RESEARCH ARTICLE

Disaggregating the longitudinal association between urbanization and body weight in Chinese adults over 1991 – 2015

Supplymentary File

Table S1. Descriptive statistics of the continuous outcome variables.

Survey wave	BMI			WC			WHpR			WHtR		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Women												
1991	21.9	3.0	4,038	—	—		—	—		—	—	
1993	22.1	3.0	3,758	74.9	9.1	3,626	0.8	0.1	3,605	0.5	0.1	3,617
1997	22.5	3.1	3,746	75.9	9.1	3,652	0.8	0.1	3,620	0.5	0.1	3,646
2000	22.9	3.2	4,018	77.6	9.4	3,995	0.8	0.1	3,961	0.5	0.1	3,988
2004	23.2	3.4	3,969	78.9	9.6	3,959	0.8	0.1	3,895	0.5	0.1	3,950
2006	23.3	3.8	3,911	79.3	9.7	3,877	0.8	0.1	3,831	0.5	0.1	3,870
2009	23.4	3.5	4,019	80.6	10.0	4,001	0.9	0.1	3,967	0.5	0.1	3,998
2011	23.8	4.2	3,840	81.5	11.6	3,838	0.9	0.1	3,838	0.5	0.1	3,835
2015	24.1	4.7	3,766	80.6	13.9	3,761	0.9	0.4	3,486	0.5	0.1	3,757
Men												
1991	21.5	2.6	3,707	—	—		—	—		—	—	
1993	21.7	2.6	3,469	76.4	8.5	3,329	0.9	0.1	3,314	0.5	0.0	3,327
1997	22.2	2.9	3,593	78.7	9.1	3,519	0.9	0.1	3,494	0.5	0.1	3,516
2000	22.7	3.1	3,760	80.9	9.7	3,735	0.9	0.1	3,704	0.5	0.1	3,731
2004	23.0	3.1	3,688	82.4	9.6	3,680	0.9	0.1	3,620	0.5	0.1	3,667
2006	23.2	3.2	3,548	83.0	9.6	3,527	0.9	0.1	3,470	0.5	0.1	3,518
2009	23.4	3.3	3,687	84.3	10.1	3,679	0.9	0.1	3,648	0.5	0.1	3,672
2011	24.0	4.2	3,452	85.6	10.7	3,452	0.9	0.1	3,452	0.5	0.1	3,448
2015	24.6	4.3	3,405	85.4	14.0	3,403	0.9	0.4	2,920	0.5	0.1	3,401

BMI, body mass index (kg/m^2); WC, waist circumference (cm); WHpR, waist-to-hip ratio; WHtR, waist-to-height ratio.

Table S2. Descriptive statistics of the dichotomous outcome variables.

Survey wave	Overweight		Abdominal obesity based on					
			WC		WHpR		WHtR	
	%	*n*	%	*n*	%	*n*	%	*n*
Women								
1991	22.1	4,038	—		—		—	
1993	23.8	3,758	14.8	3,626	33.7	3,605	33.8	3,617
1997	28.8	3,746	17.4	3,652	34.4	3,620	38.3	3,646
2000	33.8	4,018	22.8	3,995	37.6	3,961	44.5	3,988
2004	36.8	3,969	26.3	3,959	46.1	3,895	50.1	3,950
2006	37.5	3,911	27.4	3,877	47.8	3,831	50.6	3,870
2009	39.2	4,019	32.9	4,001	50.9	3,967	55.8	3,998
2011	42.7	3,840	36.0	3,838	55.8	3,838	59.9	3,835
2015	45.7	3,766	38.1	3,761	55.6	3,486	59.6	3,757
Men								
1991	14.8	3,707	—		—		—	
1993	16.9	3,469	8.3	3,329	19.9	3,314	19.7	3,327
1997	23.3	3,593	13.6	3,519	23.8	3,494	27.5	3,516
2000	30.4	3,760	19.5	3,735	29.0	3,704	36.5	3,731
2004	34.9	3,688	22.8	3,680	35.1	3,620	41.8	3,667
2006	37.7	3,548	24.7	3,527	36.9	3,470	44.8	3,518
2009	41.7	3,687	30.0	3,679	41.1	3,648	50.2	3,672
2011	46.0	3,452	35.2	3,452	45.4	3,452	55.9	3,448
2015	51.4	3,405	38.3	3,403	51.5	2,920	58.3	3,401

Overweight if body mass index ≥24 kg/m². Abdominal obesity if waist circumference (WC) ≥90 cm in men or≥85 cm in women; waist-to-hip ratio (WHpR) ≥0.9 in men or≥0.85 in women; or waist-to-height ratio (WHtR) >0.5.

Table S3. Descriptive statistics of community-level urbanicity index values, stratified by year and community type.

Survey wave	Community-level urbanicity index value														
	City			Suburb			Town			Village			Total		
	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*
1991	64.5	8.5	31	50.5	13.8	31	59.8	8.2	32	34.8	10.1	96	46.4	16.1	190
1993	66.5	7.3	30	55.1	13.5	31	62.0	9.2	31	36.3	9.9	96	48.5	16.3	188
1997	72.9	9.2	32	56.6	14.6	32	68.3	10.6	32	40.2	12.2	96	53.1	18.2	192
2000	78.4	6.8	36	65.3	15.2	37	76.3	8.8	36	45.0	10.8	108	59.2	18.3	217
2004	86.3	7.5	36	69.9	18.0	37	78.6	12.0	35	47.3	11.6	108	62.7	20.4	216
2006	87.7	7.2	36	72.2	18.3	37	79.0	12.8	37	49.1	12.3	108	64.5	20.5	218
2009	88.2	6.6	36	73.3	19.8	37	84.3	11.5	37	53.5	11.5	108	67.8	19.6	218
2011	87.6	7.7	36	74.0	16.7	37	83.8	11.5	37	54.2	12.3	108	68.1	18.9	218
2015	86.6	9.4	35	76.9	16.3	37	88.6	8.3	36	59.0	12.5	108	71.5	17.8	216

Table S4. Full results from Model 3 (growth curve disaggregation) for continuous measures of body weight status in Chinese female adults (18–65 years).

Control variables	BMI	WC	WHpR	WHtR
Female sample	(n=35,065)	(n=30,709)	(n=30,203)	(n=30,661)
Age (mean-centered)				
	0.060***	0.253***	0.154***	0.199***
	(0.003)	(0.009)	(0.008)	(0.006)
Age-squared	−0.002***	−0.002***	0.000	−0.001*
	(0.000)	(0.000)	(0.001)	(0.000)
Marital status (ref: married)				
Never married	0.079	−0.677*	−299	−0.473**
	(0.078)	(0.265)	(0.258)	(0.164)
Divorced/Widowed	−0.199*	−0.656*	−0.589*	−0.298
	(0.099)	(0.306)	(0.253)	(0.206)
Education (ref: ≤primary school)				
Middle school	−0.109†	−0.585**	−0.654**	−.532***
	(0.056)	(0.177)	(0.225)	(0.111)
High school or above	−0.549***	−2.085***	−1.344***	−1.623***
	(0.084)	(0.259)	(0.359)	(0.168)
Income quartiles (ref: poorest)				
2nd quartile	0.045	−0.142	−0.541*	−0.072
	(0.036)	(0.150)	(0.229)	(0.095)
3rd quartile	0.154***	−0.049	−0.538*	−0.031
	(0.039)	(0.162)	(0.268)	(0.105)
4th quartile (richest)	0.123*	−0.143	−0.163	−0.161
	(0.057)	(0.185)	(0.378)	(0.117)
Growth curve disaggregation of urbanicity				
Between-community component	0.013***	0.031***	−0.009	0.004
	(0.003)	(0.009)	(0.008)	(0.006)
Within-community component	0.002	0.010	−0.001	0.004
	(0.003)	(0.012)	(0.015)	(0.008)
Constant	23.271***	78.679***	84.175***	50.001***
	(0.143)	(0.444)	(0.409)	(0.280)
Survey wave fixed effects	Yes	Yes	Yes	Yes
Provincial fixed effects	Yes	Yes	Yes	Yes
Variance of community-level random intercepts	0.209	3.367	1.381	1.631
	(0.039)	(1.368)	(0.414)	(0.629)
Variance of individual-level random intercepts	8.432	50.319	9.959	18.577
	(0.948)	(4.398)	(3.082)	(0.717)
Variance of residuals	3.573	43.101	206.878	17.526
	(0.519)	(2.336)	(55.041)	(0.895)

BMI, body mass index (kg/m^2); WC, waist circumference (cm); WHpR, waist-to-hip ratio (multiplied by 100); WHtR, waist-to-height ratio (multiplied by 100). Robust standard errors are in parentheses. All the models adjusted for age, marital status, education, household income, provincial fixed effects, and time fixed effects. †P<0.1; *P<0.05; **P<0.01; ***P<0.001.

Table S5. Hierarchical logistic models of longitudinal associations of urbanicity with overweight and abdominal obesity defined by alternative cut-points among Chinese adults (18–65 years).

Key predictors	Overweight	Abdominal obesity based on WC
Female sample	(*n*=35,065)	(*n*=30,709)
Model 1: Urbanicity index	0.015***	0.006*
	(0.003)	(0.003)
Model 2: Standard disaggregation		
Between-community component	0.021***	0.012***
	(0.004)	(0.003)
Within-community component	0.011*	0.000
	(0.005)	(0.004)
Model 3: Growth curve disaggregation		
Between-community component	0.024***	0.014***
	(0.004)	(0.003)
Within-community component	0.007	-0.002
	(0.005)	(0.004)
Male sample	(*n*=32,309)	(*n*=28,324)
Model 1: Urbanicity index	0.028***	0.021***
	(0.003)	(0.003)
Model 2: Standard disaggregation		
Between-community component	0.047***	0.035***
	(0.004)	(0.003)
Within-community component	0.011*	0.005
	(0.005)	(0.005)
Model 3: Growth curve disaggregation		
Between-community component	0.050***	0.039***
	(0.004)	(0.003)
Within-community component	0.009†	0.002
	(0.005)	(0.005)

Overweight if body mass index≥25 kg/m². Abdominal obesity if waist circumference (WC) ≥90 cm in men or≥80 cm in women. Standard errors are in parentheses. All the models adjusted for age, marital status, education, household income, provincial fixed effects, and time fixed effects. † *P*<0.1; *P*<0.05; **P*<0.01; *** *P*<0.001.

Table S6. Three-level growth curve linear models of longitudinal associations between urbanicity and body weight status in Chinese adults (18–65 years) with unstructured.

Key predictors	BMI	WC	WHpR	WHtR
Female sample	(*n*=35,065)	(*n*=30,709)	(*n*=30,203)	(*n*=30,661)
Model 1: Urbanicity index	0.004*	0.013*	−0.011†	0.000
	(0.001)	(0.005)	(0.007)	(0.003)
Model 2: Standard disaggregation				
Between-community component	0.008**	0.020*	−0.011	−0.003
	(0.003)	(0.008)	(0.008)	(0.005)
Within-community component	0.001	0.008	−0.011	0.003
	(0.002)	(0.007)	(0.013)	(0.004)
Model 3: Growth curve disaggregation				
Between-community component	0.010***	0.025**	−0.013	−0.001
	(0.003)	(0.009)	(0.008)	(0.006)
Within-community component	0.001	0.007	−0.003	0.003
	(0.002)	(0.007)	(0.015)	(0.005)
Male sample	(*n*=32,309)	(*n*=28,324)	(*n*=27,622)	(*n*=28,280)
Model 1: Urbanicity index	0.010***	0.036***	0.022***	0.015***
	(0.001)	(0.006)	(0.006)	(0.003)
Model 2: Standard disaggregation				
Between-community component	0.022***	0.092***	0.030***	0.037***
	(0.002)	(0.009)	(0.006)	(0.005)
Within-community component	0.004*	0.008	−0.009	0.002
	(0.002)	(0.007)	(0.012)	(0.004)
Model 3: Growth curve disaggregation				
Between-community component	0.024***	0.102***	0.033***	0.042***
	(0.002)	(0.009)	(0.006)	(0.005)
Within-community component	0.004*	0.004	−0.013	0.000
	(0.002)	(0.007)	(0.014)	(0.004)

BMI, body mass index (kg/m^2); WC, waist circumference (cm); WHpR, waist-to-hip ratio (multiplied by 100); WHtR, waist-to-height ratio (multiplied by 100). Robust standard errors are in parentheses. All the models adjusted for age, marital status, education, household income, provincial fixed effects, and time fixed effects. †$P<0.1$; *$P<0.05$; **$P<0.01$; ***$P<0.001$.