

Prevalence and Health Hazards of Breakfast Skipping in Children and Adolescents in China

Jinyi Zhu*

RDFZ Chaoyang Branch School, Beijing, 100028, China

*Corresponding author: zhujinyi@rdfzcygj.cn

Abstract. Children and teenagers require a proper and balanced diet in order to grow and develop. However, breakfast skipping (BS) is quite common in Chinese children. From the large-scale surveys published in Pub Med and China National Knowledge Infrastructure (CNKI), the prevalence of skipping breakfast is around 8-25% in Chinese children and adolescents. Skipping breakfast is related to personal and social economic factors. In China, children from low-income and low urbanization areas are at a higher rate of skipping. Skipping breakfast is also related to sleep insufficiency. Skipping breakfast has a lot of health hazards to children and adolescents. Breakfast skippers had worse cognitive, physical and social performance than the peers that eat breakfast. In some groups of children, BS was also associated with malnutrition. Research in some Chinese areas found that breakfast skippers had a higher rate of overweight/obesity, but other groups do not show the relationship. Some studies also showed BS tend to cluster with other unhealthy behaviors and increase the risk of metabolic syndrome. Further research is necessary to understand the mechanism of BS and its dangers.

Keywords: Breakfast Skipping; Adolescents; Children.

1. Introduction

Childhood and Adolescence is a very important stage of life, which is a critical stage for growth and development. So, in this period of time, sufficient and balanced diet is necessary. A good eating habits will benefit the whole life. The lifestyle in China has a dramatic change during the past 30 years, dietary composition has significantly improved, the proportion of protein derived from animal food increased from 18.9% in 1992 to 35.2% in 2015 for urban and rural residents nationwide. The energy supply ratio of carbohydrates in rural areas decreased from 70.1% in 1992 to 55.3% in 2015 [1]. While the nutrition status improved, overweight and obesity rate increase dramatically. In kids, the obesity rate is 11.1% and 7.9% for 6-17 years old. And the life pace is quicker in China, people rush to school and work, skipping breakfast (BS) and eating big meal at dinner are quite common in China. Adult studies have revealed that BS raises the risk of obesity and metabolic disorders. This investigation is goal to provide an analysis of the prevalence and relationships of BS in Chinese children and adolescents (CA), as well as its connections to body weight, nutritional, and metabolic indices.

2. Prevalence of BS in Chinese CA

In most of the countries, BS is very common, especially in teenagers and young adults. Depending on the definition of BS utilized, the stated prevalence of them displayed unusually broad diversity, ranging from 0.7% to 74.7% [2]. Survey in China also show the variability depending on the age, sex, living area, etc.

In 2005, National Survey on Adolescents' Health Risk Behavior got 177115 questionnaire results, the overall prevalence of BS is 8.8% and 7.8% among middle school boys and girls [3]. In another study, 5254 children aged 6-17 years from Nutrition Survey were included, 24.0% children BS (<3 times/week) [4].

In a study with more children in 2011, 91.1% (26 776/29 393) take breakfast daily, and rate of children aged 12- 17 years (87.8%) was lower than that of aged 6- 11 years (94.6%), more adolescents do not eat breakfast regularly [5].

In 2017, Chinese Adolescent Health Danger Behavior Monitoring Questionnaire included 15,415 students from junior middle schools, regular high schools and vocational high schools from 15 districts / counties in 11 central, western and eastern China. proportion of adolescents eating breakfast every day in the past 7 days was 62.4%, 1.8% never eat breakfast, and 35.7% eat breakfast sometimes (Table 1) [6].

Table 1. Breakfast consumption of adolescents in the past 7 day [n (%)]

Group	N	Never	Sometimes	Everyday	x2
Gender					9.421
Male	7661	158 (2.1)	2664 (34.8)	4839 (63.2)	
Female	7740	125 (1.6)	2883 (36.7)	4776 (61.7)	
School					271.978
Middle school	6056	113 (1.9)	1997 (33.0)	3946 (65.2)	
Normal high school	6444	113 (1.8)	2090 (32.4)	4241 (65.8)	
Vocational high school	2901	57 (2.0)	1416 (48.8)	1428 (49.2)	
Region					51.796
West	3077	60 (1.9)	1267 (41.2)	1750 (56.9)	
Middle	4153	78 (1.9)	1443 (34.7)	2632 (63.4)	
East	8171	145 (1.8)	2793 (34.2)	5233 (64.0)	
Total	15401	283 (1.8)	5503 (35.7)	9615 (62.4)	

3. Related Factors to BS

Personal and social factors can both influence the breakfast habits. The reasons for BS include not hungry, no enough time, no favorite food, going on diet, no available food, no breakfast habit etc.

Breakfast attitudes are influenced by household income and the degree of urbanization in the town. More children from low urbanization communities and low-income families tend to omit breakfast. Following the survey, 3.6% of kids in underdeveloped rural regions reported never eating breakfast [5]. For the types of food, more children from high urbanization community chose high-protein food such as milk, bean, meat and egg etc., as breakfast (Table 2)

Insufficient sleep is more and more common in school children, study showed that sleep insufficiency was related to BS. According to the study among Chinese students, sleeping depriving was associated with BS. According to the NHC Report, children aged 6-12 and those aged 13-17 slept for average 8.9 and 7.9 hours everyday, which is a 0.2 and 0.6-hour reduction from 2002. The sleeping time is much shorter than recommendations for 10 and 8-9 hours respectively. Shorter sleep was linked to greater BS rates. Children who slept severely short had a higher possibility of selecting and consuming sweet drinks as snacks. (Table 3).

Table 2. Breakfast prevalence of CA [n (%)]

Character	Eating breakfast		X ²	P
	Yes	No		
Gender			0.45	0.503
Male	998(97. 2)	29(2.8)		
Female	925(96. 7)	32(3.3)		
Age			0.745	0.863
4~6	450(97.2)	13(2. 8)		
7~10	608(97.0)	19(3. 0)		
11~13	389(96. 3)	15(3.7)		
14~17	476(97. 1)	14(2. 9)		
Urbanization level			19. 214	<0. 001
Low	605(94.7)	34(5.3)		
Medium	643(97. 1)	19(2. 9)		
High	675(98. 8)	8(1.2)		
Income			10. 323	0. 006
Low	592 (95.6)	271 (4. 4)		
Medium	606 (96.3)	23(3.7)		
High	725 (98.5)	11(1.5)		
Total	1923 (96.9)	61(3.1)		

Table 3. Logarithmic relationship between BS and meal variety and sleep length

	Skipping Breakfast		Breakfast Food Diversity		Rate of Snack Consumption		Rate of Snack Consumption≥1 Times/d		Rate of Post-Dinner Snacks CONSUMPTION	
Original										
Moderate sleep		ref		ref		ref		ref		ref
Slightly short sleep	1. 1	(1.00, 1.33)	0.9 4	(0.83, 1.06)	0.7 8	(0.69, 0.89)	0.88	(0.78, 1.01)	0.9	(0.79, 1.02)
Severely short sleep	1. 3	(1.04, 1.77)	1.2 9	(0.99, 1.67)	0.6 3	(0.49, 0.82)	0.78	(0.57, 1.07)	0.69	(0.51, 0.93)
Bootstrapping										
Moderate sleep		ref		ref				ref		ref
Slightly short sleep	1. 1	(1.00, 1.33)	0.9 4	(0.84, 1.06)	0.7 8	(0.69, 0.89)	0.89	(0.78, 1.02)	0.9	(0.79, 1.03)
Severely short sleep	1. 3	(1.03, 1.77)	1.2 9	(0.99, 1.67)	0.6 3	(0.49, 0.82)	0.78	(0.57, 1.06)	0.68	(0.51, 0.93)

4. Clustering of Other Unhealthy Behaviors With BS

Investigations showed BS was clustering with bad habits such as watching too much TV, lack of physical activity and playing too much electronic games, preference to junk food. In National Survey on Adolescents' Health Risk Behavior survey, Ji studied the diet habit and other unhealthy habits(N>10000), it showed among those who had unhealthy behaviors, 53.2% boys and 62.4% girls

had more than 1 unhealthy habits [3]. Patterson K.A.E reported that unhealthier childhood clusters including BS, smoking, less physical activity predicted a significantly worse metabolic score after a 20-year follow-up [7].

5. BS and Cognitive and Physical Performance

Regular meal can give the nutrients body needs, it is especially important during childhood and adolescence for the need to grow and develop, after a whole night fasting, breakfast help to give the energy to support body activity. Studies had showed regular meal benefit for the cognitive development. A significant research of 56,238 and 91,543 Chinese elementary and middle school students concluded that eating breakfast each day helped pupils' cognitive growth, and had a significant effect on academic results. Ho, C Y study breakfast with school performance. The modified SAED questionnaire was utilized to evaluate their social and academic performance. Children who regularly ate breakfast had a considerably better competence score. In a health survey, Hu, J. investigated BS and physical wellness in 1849 teenagers. Tests of standing long jump, sprint, long distance run, and vital capacity were used to gauge physical fitness. Boys who eat breakfast regularly performed better in sprint, the long distance run, and vital capacity tests than those who omitting often. Girls of breakfast eater also had better performance on the jump test. Chinese teenagers aged 13 to 18 may have decreased physical wellness due to BS, particularly boys [8].

6. Relation of BS to Malnutrition

Proper food is essential to health, especially to growth and development. The nutrition condition has improved greatly in China during the past 30 years. Urban-rural disparities have gradually closed. For both urban and rural residents nationally, the percentage of protein from animal diet climbed from 18.9% in 1992 to 35.2% in 2015. But malnutrition still an issue.

According to one survey in 2010, the rate of malnutrition in children omitting breakfast was 16.5%, with 5.6% stunting and 11.0% wasting rates [9]. BS is an independent factor that contributed to malnutrition.

In rural areas, the condition was even worse. In the study of students in Guizhou province in 2019, The malnutrition rate, growth retardation rate and wasting rate was 21.39%, 13.13% and 8.26% respectively [10]. The frequency and quality of breakfast were important factors to influence malnutrition. Breakfast-skippers were more likely to be malnourished.

7. Relation of BS to Overweight / Obesity

Though BS was showed to related to malnutrition, a lot of studies show breakfast skippers are also at a higher risk to be overweight and obesity.

H K So conducted study in Hongkong with total of 11 570 children, students who skipped breakfast were 8% in elementary school and 14% in high school [11]. The 12 % of children who is BS will had higher BMI than their counterparts.

Tin S P studied 113,457 primary participants for 2 years [12]. At the time of the baseline survey, about 5.3% students skipped their breakfast. Baseline breakfast skippers saw a higher increase in BMI compared to eaters over the next two years.

As for the reasons for overweight /obesity related to the breakfast-skipper, some authors suggest that breakfast skippers tend to eat more during the rest of the day, and other factors such as sleep habits, lower physical activity levels contribute to it.

But some studies did not show this association. Among kids who regularly ate breakfast, 17.1% had a combined overweight or obesity rate, according to the Nutrition Survey 2010, which was substantially higher than the rate among kids who skipped breakfast. The frequency of breakfast did not affect whether or not they were overweight or obese, according to a logistic regression study [9].

8. Relation of BS to Glucose and Other Metabolic Indices

BS means longer fasting time, and might induce metabolic change. Alessa Nas investigated if there was a metabolic difference between the BS day and a day without dinner in comparison to a typical three-meal schedule [13]. In response to prolonged fasting, the results demonstrated greater postprandial insulin concentrations and enhanced fat oxidation on the BS day, which may eventually culminate in low-grade inflammation and altered glucose homeostasis (Fig 1).

There was inconsistent about the fasting glucose level and BS. Shafiee et al studied in more than 5000 children, there was no association between fasting glucose and BS [14]. ZHU WG study the factors related to high fasting glucose in 5-15 years old Chinese children. it showed that BS is one factor associated to higher fasting glucose level [15].

Some study reported a worse lipid and prevalence of metabolic syndrome in BS children.

Ho, C Y explores Taiwanese children's breakfast habit and the metabolic syndrome [16]. Students from the Elementary School were enlisted as participants, 1287 boys and 1114 girls Compared to children who eat breakfast 0–4 times/week, children who eat breakfast every day had decreased odds of high blood pressure and metabolic syndrome.

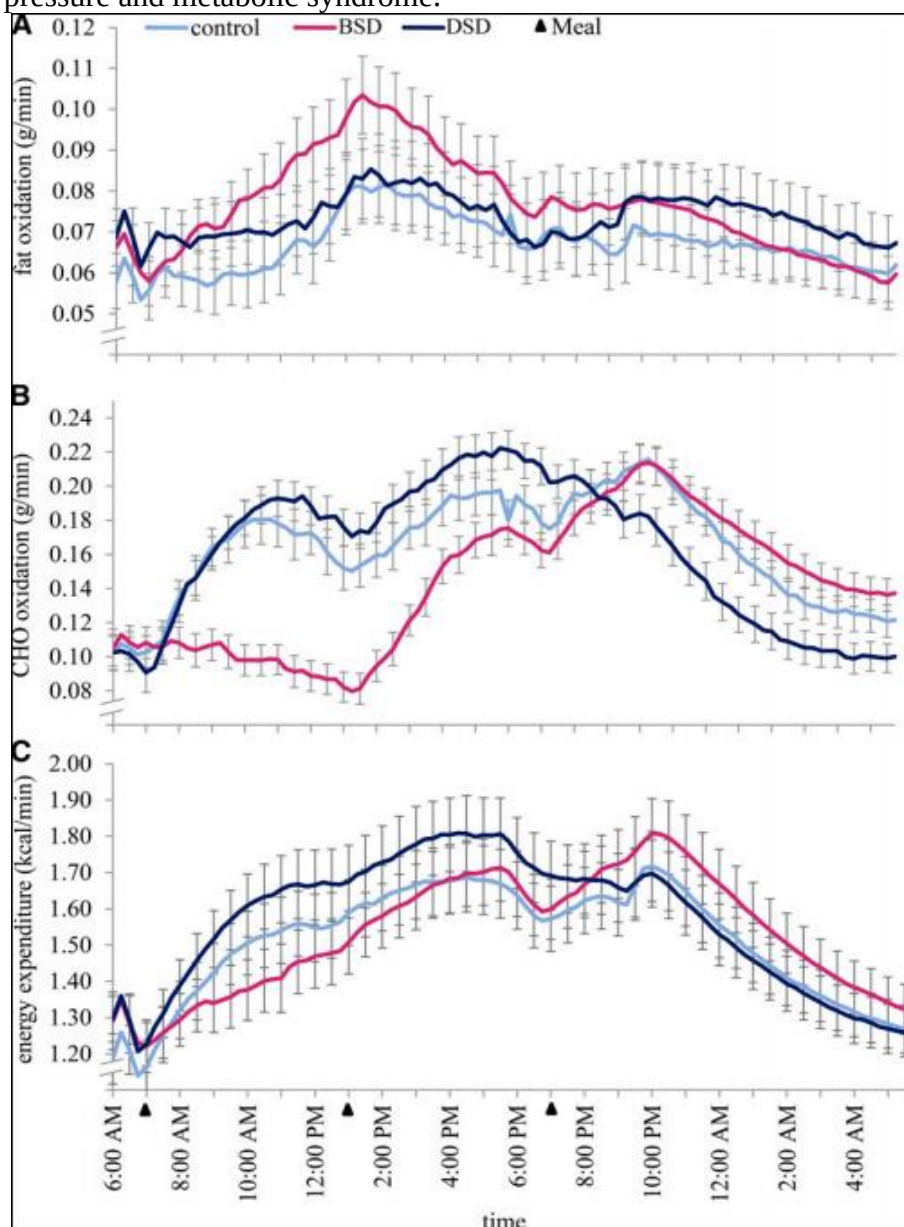


Fig. 1 24 hour energy expenditure, lipid oxidation, and carbohydrate oxidation for the control, BS, and dinner skipping groups

9. Discussion

Breakfast skipping is common in Chinese CA, from large-scale survey, the prevalence of BS in CA is round 8-25%. As life style changed, the BS rate did not go down. The personal reasons of BS include not hungry, no enough time, no food available, etc. Sleeping habits also related to the breakfast-skipping rate. Sleep insufficiency was associated with higher rate of BS. It is a big issue need to pay more attention. Cause more and more school children lack of sleeping. Children with little sleep were 1.3 times more likely to have BS than youngsters with appropriate sleep, according to a study of 177,091 Greek children [17]. With today's early start to school, kids with poor sleep patterns rarely have time for breakfast. Short sleep duration may affect one's appetite and calorie intake by changing the physiological statue for satiety and hunger. The social-economic factors also influence the prevalence. China Health and Nutrition Survey explored that more people from low-income families and low urbanization areas tend to skip breakfast. And BS also cluster with other unhealthy habits, such as junk food preference, less activity, long time TV watching, indulging in network, etc., it showed as a marker of unhealthy life style [3].

Regular meal can provide the energy and nutrients body needs, it is very important especially during child and adolescence stage. BS had a lot health influence. It showed relation to malnutrition especially in less developed area. Breakfast skipper in Chinese CA had worse cognitive, physical and social performance compared with their peers. When study the change of glucose metabolism, in BS day, the postprandial insulin concentrations and fat oxidation increased. Some studies showed BS in children was related to overweight/obesity, higher fasting glucose, higher blood pressure lever, and metabolic syndrome, this relation to overweight was also observed in other group of children and adults. The reason to that maybe because the high-energy food taken during the rest of the day, or because the clustering with other unhealthy habits, And the mechanism needs to be study further.

10. Conclusion

The prevalence of skipping breakfast is around 8-25% in Chinese CA. And it is more common in low-income and low urbanization areas in China. Sleep insufficiency was related to BS. The BS children had worse cognitive and physical performance than regular eater. The BS was related to malnutrition in some group children. Studies in some Chinese areas found that breakfast skippers had higher rate of overweight and obesity, other studies do not show the relationship. Studies also showed BS tend to cluster with other unhealthy behaviors and increase the risk to metabolic syndrome. More studies should elucidate the reasons for relationship of BS and its hazards, especially obesity. And it is very important for CA to shape their health-promoting dietary habits and active lifestyle.

References

- [1] CDC. The Scientific Research Report on the Dietary Guidelines for Chinese Residents. 2021.
- [2] Monzani Alice, Ricotti Roberta, Caputo Marina, et al. A systematic review of the association of skipping breakfast with weight and cardiometabolic risk factors in children and adolescents. What should we better investigate in the future? *Nutrients*, 2019, 11(2): 387.
- [3] Ji CY, Chen TJ, Huang LQ, et al. Analyses on the dietary pattern-related health-risk behaviors and the cluster features in Chinese middle school students. *Chin J Sch Health*, 2009, 30: 118-121.
- [4] Li Li, Yang TT, Xu PP, et al. Study on breakfast consumption of children aged from 6-17 in China in 2010-2012. *Zhonghua yu Fang yi xue za zhi [Chinese Journal of Preventive Medicine]*, 2017, 51(6): 523-526.
- [5] Su Chang, Wang Huijun, Wang Dantong, et al. The impact of community urbanization and household income on breakfast behaviors among Chinese children and adolescents in twelve provinces. *Wei Sheng Yan Jiu= Journal of Hygiene Research*, 2016, 45(6): 882-887.

- [6] Nie Yan, Zheng Ruimin, Luo Xiaomin, et al. Investigation and analysis on dietary behavior and exercise status of adolescents in 11 provinces in China. *China Maternal and Child Health Research*, 2022, 33(6): 7.
- [7] Patterson Kira AE, Ferrar Katia, Gall Seana L, et al. Cluster patterns of behavioural risk factors among children: Longitudinal associations with adult cardio-metabolic risk factors. *Preventive Medicine*, 2020, 130: 105861.
- [8] [8] Hu Jingcen, Li Zhifei, Li Sixuan, et al. Skipping breakfast and physical fitness among school-aged adolescents. *Clinics*, 2020, 75.
- [9] Li Li, Xu Peipei, Yang Titi, et al. Relationship between breakfast and nutrition status study of children aged 6-17 in China from 2010 to 2012. *Wei Sheng yan jiu= Journal of Hygiene Research*, 2018, 47(3): 373-377.
- [10] Liu Yingjie, Zhou Huimin, Wang Shiran, et al. Relationship between nutritional status and breakfast behaviors of rural primary and middle school students in a minority area of a city in Guizhou Province in 2019. *Wei Sheng yan jiu= Journal of Hygiene Research*, 2021, 50(4): 552-557.
- [11] So Hung K, Nelson EAS, Li Albert M, et al. Breakfast frequency inversely associated with BMI and body fatness in Hong Kong Chinese children aged 9–18 years. *British journal of nutrition*, 2011, 106(5): 742-751.
- [12] Tin SPP, Ho SY, Mak KH, et al. Breakfast skipping and change in body mass index in young children. *International journal of obesity*, 2011, 35(7): 899-906.
- [13] Nas Alessa, Mirza Nora, Hägele Franziska, et al. Impact of breakfast skipping compared with dinner skipping on regulation of energy balance and metabolic risk. *The American journal of clinical nutrition*, 2017, 105(6): 1351-1361.
- [14] Shafiee Gita, Kelishadi Roya, Qorbani Mostafa, et al. Association of breakfast intake with cardiometabolic risk factors. *Jornal de pediatria*, 2013, 89(6): 575-582.
- [15] Zhu W. G., Shen C., Liu Q., et al. Study on the risk factor of glucose elevating in children and adolescents. *Chinese Journal of Disease Control & Prevention*, 2010.
- [16] Ho Chia-Yi, Huang Yi-Chen, Lo Yuan-Ting C, et al. Breakfast is associated with the metabolic syndrome and school performance among Taiwanese children. *Research in developmental disabilities*, 2015, 43: 179-188.
- [17] Tambalis Konstantinos D, Panagiotakos Demosthenes B, Psarra Glyceria, et al. Insufficient sleep duration is associated with dietary habits, screen time, and obesity in children. *Journal of Clinical Sleep Medicine*, 2018, 14(10): 1689-1696.