Original Article

Trends of Overweight and Obesity in Yi People between 1996 and 2007: An Yi Migrant Study*

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Abstract

Objective To evaluate trends of overweight and obesity prevalence between 1996 and 2007 in Yi farmers and Yi migrants.

Methods An Yi migrant study was conducted in Liangshan Yi Autonomous Prefecture, Sichuan Province, China from 1996 to 2007. Data were collected with identical methods, including standardized questionnaire and body measurements.

Results Age- and sex-specific body mass index (BMI) significantly increased from 20.02 in 1996 to 22.36 in 2007, among Yi farmers, which was significantly different from those among Yi migrants (23.67 in 2007 and 20.90 in 1996) (P<0.05). Prevalence of obesity rose from 1.21 % in 1996 to 4.55 % in 2007 (OR=1.15, P<0.001) in Yi migrants, while that in Yi farmers from none in 1996 to 0.12 % in 2007 (P>0.05). Prevalence of overweight rose significantly to 26.24 % in 2007 from 17.24 % in 1996 (OR=1.06, P<0.001) in Yi migrants, while that in Yi farmers from 1.29 % in 1996 to 4.45 % in 2007 (OR=1.14, P<0.001). Yi migrants appeared to have a 5.52-fold higher risk on developing overweight and obesity than Yi farmers have.

Conclusion The Yi migrants had a steeper increase of overweight with year and consequently caused more obesity. Change in lifestyle may contribute most likely to higher prevalence of overweight and obesity in Yi migrants.

Key words: Body mass index (BMI); Overweight; Obesity; Ethnic Yi; Migrants; China

Biomed Environ Sci, 2011; 24(5):467-474 doi:10.3967/0895-3988.2011.05.003 ISSN:0895-3988

www.besjournal.com(full text) CN:11-2816/Q

INTRODUCTION

Obesity is a worldwide problem with a globally increasing prevalence. Overweight and obesity are associated with considerable risks of chronic non-communicable disease, lower quality of life and premature mortality[1]. With the rapid economic development and social progress in China, lifestyle and dietary patterns have been changing considerably during the past few decades especially in rural areas. A study showed that the prevalence of overweight was 18.6%; 15.1% in men and 22.1% in women in China and the prevalence of obesity was 1.7%; 1.2% in men and 2.2% in women in rural areas during 2004-2005. Also, overweight and its co-morbidities have affected the younger generation in China[3-4].

Although the prevalence of obesity and overweight

*This study was supported by a grant (No 30671811) from the national natural science foundation of China.

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Received: January 16, 2011; Accepted: May 25, 2011

are increasingly reported globally, studies on the association between acculturation and obesity/ overweight in Chinese migrants are limited. As the number of rural-urban migrants in China continues to rise, it is urgent and important to understand the tendency of change of their health status in the future.

Liangshan Yi Autonomous Prefecture is located in the southwest of Sichuan province in China, with 17 counties (cities) and 48.9% of Yi minority people, which is the largest Yi community in China. The Yi farmers live in the remote mountainous villages. In the past three decades, more and more Yi farmers have been moving to towns and cities in China for jobs. Previous studies have showed that no essential hypertension was virtually present in Yi people and also no trend of increase of blood pressure with age after puberty[5-6]. The Yi Migrant Study provides therefore an ideal opportunity to further investigate the role of environmental factors for the development of obesity and its co-morbidities in this group of the population and the aim of this study was to compare trend of overweight and obesity between Yi farmers and Yi migrants from 1996 to 2007 in order to explore interventions for obesity and related diseases, especially in regions with rapid urbanization.

METHODS AND PROCEDURES

Study Design

This Yi Migrant Study was conducted in Liangshan Yi Autonomous Prefecture of Sichuan Province in China from 1996 to 2007. The study comprised of 788 and 2 344 Yi farmers respectively in 1996 and 2007 living in Butuo, Zhaojue, Jinyang, Puge, and Xide counties and, 707 and 1393 Yi migrants respectively in 1996 and 2007 living in the seats of these counties and also in Xichang city. There are one to four county seats in each of these counties. The study samples were obtained by random cluster sampling of county seats and four villages were randomly selected from each sampled county seat. In the last sampling stage, all Yi farmers (over 20 years of age) in all selected villages were surveyed. The Yi migrants sample was comprised of Yi people who had migrated to the county seats or Xichang City for 5 years or more prior to the survey. Owing that the number of Yi migrants was relatively small in this study, all of the Yi migrants found in the selected county seats and Xichang City were enrolled into the survey.

As part of this study, secular trend of overweight and obesity between 1996 to 2007 was analyzed. Data were collected by trained physicians using standardized methods and identical examinations in 1996 and 2007, including questionnaire for assessment of demographic characteristics and anthropometrical measurements. Both body height and weight were measured with the participants in light clothing and without shoes.

Smoking was defined as never smoker, or ever smoker if the subject was a current smoker or a former smoker. Physical activity included occupational and leisure-time physical activity. Occupational and leisure-time physical activity were merged and re-grouped into three categories: (i) low-subjects who reported light levels of both occupational and leisure-time physical activity; (ii) moderate-subjects who reported moderate or high levels of either occupational or leisure-time physical activity; and (iii) high-subjects who reported a moderate or high level of both occupational and leisure-time physical activity. Education alternatives were illiterate, primary school, junior high school, high school, and college. For this analysis the alternatives were collapsed into two categories, low and high education. High education was defined as high school and college education. The participant characteristics and the study procedure was described in detail in the earlier report and only the procedures and variables relevant for this analysis will be presented here[5].

Both two surveys were approved by the bioethic committee of Institute of Basic Medical Sciences, Chinese Academy of Medical Sciences (No. 015-2011).

Study Population

The Yi people is a national minority and one of the most primitive societies in China. In this study, two population-based samples of Yi people aged 20 years and above were surveyed: Yi farmers living in the high-altitude mountainous villages in remote areas and Yi migrants who were born in the villages and then moved to the county seats and, have been living more than five years there. Yi farmers are very isolated and have preserved their own language and primitive lifestyle, and they rarely eat meat with potato, oat and buckwheat as staple food. Yi migrants living in county seats and Xichang city have changed their original lifestyle including diet to more resemble one of the Han people with their staple food of rice, meat and fresh vegetables.

Statistical Analysis

Body mass index (BMI) was calculated as weight in kilograms divided by height in square meters. For primary analysis, individuals with BMI equal to or more than 25.0 kg/m^2 and less than 30.0 kg/m^2 were

considered as overweight and individuals with BMI equal to or more than 30.0 kg/m^2 were considered as obese, according to the World Health Organization (WHO) criteria[7]. Direct standardization was performed using Yi population age structure from the Fifth National Population Census in 2000. Unconditional logistic regression analysis with a forward stepwise method was performed to calculate odds ratio (OR) for prevalence of obesity/overweight for one-calendar-year increase. Obesity/overweight was considered as dependent variable and calendar year ("zero" for 1996 survey and "eleven" for 2007 survey) as independent variable in the analysis mode. Multivariable logistic regression analysis was also used to determine variables likely to be significantly associated to overweight and obesity. A *p*-value of less than 0.05 was considered statistically significant. All data analyses were performed using SAS version 9.1 software (SAS Institute Inc., Cary, NC, USA).

RESULTS

General characteristics associated with overweight and obesity among Yi farmers and migrants between 1996 and 2007 are shown in Table 1.

Table 1. Characteristics of the Study Population among Yi farmers and migrants during 1996 and 2007

	1996		2007	
	Yi Farmers	**Yi Migrants**	**Yi Farmers**	**Yi Migrants**
Number	788	707	2 344	1 393
Male (%)	63.96 (60.61,67.31)	57.00* (53.35,60.65)	46.14*** (44.13,48.15)	59.20** (56.61,61.78)
Age, yrs	33.10±13.10	37.56±11.35*	39.41±12.02***	39.45±11.85****
Age group, yrs (%)		*	***	**,****
20~	50.76 (47.27,54.25)	28.15 (24.83,31.46)	23.11 (21.41,24.81)	22.34 (20.15,24.53)
30~	18.40 (15.70,21.11)	30.27 (26.88,33.66)	27.23 (25.43,29.02)	31.11 (26.87,33.54)
40~	14.97 (12.48,17.47)	26.17 (22.93,29.41)	26.76 (24.97,28.55)	25.14 (22.86,27.42)
50~	12.44 (10.13,14.74)	10.89 (8.59,13.19)	17.94 (16.39,19.49)	15.73 (13.82,17.65)
60~	3.43 (2.16,4.70)	4.53 (2.99,6.06)	4.96 (4.09,5.84)	5.68 (4.46,6.89)
⩾High School degree(%)	5.42 (3.83,7.01)	81.11* (78.22,84.00)	6.75 (5.73,7.77)	79.00**,**** (76.83,81.16)
Heavy physical activity(%)	88.96 (86.77,91.15)	1.27* (0.45,2.10)	91.22 (90.08,92.36)	6.47**,**** (5.17,7.76)
Current Smoking (%)	50.00 (46.51,53.49)	44.55 (40.89,48.22)	41.01*** (39.02,42.99)	39.44**** (36.87,42.01)
Current Drinking (%)	38.20 (34.81,41.59)	44.70* (41.03,48.36)	29.77*** (27.93,31.62)	51.36**,**** (48.74,53.99)
Duration of migration, yrs		16.53±10.32		23.08±12.19****
Years of migration (%)				****
5~ <10		31.61 (28.11,35.11)		16.03 (14.01,18.04)
10~		20.38 (17.35,23.42)		11.78 (10.01,13.55)
15~		16.10 (13.33,18.87)		11.55 (9.79,13.30)
20~		31.91 (28.39,35.42)		60.64 (57.96,63.33)

Note. *denotes *P*<0.05 between Yi farmers and Yi migrants in 1996. **denotes *P*<0.05 between Yi farmers and Yi migrants in 2007. ***denotes *P*<0.05 in Yi farmers between 1996 and 2007. ****denotes *P*<0.05 in Yi migrants between 1996 and 2007. Data are percentage (95% CI) expected for the age and duration of migrant which are mean±SD.

Mean migrant year of Yi migrants in 2007 was significantly higher than that in 1996, with a higher proportion of migrant duration of 20 years or more in 2007. Figure 1 shows BMI values by gender for Yi farmers and Yi migrants in 1996 and 2007 respectively. For men and women, gender-specific mean BMI was 20.00 and 19.99 kg/m^2 (P>0.05) in 1996, 20.66 and 21.12 in 2007 (P<0.001) for Yi farmers, 22.52 and 22.20 in 1996 (P>0.05) and 23.86 and 23.39 (P<0.05) in 2007 for Yi migrants. There was no statistically significant difference in gender-specific BMI values between men and women both in Yi farmers and migrants in 1996 (P>0.05), while women had significant higher BMI values than men in Yi farmers and men had significant higher BMI values than women in Yi migrants in 2007 (P<0.05). For Yi farmers and migrants, mean gender-specific BMI values was significantly higher in 2007 than that in 1996 both in men and women (P<0.05). There was a significant increase in age-specific BMI values between different age groups both in Yi migrants and Yi farmers from 1996 to 2007 (P<0.05), except that in the groups aged under 30 years and over 60 years in Yi migrants (P>0.05) (Figure 2).

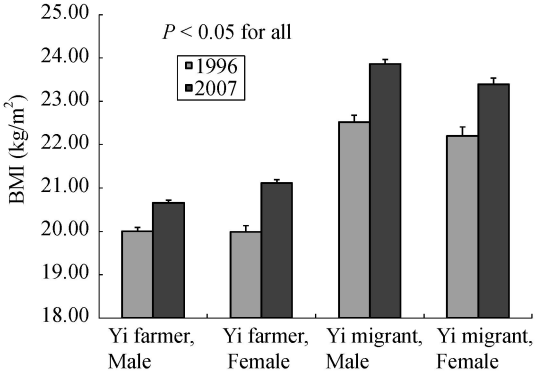

Figure 1. Mean body mass indx (BMI) in Yi farmer and Yi migrant by gender from 1996 to 2007 (estimates have been weighted for age). Handles represent the standard error of the mean.

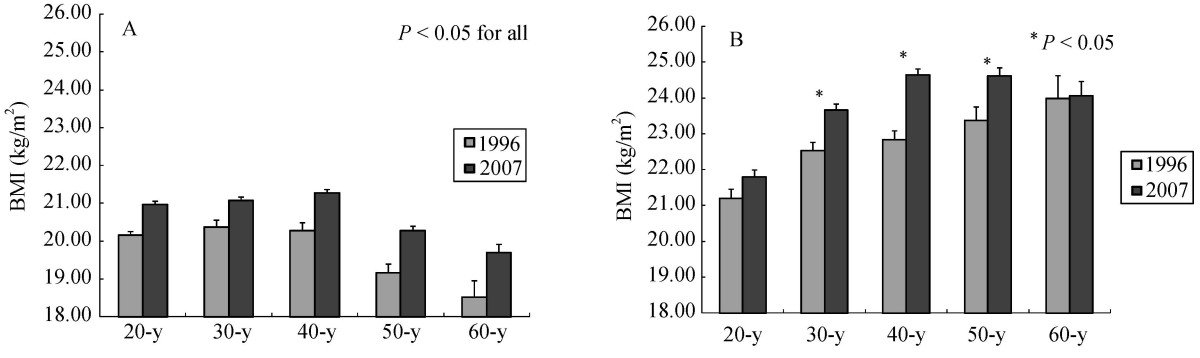

Figure 2. Mean body mass indx (BMI) in Yi farmer (A) and Yi migrant (B) by age group from 1996 to 2007 (estimates have been weighted for gender). Handles represent the standard error of the mean.

Prevalence of obesity and overweight in Yi farmers and Yi migrants from 1996 to 2007 is presented in Table 2. Standardized prevalence of obesity was zero both in men and women in 1996 and zero in men and 0.23% in women in 2007, respectively for Yi farmers, compared to 0.50% and 3.15% in 1996 and 3.91% and 5.54% in 2007 for Yi migrants, respectively. Standardized prevalence of overweight was only 0.98% and 1.82% among men and women, respectively, in 1996 and 3.15% and 5.75%, respectively, in 2007 for Yi farmers compared to 19.91% and 17.24% in 1996 and 31.49% and 18.51%, respectively, in 2007 for Yi migrants.

The secular trend of overweight and obesity from 1996 and 2007 was not consistent between Yi famers and migrants. Overall, prevalence of obesity rose gradually from 1.21% in 1996 to 4.55% in 2007 (OR=1.15 for one-calendar-year increase, P<0.001), respectively in Yi migrants, while from zero in 1996 to 0.12% in 2007, respectively in Yi farmers (P>0.05). Compared with obesity, prevalence of overweigh had a more apparent increases in both Yi migrants (from 17.24% to 26.24%, OR=1.06 for one- calendar-year increase, P<0.001) and farmers (from 1.29% to 4.45%, OR=1.14 for one-calendar-year increase, P<0.001) during 1996 to 2007.

For Yi farmers, there was no significant increase in prevalence of obesity by each age group from1996 to 2007 (P>0.05). For Yi migrants, increase in prevalence of obesity was observed only in the ages of

Table 2. Standardized[†] Prevalence of Obesity and Overweight among Yi Farmers and Yi Migrants during 1996 and 2007 by Gender and Age Group (%)

	Yi Farmers			Yi Migrants		
	n 1996 %[a] (%[b])	*n* 2007 %[a] (%[b])	OR[‡] (95% CI[#])	*n* 1996 %[a] (%[b])	*n* 2007 %[a] (%[b])	OR (95% CI)
Obesity						
Age (yrs.)						
20~	400 0 (0)	543 0.19 (0.18)	1.45 (0.22~9.44)	199 0 (0)	311 2.57 (2.57)	1.62 (0.55~4.77)
30~	145 0 (0)	637 0 (0)	—	214 0.47 (0.47)	433 6.21 (6.24)	1.27**(1.06~1.51)
40~	118 0 (0)	625 0.14 (0.16)	1.24 (0.22~7.02)	185 1.33 (1.08)	350 6.62 (6.29)	1.18*(1.03~1.34)
50~	98 0 (0)	423 0.20 (0.24)	1.31 (0.19~9.03)	77 6.51 (5.19)	219 4.62 (3.65)	0.98(0.88~1.10)
60~	27 0 (0)	116 0 (0)	—	32 8.44 (3.13)	80 5.12 (5.00)	1.02(0.83~1.26)
Gender						
Men	504 0 (0)	1 087 0 (0)	—	403 0.50 (0.50)	825 3.91 (4.24)	1.22**(1.07~1.39)
Women	284 0 (0)	1 257 0.23 (0.24)	1.32 (0.48~3.63)	304 3.15 (1.97)	568 5.54 (5.99)	1.10*(1.02~1.19)
Total	788 0 (0)	2 344 0.12 (0.13)	1.32 (0.48~3.63)	707 1.21 (1.13)	1,393 4.55 (4.95)	1.15** (1.07~1.23)*
Overweight						
Age (yrs.)						
20~	400 0.55 (0.50)	543 4.34 (4.24)	1.20** (1.05~1.36)	199 6.95 (7.04)	311 12.00 (11.90)	1.06(0.99~1.12)
30~	145 3.80 (3.45)	637 4.37 (4.55)	1.01 (0.93~1.11)	214 17.74 (17.76)	433 27.13 (27.94)	1.05**(1.01~1.09)
40~	118 0.67 (0.85)	625 7.11 (7.36)	1.19* (1.01~1.41)	185 19.55 (18.92)	350 35.74 (36.29)	1.08*** (1.04~1.13)
50~	98 0 (0)	423 2.41 (2.36)	1.34 (0.76~2.39)	77 27.16 (28.57)	219 37.52 (42.92)	1.05(1.00~1.11)
60~	27 0 (0)	116 2.64 (2.59)	1.35 (0.49~3.74)	32 42.40 (37.50)	80 36.11 (36.25)	0.99(0.92~1.08)
Gender						
Men	504 0.98 (0.79)	1 087 3.15 (3.40)	1.13** (1.03~1.24)	403 19.91 (20.12)	825 31.49 (35.27)	1.07*** (1.04~1.10)
Women	284 1.82 (1.41)	1,257 5.75 (5.89)	1.15** (1.05~1.25)	304 14.72 (13.16)	568 18.51 (20.60)	1.04*(1.00~1.08)
Total	788 1.29 (1.02)	2 344 4.45 (4.74)	1.14*** (1.07~1.22)	707 17.24 (17.11)	1 393 26.24 (29.29)	1.06*** (1.04~1.08)

Note. Overweight is defined as body mass index$\geqslant$25.0 kg/m^2 and<30.0 kg/m^2. Obesity is defined as body mass index$\geqslant$30.0 kg/m^2. [†]Standardized using age structure of Yi population aged 20 ~70 years from the Fifth National Population Census. [‡]Odds ratio for one-year increase in calendar year. $^{*}P$<0.05; $^{**}P$<0.01; $^{***}P$<0.001. [#]Confidence interval. [a]Standardized prevalence. [b]Crude prevalence.

30-49 years (P<0.05) from 1996 to 2007. In Yi farmer and Yi migrants, the trend of overweight was not consistent in varied groups aged 20-49 years, and no significant increase in prevalence of overweight

between 1996 and 2007 was observed among those aged over 50 years.

Table 3 presents the results of multiple logistic regression analysis of associated factors with overweight and obesity in both Yi farmers and Yi farmers in 2007. Yi migrants appeared to have higher risk on the development of overweight and obesity than Yi farmers (OR=5.52, *P*<0.0001). In addition, age, physical activity and alcohol intake were significantly associated with overweight and obesity (*P*<0.05). No association of overweight and obesity was observed with regard to education and smoking status (*P*>0.05).

Table 3. Multiple Logistic Regression Analysis of Associated Factors for Overweight and Obesity in both of Yi Migrants and Yi Farmers in 2007

Factors	Odds Ratio (95% CI)	*P* Values
Sex (vs. male)	0.94 (0.74,1.18)	0.5811
Age (years) (vs. 20~)		
30~	1.96 (1.44,2.68)	<0.0001
40~	2.89 (2.11,3.95)	<0.0001
50~	2.32 (1.64,3.29)	<0.0001
60~	2.25 (1.40,3.64)	0.0009
Physical activity (vs. low)		
Moderate	0.45 (0.32,0.64)	<0.0001
Heavy	0.61 (0.40,0.94)	0.0258
High education (vs. < High school)	1.06 (0.99,1.14)	0.1127
Current smoking, yes/no	0.86 (0.73,1.02)	0.0893
Current alcohol intake yes/no	1.18 (1.05,1.33)	0.0048
Yi migrant (vs. Yi farmer)	5.52 (3.62,8.42)	<0.0001

Note. Either overweight or obesity was dependent variable which was defined as body mass index $\geqslant$25. CI: Confidence interval.

DISCUSSION

This paper aims to address a gap in our understanding of health issues among migrants by examining the trends of excess weight - an important indicator of current and future health status. Previous studies on trend of overweight or obesity within China have presented consistent results. In China, combined prevalence of overweight and obesity increased from 14.6% in 1992 to 21.8% in 2002[8]. The prevalence of overweight and obesity increased in all age groups, in rural and urban areas, and in North and South China, with greater increases in obesity among older age groups in Southern China, and in rural areas. Overweight and obesity increased tremendously during the 1990s in China[9].

Reports from other parts of the world showed that China is not alone in experiencing significant increasing trend of prevalence of obesity. A study on secular trend of obesity in Iran between 1999 and 2007 showed that overall prevalence of obesity increased from 13.6% in 1999 to 22.3% in 2007 (*OR*=1.08 for one-calendar-year increase). For overweight subjects, prevalence of obesity increased by 32.2% in 1999 and 36.3% in 2007 (*OR*=1.02 for one-calendar-year increase)[10].

Although the prevalence of obesity and overweight is increasingly reported globally, studies on association between acculturation and obesity/overweight in migrants moving within the country are limited. The New Immigrant Survey (NIS) found that immigrants who arrived in the United States before the age of 20 years were more likely to be overweight or obese with increasing duration of residence than immigrants who arrived at later ages. Increasing duration of residence in the United States is significantly associated with greater odds of overweight/obesity, and age at arrival significantly modifies this relationship[11].

We assessed secular trend of obesity and overweight in Yi migrants and Yi farmers during 1996 and 2007 according to the World Health Organization criteria. The consistent trends were found even though the definition of overweight and obesity recommended by the Chinese guideline for prevention and control of overweight and obesity in Chinese adults was used, where overweight was defined as BMI value was 24.0-27.9, and BMI value was $\geqslant$28 for obesity[12]. The ethnic background of Yi migrants is similar to that of Yi farmers. However, the trend during this period was not consistent in Yi famers and migrants. Prevalence of obesity and particularly overweight increased in Yi migrants from 1996 to 2007. For Yi farmers, increase in prevalence of overweight was less dramatic and trend of obesity had no apparent change. Yi farmers are very isolated and have preserved their own language and primitive lifestyle. In 1986, a sample of Yi men participated in more detailed studies on diet, physical activity and blood pressure. Yi farmers consume a diet low in fat and cholesterol with potato, oat and buckwheat as their staple food and rarely with meat. Compared to Yi farmers, Yi migrants have changed their diet with more intake of fat and cholesterol, with a diet similar to that of the county seat native residents, the Han people, with their staple food of rice, meat and fresh

vegetables. Proportion of energy in their food from fat ranged from 10% in Yi farmers to almost 40% in Yi migrants, respectively[6]. In addition, Yi migrants had a lower proportion of heavy physical activity than Yi farmers. Up to now Yi farmers have maintained their traditional diet pattern and their main occupation is non-mechanized agricultural labor with heavy physical activity. Yi migrants appeared to have a 5.52-fold higher risk of developing overweight and obesity than Yi farmers. As observed in the other populations, age, physical inactivity and alcohol intake were determinants of overweight and obesity in Yi people[13-16]. Only heavy physical activity was observed as a protective factor for overweight and obesity. We therefore suggest that change in lifestyle, and in particular, changes of dietary pattern and physical activity, contribute greatly to rising trend of overweight and obesity in Yi migrants[17-20]. It must be kept in mind that because these data were collected from two cross-sectional studies rather than longitudinal, the direct effect of migration cannot be assessed. Although further study is needed, our study does provide one more piece of evidence imputing urbanization and lifestyle with more dietary intakes of fat and cholesterol to higher BMI values.

There were some limitations in this study. Although the study was designed to be conducted in the same regions, cross-sectional nature of the study did not allow us to make any inferences regarding causality. Method of selecting Yi migrants for the study resulted in a disproportionate number of those who have resided in towns for five years or more, and only migrants with permanent residence status were sampled, which may be different from those without permanent residence. For Yi migrants, the age of moving to town and duration of residence are variables of interest, but no detail information is included in the survey. Although our analysis could not account for cohort effects related to year at migration, related research implied that patterns of health assimilation including BMI values are similar across cohorts of immigrants[7]. Lastly, although no detail information about change in dietary components was available in this study, dramatic difference in dietary structure and lifestyle between Yi farmers and Yi migrants allowed us to assess relevant public health implications.

This study indicates a dramatic increase in prevalence of overweight and obesity occurred among Yi migrants in the past 11 years, compared with that in Yi farmers. These data call for immediate implementation of weight control and overweight and obesity prevention programs among Chinese adults, including Yi people to minimize individual and community burdens of chronic non-communicable disease in China. Public policies should aim at educating people to adopt healthier food (like fruit and vegetables) intake. People, especially those living in cities and towns, should be educated to become more physically active as part of their healthier lifestyle.

ACKNOWLEDGEMENTS

Special thanks go to Prof. Guan Qing HE for his great contribution to the project initiation. We would like to thank professors (LI Hui, ZHANG KongLai, LIAO SuSu, and ZENG XianJia from Institute of Basic Medical Sciences CAMS, School of Basic Medicine PUMC, Beijing, China) and physicians (WANG Ping, WANG XueChao, HUANG JiaHong, and DENG XueJun from Liangshan Yi Autonomous Prefectural Center for Disease Control and Prevention, Xichang, Sichuan province, China) for providing assistance to the Study. We thank the participants, staff, and research fellows in the Yi Migrant Study for their long-term commitment to the study.

REFERENCES

1. Oanh TH Trinh, Nguyen D Nguyen, Philayrath Phongsavan, et al. Prevalence and risk factors with overweight and obesity among Vietnamese adults: Caucasian and Asian cut-offs. Asia Pac J Clin Nutr, 2009; 18 (2), 226-33.
2. Zhang Xingang, Sun Zhaoqing, Zhang Xinzhong, et al. Prevalence and Associated Factors of Overweight and Obesity in a Chinese Rural Population. Obesity, 2008; 16(1), 168-71.
3. Li YanPing, Hu XiaoQi, Evert G Schouten, et al. Report on Childhood obesity in China (8): Effects and Sustainability of Physical Activity Intervention on Body Composition of Chinese Youth. Biomedical and environmental science, 2010; 23, 180-7.
4. Xu YiQun, Ji ChengYe, Cooperative Study on Childhood Working Group on Obesity in China. Report on Childhood Obesity in China (7) Comparison of NCHS and WGOC1. Biomed environ sci, 2008; 21, 271-9.
5. He Jiang, Michael J Klag, Paul K Whelton, et al. Migration, Blood Pressure Pattern, and Hypertension: The Yi Migrant Study. Amer J Epidemiol, 1991; 134, 1085-101.
6. He Jiang, Grethe S Tell, Tang YuanChang, et al. Effect of Migration on Blood Pressure: The Yi People Study. Epidemiology, 1991; 2(2), 88-97.
7. World Health Organization. Obesity: preventing and managing the global epidemic: report of a World Health Organization Consultation. Presented at the World Health Organization. Geneva, Switzerland, 1997; June 3-5.
8. Wang Y, Mi J, Shan XY, et al. Is China facing an obesity epidemic and the consequences? The trends in obesity and chronic disease in China. Int J Obes, 2007; 31, 177-88.

9. Rachel P Wildman, Dongfeng Gu, Paul Muntner, et al. Trends in Overweight and Obesity in Chinese Adults: Between 1991 and 1999-2000. Obesity, 2008; 16(6), 1448-53.
10. Alireza Esteghamati, Omid Khalilzadeh, Kazem Mohammad, et al. Secular Trends of Obesity in Iran between 1999 and 2007: National Surveys of Risk Factors of Non-communicable Diseases. Metabolic Syndrome and Related Disorders, 2010; 8(3), 209-13.
11. Reshma Roshania, Venkat Narayan KM, Reena Oza-Frank. Age at Arrival and Risk of Obesity Among US Immigrants. Obesity, 2008; 16, 2669-75.
12. Council of Disease Control, Health Ministry P.R. China. Guideline for Prevention and Control of Overweight and Obesity in Chinese Adults. Peoples Medical Publishing House: Beijing (2006). (In Chinese)
13. Zhang Xingang, Sun Zhaoqing, Zhang Xinzhong, et al. Prevalence and associated factors of overweight and obesity in a Chinese rural population. Epidemiology, 2008; 16(1), 168-71.
14. Wing R, Mathews K, Kuller L, et al. Waist to hip ratio in middle aged women. Associations with behavioural and psychosocial factors and with changes in cardiovascular risk factors. Arterioscler Thromb, 1991; 11, 1250-7.
15. MA Wenjun, XU Yanjun, LI Jiansen, et al. Study on the epidemiological characteristics of overweight and obesity among population aged eighteen and over in Guangdong province in 2002. Chinese Journal of Epidemiology, 2004; 25(12), 1035-8. (In Chinese)
16. LIU Cheng, MA Xiang, MA Yitong, et al. Prevalence on overweight and obesity in Han, Uygur and Hazakh in adults from Xinjiang. Chinese Journal of Epidemiology, 2010; 31(10), 1139-43. (In Chinese)
17. Kristi Reynolds, Dongfeng Gu, Paul K Whelton, et al. Prevalence and Risk Factors of Overweight and Obesity in China. Obesity, 2007; 15(1), 10-8.
18. Lv N, Cason KL. Dietary pattern change and acculturation of Chinese Americans in Pennsylvania. J Am Diet Assoc, 2004; 104, 771-8.
19. Kruseman M, Barandereka NA, Hudelson P, et al. Postmigration dietary changes among African refugees in Geneva: a rapid assessment study to inform nutritional interventions. Soz Praventivmed, 2005; 50, 161-5.
20. Pan YL, Dixon Z, Himburg S, et al. Asian students change their eating patterns after living in the United States. J Am Diet Assoc, 1999; 99, 54-7.