.

Evidence from a recent narrative review suggests that the risk of lifetime obesity and cardiovascular events could be modified by the intervention of a high birth weight [37]. Our findings also revealed that the proportions of children engaging in adequate physical activity, consuming sufficient fruits and vegetables, and having a lower intake of carbonated drinks were higher in the weight decrease group compared to the consistently excess weight and weight increase groups (Table 1). These lifestyle factors may contribute to the transformation of infants with a high birth weight into children of healthy weight, thereby reducing BP levels and high BP prevalence in childhood. Thus, although a strong correlation between birth weight and childhood overweight/obesity exists [38], adopting healthy lifestyles during childhood can effectively prevent overweight/obesity and reduce the risk of high BP in childhood.

However, several limitations should be considered. First, the sample size in the groups of consistently excess weight and a weight decrease is not large, which may have limited statistical power. Second, birth weight was reported by parental recall and may be subject to recall bias. Third, since participants were from the same primary school in China, the generalizability of our findings to children in other regions should be approached with caution. Fourth, although we adjusted for several confounders, residual or unmeasured confounders, such as psychological stress and genetic factors [39,40], may still affect our results. Fifth, while we primarily focused on the association of healthy and overweight children with high BP, the potential implications of underweight children were not thoroughly analyzed.

5. Conclusions

In conclusion, consistently excess weight from birth to childhood or healthy birth weight followed by an overweight status (including obesity) during childhood is associated with increased odds of high BP in childhood. However, the risk associated with a high birth weight may be minimized or eliminated if healthy weight can be achieved during childhood. Our findings emphasize the significance of maintaining a healthy weight in childhood to reduce the risk of high BP in childhood.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/future2040013/s1, Table S1: BMI (kg/m^2) cutoff values for overweight among children aged 6 to 11 years in China, categorized by gender and age.

Author Contributions: B.X. and Z.L. conceived the idea of this study. Z.L. analyzed the data and drafted the initial manuscript. L.Y. and Y.Y. conducted a critical review of the manuscript. M.Z. assisted with data acquisition. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the National Natural Science Foundation of China (81673195, 81722039).

Institutional Review Board Statement: This study was approved by the Ethics Committees of the School of Public Health, Shandong University, China (Approval number: 20160308).

Informed Consent Statement: Written informed consent was obtained from all participants and their parents or guardians.

Data Availability Statement: Due to privacy and ethical considerations, data sharing is not applicable to this article.

Acknowledgments: We extend our sincere gratitude to all participants of the Huantai Childhood Cardiovascular Health Cohort Study and their guardians for their invaluable cooperation. Additionally, we express our deep appreciation to all staff members for their dedication.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Roth, G.A.; Mensah, G.A.; Johnson, C.O.; Addolorato, G.; Ammirati, E.; Baddour, L.M.; Barengo, N.C.; Beaton, A.Z.; Benjamin, E.J.; Benziger, C.P.; et al. Global Burden of Cardiovascular Diseases and Risk Factors, 1990–2019: Update From the GBD 2019 Study. *J. Am. Coll. Cardiol.* **2020**, *76*, 2982–3021. [CrossRef] [PubMed]
2. National Center for Cardiovascular Diseases, China. *Annual Report on Cardiovascular Health and Diseases in China (2023)*; Peking Union Medical College Press: Beijing, China, 2023.
3. Carey, R.M.; Moran, A.E.; Whelton, P.K. Treatment of Hypertension: A Review. *JAMA* **2022**, *328*, 1849–1861. [CrossRef]
4. Roulet, C.; Bovet, P.; Brauchli, T.; Simeoni, U.; Xi, B.; Santschi, V.; Paradis, G.; Chiolero, A. Secular trends in blood pressure in children: A systematic review. *J. Clin. Hypertens.* **2017**, *19*, 488–497. [CrossRef] [PubMed]
5. Song, P.; Zhang, Y.; Yu, J.; Zha, M.; Zhu, Y.; Rahimi, K.; Rudan, I. Global Prevalence of Hypertension in Children: A Systematic Review and Meta-analysis. *JAMA Pediatr.* **2019**, *173*, 1154–1163. [CrossRef] [PubMed]
6. Kollias, A.; Dafni, M.; Poulidakis, E.; Ntineri, A.; Stergiou, G.S. Out-of-office blood pressure and target organ damage in children and adolescents: A systematic review and meta-analysis. *J. Hypertens.* **2014**, *32*, 2315–2331; discussion 2331. [CrossRef]
7. Yang, L.; Yang, L.; Zhang, Y.; Xi, B. Prevalence of Target Organ Damage in Chinese Hypertensive Children and Adolescents. *Front. Pediatr.* **2018**, *6*, 333. [CrossRef] [PubMed]
8. Yang, L.; Sun, J.; Zhao, M.; Liang, Y.; Bovet, P.; Xi, B. Elevated blood pressure in childhood and hypertension risk in adulthood: A systematic review and meta-analysis. *J. Hypertens.* **2020**, *38*, 2346–2355. [CrossRef] [PubMed]
9. Chen, X.; Wang, Y. Tracking of blood pressure from childhood to adulthood: A systematic review and meta-regression analysis. *Circulation* **2008**, *117*, 3171–3180. [CrossRef] [PubMed]
10. Daniels, S.R.; Pratt, C.A.; Hayman, L.L. Reduction of risk for cardiovascular disease in children and adolescents. *Circulation* **2011**, *124*, 1673–1686. [CrossRef]
11. Erlingsdottir, A.; Indridason, O.S.; Thorvaldsson, O.; Edvardsson, V.O. Blood pressure in children and target-organ damage later in life. *Pediatr. Nephrol.* **2010**, *25*, 323–328. [CrossRef]
12. Wühl, E. Hypertension in childhood obesity. *Acta Paediatr.* **2019**, *108*, 37–43. [CrossRef]
13. Manios, Y.; Karatzi, K.; Protogerou, A.D.; Moschonis, G.; Tsirimiagou, C.; Androutsos, O.; Lionis, C.; Chrousos, G.P. Prevalence of childhood hypertension and hypertension phenotypes by weight status and waist circumference: The Healthy Growth Study. *Eur. J. Nutr.* **2018**, *57*, 1147–1155. [CrossRef]
14. Dong, Y.; Ma, J.; Song, Y.; Ma, Y.; Dong, B.; Zou, Z.; Prochaska, J.J. Secular Trends in Blood Pressure and Overweight and Obesity in Chinese Boys and Girls Aged 7 to 17 Years From 1995 to 2014. *Hypertension* **2018**, *72*, 298–305. [CrossRef] [PubMed]
15. Edvardsson, V.O.; Steinthorsdottir, S.D.; Eliasdottir, S.B.; Indridason, O.S.; Palsson, R. Birth weight and childhood blood pressure. *Curr. Hypertens. Rep.* **2012**, *14*, 596–602. [CrossRef]
16. Zhang, Y.; Li, H.; Liu, S.J.; Fu, G.J.; Zhao, Y.; Xie, Y.J.; Zhang, Y.; Wang, Y.X. The associations of high birth weight with blood pressure and hypertension in later life: A systematic review and meta-analysis. *Hypertens. Res.* **2013**, *36*, 725–735. [CrossRef]
17. Kuciene, R.; Dulskiene, V.; Medzioniene, J. Associations between high birth weight, being large for gestational age, and high blood pressure among adolescents: A cross-sectional study. *Eur. J. Nutr.* **2018**, *57*, 373–381. [CrossRef]
18. Law, C.M.; Shiell, A.W.; Newsome, C.A.; Syddall, H.E.; Shinebourne, E.A.; Fayers, P.M.; Martyn, C.N.; de Swiet, M. Fetal, infant, and childhood growth and adult blood pressure: A longitudinal study from birth to 22 years of age. *Circulation* **2002**, *105*, 1088–1092. [CrossRef]
19. Horta, B.L.; Barros, F.C.; Victora, C.G.; Cole, T.J. Early and late growth and blood pressure in adolescence. *J. Epidemiol. Community Health* **2003**, *57*, 226–230. [CrossRef]
20. Hughes, M.M.; Black, R.E.; Katz, J. 2500-g Low Birth Weight Cutoff: History and Implications for Future Research and Policy. *Matern. Child Health J.* **2017**, *21*, 283–289. [CrossRef]
21. Screening Standard for Malnutrition of School-Age Children and Adolescents. Available online: https://hbba.sacinfo.org.cn/stdDetail/8dfa4f569546fee01d6148f9b3cb86d0 (accessed on 23 July 2024).
22. Meng, L.; Hou, D.; Shan, X.; Mi, J. Accuracy evaluation of Omron HEM-7012 electronic sphygmomanometers in measuring blood pressure of children and adolescents. *Chin. J. Hypertens.* **2013**, *21*, 158–162.
23. Araujo Júnior, E.; Peixoto, A.B.; Zamarian, A.C.; Elito Júnior, J.; Tonni, G. Macrosomia. *Best Pract. Res. Clin. Obstet. Gynaecol.* **2017**, *38*, 83–96. [CrossRef]

24. Li, H.; Zong, X.N.; Ji, C.Y.; Mi, J. Body mass index cut-offs for overweight and obesity in Chinese children and adolescents aged 2–18 years. *Chin. J. Epidemiol.* **2010**, *31*, 616–620.
25. Fan, H.; Yan, Y.K.; Mi, J. Updating blood pressure references for Chinese children aged 3–17 years. *Chin. J. Hypertens.* **2017**, *25*, 428–435.
26. WHO: Recommended definitions, terminology and format for statistical tables related to the perinatal period and use of a new certificate for cause of perinatal deaths. Modifications recommended by FIGO as amended October 14, 1976. *Acta Obstet. Gynecol. Scand.* **1977**, *56*, 247–253.
27. Sayres, S.; Visentin, L. Breastfeeding: Uncovering barriers and offering solutions. *Curr. Opin. Pediatr.* **2018**, *30*, 591–596. [CrossRef]
28. WHO and FAO Announce Global Initiative to Promote Consumption of Fruit and Vegetables. Available online: https://www.who.int/news/item/11-11-2003-who-and-fao-announce-global-initiative-to-promote-consumption-of-fruit-and-vegetables (accessed on 23 July 2024).
29. Global Recommendations on Physical Activity for Health. Available online: https://www.who.int/dietphysicalactivity/factsheet_recommendations/en/ (accessed on 23 July 2024).
30. Holstein, B.E.; Damsgaard, M.T.; Due, P.; Krølner, R.F.; Pedersen, T.P.; Rasmussen, M. Intake of sugar sweetened soft drinks among adolescents: Trends and social inequality in Denmark 2002–2018. *Nutr. Health* **2020**, *26*, 3–8. [CrossRef]
31. Hou, Y.; Wang, M.; Yang, L.; Zhao, M.; Yan, Y.; Xi, B. Weight status change from childhood to early adulthood and the risk of adult hypertension. *J. Hypertens.* **2019**, *37*, 1239–1243. [CrossRef] [PubMed]
32. Juonala, M.; Magnussen, C.G.; Berenson, G.S.; Venn, A.; Burns, T.L.; Sabin, M.A.; Srinivasan, S.R.; Daniels, S.R.; Davis, P.H.; Chen, W.; et al. Childhood adiposity, adult adiposity, and cardiovascular risk factors. *N. Engl. J. Med.* **2011**, *365*, 1876–1885. [CrossRef] [PubMed]
33. Suglia, S.F.; Clark, C.J.; Gary-Webb, T.L. Adolescent obesity, change in weight status, and hypertension: Racial/ethnic variations. *Hypertension* **2013**, *61*, 290–295. [CrossRef] [PubMed]
34. Sun, J.; Xi, B.; Yang, L.; Zhao, M.; Juonala, M.; Magnussen, C.G. Weight change from childhood to adulthood and cardiovascular risk factors and outcomes in adulthood: A systematic review of the literature. *Obes. Rev.* **2021**, *22*, e13138. [CrossRef]
35. Lei, X.; Zhao, D.; Huang, L.; Luo, Z.; Zhang, J.; Yu, X.; Zhang, Y. Childhood Health Outcomes in Term, Large-for-Gestational-Age Babies with Different Postnatal Growth Patterns. *Am. J. Epidemiol.* **2018**, *187*, 507–514. [CrossRef]
36. Renom Espineira, A.; Fernandes-Rosa, F.L.; Bueno, A.C.; de Souza, R.M.; Moreira, A.C.; de Castro, M.; Barbieri, M.A.; Bettiol, H.; Antonini, S.R. Postnatal growth and cardiometabolic profile in young adults born large for gestational age. *Clin. Endocrinol.* **2011**, *75*, 335–341. [CrossRef] [PubMed]
37. Viswanathan, S.; McNelis, K.; Makker, K.; Calhoun, D.; Woo, J.G.; Balagopal, B. Childhood obesity and adverse cardiometabolic risk in large for gestational age infants and potential early preventive strategies: A narrative review. *Pediatr. Res.* **2022**, *92*, 653–661. [CrossRef]
38. Yu, Z.B.; Han, S.P.; Zhu, G.Z.; Zhu, C.; Wang, X.J.; Cao, X.G.; Guo, X.R. Birth weight and subsequent risk of obesity: A systematic review and meta-analysis. *Obes. Rev.* **2011**, *12*, 525–542. [CrossRef]
39. Kivimäki, M.; Steptoe, A. Effects of stress on the development and progression of cardiovascular disease. *Nat. Rev. Cardiol.* **2018**, *15*, 215–229. [CrossRef]
40. Giri, A.; Hellwege, J.N.; Keaton, J.M.; Park, J.; Qiu, C.; Warren, H.R.; Torstenson, E.S.; Kovesdy, C.P.; Sun, Y.V.; Wilson, O.D.; et al. Trans-ethnic association study of blood pressure determinants in over 750,000 individuals. *Nat. Genet.* **2019**, *51*, 51–62. [CrossRef]