Being a Little Emperor or Empress Matters Equally: The One Child Policy and Child Nutrition in China

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Abstract

China's one child policy coupled with rapid economic growth has triggered major changes in both urban and rural families. This paper examines how being an only child in urban and rural areas combined with son preferences may contribute to changing diets among Chinese children. Using data from four waves of the China Health and Nutrition Surveys this analysis includes 13,148 observations of two- to eighteen-year olds. The analyses use random effects regression and controls for confounders. Children from single-child households have significantly higher consumption of energy from fat than households with more than one child. In addition, the urban residency is significantly related to percentage energy from fats and animal source food intake. The gender effect in general was not significant. These findings indicate that the one-child policy might be a contributory factor in the shift toward less healthy nutrition among children in China, particularly in the urban areas.

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I) Introduction

Over the last two decades, there has been mounting concern over the negative consequences of China's one child policy particularly in lieu of the important economic, social and health changes China has been experiencing. On the health side, there has been a shift from communicable diseases to non-communicable chronic diseases. In particular, diseases related to adult obesity, poor diets and inactivity has grown, and researchers are becoming increasingly concern that the same dramatic shifts will occur among children (Du, Lu, Zhai, & Popkin, 2002; Popkin, Horton, Kim, Mahal, & Jin, 2001). Already, research show that child overweight and obesity is beginning to emerge as a problem in China (Luo & Hu, 2002; Wang, Ge, & Popkin, 2000). Scholars have proposed that the emergence of the spoilt little emperor or empress, the only child in the Chinese family, may be a cause for many of the emerging problems facing China's newly prosperous society (Cheng, 2004; Jing, 2000). Using data from the nine-province 1991, 1993, 1997 and 2000 longitudinal China Health and Nutrition Surveys (CHNS), this paper explores three related issues linked with the effect of being an only child, the differential effects of being a only child in urban and rural areas and the potential gender bias linked with this status on child nutrition.

China's One Child Policy

Limiting couples to one child appeared to be a simple and effective way of achieving China's goal of population control, but there are a number of social effects of this policy. Under the one-child program introduced in 1979, a sophisticated system rewarded those who observed the policy and penalized those who did not. Couples with only one child were given a "one-child certificate" entitling them to benefits such as cash bonuses, longer maternity leave, better child care, and preferential housing assignments [1]. In the countryside, there was great pressure to adhere to the one-child limit since the rural population accounted for about 70 percent [2] of the total population (Congress, 1988). However, the one-child policy enjoyed much greater success in urban than in rural areas(Hesketh & Zhu, 1997).

In 1984, the government responded to the strong opposition to the one-child limit in the rural areas by allowing rural families with only a daughter to have a second child (Greenhalgh, 1986; Merli & Smith, 2002; Peng, 1991). This decision reinforced patriarchal attitudes by recognizing and honoring the traditional Chinese desire for male children to carry on the family name (Ching, 1982), underscoring the gender bias since the state effectively admitted that sons were more valuable than daughters (White, 2000). However, in late 1980s, fertility levels were still unacceptably high for policy-makers, so local efforts were strengthened through changes in incentives and disincentives, family planning organizations, and the allocation of resources (Riley, 2004). In general, the strategy worked. As Figure 1 shows, from 1973 to 2000, there was success in bringing down the number of births within families based on Chinese Census reports.

Figure 1 about here

In 2000 and 2001, the Chinese government shifted away from its more stringent measures by allowing urban couples of single child families to have two children (SFPCR, 2000; Zhao, 2001). Nonetheless, there was still a significant difference in the birth rates in urban and rural China. A 2001 survey showed that the total fertility rate in urban areas was 1.22 children per woman, significantly lower than the rural total fertility rate of 1.98 (CPIRC, 2001). This is not surprising since enforcement was easier in urban areas (Merli & Smith, 2002) and there were compelling reasons for urban couples to limit the family to a single child even without state intervention. Raising a child was expensive in urban areas, and added childcare pressures for dual-working parents. In addition, since city dwellers employed in state enterprises received pensions after retirement, the gender of their first child was less important to them than it was to those in rural areas (Goodstart, 1982).

Together with the growing acceptance and enforcement of China's one-child policy, however, other demographic changes also occurred. According to 2000 Census data, the estimated sex ratio for all births in 2000 was 120, the highest in the world. Past studies have also noted that gender bias might be stronger in rural areas (Arnold & Liu, 1986; Ge & Xue, 1994; Zeng, Tu, Gu, Xu, Li, & Li, 1993). Therefore the gender of the children is an important consideration in the Chinese context due to its relationship with the number of births and urbanicity.

China's Little Emperors and Empresses

In "Feeding China's Little Emperors" (Jing, 2000), the authors argue that the four-two-one syndrome (four grandparents, two parents, one child) as a result of China's one child policy has impacted the nutrition, growth and socialization of Chinese children substantially. Economic developments, the influx of transnational companies targeting their products on children, and social transition towards consumerism have shifted the decision making power within the family from senior to junior generations (Yan, 1994). Some studies estimate that the shift is dramatic, with children in Beijing determine nearly 70 percent of family's overall spending compared to United States' 40 percent (McNeal & Wu, 1995). Chinese children are receiving more spending money of their own, which allows them to become more discerning about their consumption and aware of the various food products available (Jing, 2000).

Anthropologists offer up a number of factors might have influenced the diet of Chinese children. Chee and Guo point out that there appears to be a generational divide regarding food. To most grandparents and parents who lived though the ravages of war, the famine of 1958-1961 and the Cultural Revolution from 1966 to1976 (Guo, 2000), food was about physical survival. To most children now, however, access to and knowledge of "modern" food has become a status symbol used to develop networks and position among their peers (Chee, 2000). Moreover, plumpness has traditionally been seen as a symbol of luck and prosperity. Consequently, obesity did not become a recognized pathology until the late 1980s (Watson, 2000).Observers have also cited "compensation syndrome" by parents who are determined to provide children with the

material wealth they lacked when growing up under Mao (Crowell & Hsieh, 1995; McNeal & Yeh, 1997) as a major factor.

Meanwhile, sociologists have pointed out that the only child in China runs the risk of becoming self-centered, demanding, uncooperative and materialistic adults who lacks self-discipline and interests in serving others (Chen, 1994; Wu, 1984; Wyner, 1987). Single children appear to have more "bad habits", yet they also tend to be faster learners and intellectually more mature, but concentrated parental expectations and pressure to succeed may have some mental health and social consequences (Wu, 1984; Xie & Shi, 1985), although there are some studies that do not support this argument (Hesketh, Qu, & Tomkins, 2003). Due to the heavy emphasis on academics, Chinese youth, particularly urban youth are also much less likely to perform household chores, participate in in-school activities or extra-curricular physical activity (Tudor-Locke, Ainsworth, Adair, Du, & Popkin, 2003).

Patterns of Child Overweight and Obesity

As with other dimensions of social and economic change, China has experienced dramatic shifts in the structure of diet and activity (Du, Lu, Zhai et al., 2002). These include large increases in consumption of animal source foods and edible oils on the diet side, close to universal ownership of television, reduction of active transportation such as walking and bicycling, and reduced activity at work (Bell, Ge, & Popkin, 2001, 2002). The result has been a marked shift the stage of the nutrition transition from one dominated by under-nutrition to over-nutrition and increases in related non-communicable chronic diseases (Mendez, Monteiro, & Popkin, 2005; Popkin, Horton, Kim et al., 2001; Popkin, Keyou, Zhai, Guo, Ma, & Zohoori, 1993).

Among children, an equally remarkable shift in body composition appears to be happening (Luo & Hu, 2002; Wang, Monteiro, & Popkin, 2002). Using age-and sex-specific body mass index (BMI) cut-off points proposed by International Obesity Task Force (IOTF), Wang and his colleagues found that the increase largely occurred in urban areas. In addition, past studies showed that overweight children were 2.8 times as likely as all other children to become overweight adolescents (Wang, Ge, & Popkin, 2000).

Clearly there are several issues that merit testing in this study. The first is the effect of being a single child followed by being a single child in an urban versus rural area and of being a single son versus single daughter in urban and rural areas. We systematically examine these factors and use dietary measures as our outcomes.

II) Methods

Data and Sample

This paper used data from the China Health and Nutrition Survey (CHNS) an ongoing longitudinal survey designed to examine the effects of the health, nutrition, and family planning policies and programs to study how the socio-economic transformation

of Chinese communities and society affect the health and nutritional behaviors and status of its population. Surveys were conducted in 1991, 1993, 1997 and 2000 [3], covering nine provinces [4] that vary in geography, economic development, public resources, and health indicators. A multistage, random cluster process was used to draw the sample surveyed in each of the provinces. Counties in the nine provinces were stratified by income and a weighted sampling scheme was used to randomly select four counties in each province. Villages and townships within the counties and urban and suburban neighborhoods within the cities were selected randomly. The same households were surveyed over each wave as best possible in order to allow for a longitudinal study, and newly formed households (usually linked with divorce or marriage) began to be surveyed in 1997.

Individual and household surveys were completed over a three-day period, while additional community surveys on health care and public facilities and prices were carried out. Dietary data were based on three days of weighing household food intake and consecutive 24-hour recalls (Wang, Ge, & Popkin, 2000). Physicians obtained anthropometric measurements in a clinical setting, and the remaining data were obtained from in-home interviews. Due to the rigor in obtaining the data [5], it is believed that reporting errors on the number of children in the household and the measurement errors of food consumed were minimized (CPC). Additional details on the survey design and data can be found elsewhere (Du, Mroz, Zhai, & Popkin, 2004; Popkin, Paeratakul, Ge, & Zhai, 1995).

For this study, we limited the analysis to the 6,322 children who were between two and less than eighteens years of age during any of the study waves, which accounted for 13,148 observations.

Dependent Variables

This paper uses four measures of nutrition and health based on dietary data collected [6]. They were: percentage energy from fat; percentage energy from protein; percentage consumption made up of animal food; and percentage consumption of made up of vegetable and fruits. Fat as a percent of total energy consumed is used since ample research from animal and clinical studies provides strong evidence that dietary fat plays a role in the development and treatment of overweight and obesity (Bray & Popkin, 1998). Similarly there is a growing literature that protein is more filling and has effects on overall intake patterns (Astrup, 2005). It is also important to account of actual amount consumed between the various food groups. Here, we focus on the two main food groups that have seen visible changes in consumption based on previous studies (Du, Lu, Zhai et al., 2002): animal food (from meats and organs), and vegetables and fruits, standardized based on the three- day average total consumption in grams.

Independent Variables

It is important to control for a variety of factors in this analysis. Individual level data include characteristics such as age, being an only child, gender, and ethnicity. Age is a child-wave level variable and was categorized into three age groups based on typical

Chinese school-going age [7]. Being an only child is based of the number of children in the household that was below eighteen years old during the survey wave. Ethnicity was based on whether the children were ethnic Han or not since population control policies differ for ethnic minorities [8].

Household level controls included whether it is a one child household, the number of adults in the household, deflation adjusted household income based on 1989 prices, and household assets such as owning a color television and a motorized vehicle [9], which are used as measurements of wealth. In addition, controlling for having television ownership is important given arguments that television viewing might encourage snacking as well as increase children's exposure to food advertising. Meanwhile, motorized vehicle ownership might be a proxy for reduction in physical activity.

At the community level, prices of certain goods, and the political categorization of the community as rural or urban would impact the degree in which the one-child policy is implemented and enforced. Therefore, including these controls are also essential.

Estimation

The study described here attempts to use individual and contextual determinants to explain dietary intake among Chinese children. We conducted the analyses using random effects [10] and corrected for clustering at the community level. Past studies have shown that so long as appropriate corrections are made for possible error correlations at the highest level, random effects estimators and Huber adjusted standard errors perform well (Angeles, 2002). Statistical analyses were conducted using Stata version 9, (StataCorp, 2005). The fully interacted model specified in this paper is as follows:

$$\begin{aligned} Y_{ihc} = {} & \beta_0 + \beta_1 OneChild_i + \beta_2 Urban_{ic} + \beta_3 OneChild_i * Urban_{ic} + \beta_4 Son_i + \\ & \beta_5 Son_i * OneChild_i + \beta_6 Son_i * Urban_{ic} + \beta_7 Son_i * OneChild_i * Urban_{ic} + \\ & \beta_8 Age_i + \beta_9 Han_i + \beta_{10} HH_i + \beta_{11} Prices_{ic} + u_i + v_{ic}, \end{aligned}$$

where the subscripts *i* denote individual level and *c* denote community level characteristics. Y denotes the dependent variable of interest (percent energy from fat; percent energy from protein; percent animal food consumption; or percent vegetable and fruit consumption); HH denotes the vector of household independent variables (number of adults in the household, household income, television ownership and vehicle ownership);β denotes coefficient estimates; *u* and *v* are the individual and community specific error terms, respectively.

We conducted three specifications of the same model. First, we ask whether being an only child affect nutrition, running an analysis that did not include any of the interaction terms in the model. We hypothesize that those who are the only child have a significantly higher proportion of their energy intake come from fat and protein, after controlling from various time, individual, household, and community effects. It is also likely that animal food intake is higher for an only child, possibly offsetting the consumption of vegetables and fruits [11].

Next, we examine differentials in nutrition given the socio-economic and policy differences in urban and rural communities by children who are the only child or not. By including an interaction between urbanicity and only child status, we can measure the impact of being an only child living in an urban community over being an only child in a rural community. It is likely that the combined effect of being an only child and living in an urban community reinforces each other in terms of a higher proportion of energy from fat, protein, and animal foods.

A previous study of children aged 6 and younger found that the one child policy impacted percentage fat intake for sons more than daughters, implying that post-natal gender selection occurs and that girls still bear the marginal status in the family (Li, 2003). Hence, in the last specification, two interaction terms that measure being a male only child and being a male in an urban community, as well as a three-way interaction term that combined all three factors (gender, urban and one child) were included as shown above. These allow us to add an additional dimension into the analysis that measures possible gender bias. In particular, if there is a gender bias towards males, we should expect to see positive and significant coefficients for male only children in predicting energy from fat, protein, and consumption of animal food or vegetable and fruit. Meanwhile, the three-way interaction allows us to test if gender bias might vary in degree between rural and urban areas should it exist.

III) Results

Distribution of Children in China

Past literature emphasize important differences between rural and urban areas due to the differing political, economic and social structures. Hence, it is useful to understand differential impacts of the one-child policy in rural and urban areas. As seen in Table 1, there are clear urban-rural differences in the composition of households in terms of the number of children. Not surprisingly, rural household tend to have more children than urban households, although between 1991 and 2000, the difference became smaller. In addition, the proportion of households in both urban and rural areas having only one child grew between 1991 and 2000, particularly in rural areas. These descriptive statistics show that it is important to account for urban and rural settings in the analyses due to possible local and state policies regarding implementation, changes in and enforcement of the one child policy.

Table 1 about here

Table 1 also shows that the gender differences between urban and rural communities became more apparent between 1991 and 2000, implying that it would be interesting to investigate whether there are variations in child nutrition based on gender. At the same time, there appears to be a remarkably similar age structure in urban and rural areas.

Analytical Data

Table 2 provides the descriptive statistics for the analysis sample in 1991, 2000 and for the combined data over all four waves. It is clear from this table that there have been rapid changes in the economy and lifestyles of the Chinese. From 1991 to 2000, there has been a notable increase in the dietary intake in terms of percentage of energy from fat, as well as the percentage of consumption from animal foods. While there also has been slight increased in percentage of energy from protein, and percentage consumption of vegetables and fruits, the increase was not as drastic. Ownership of some household assets such as color televisions and motorized vehicles has also increased dramatically over a 9-year period, a reflection of economic growth or perhaps increased consumerism among the Chinese. Meanwhile, inflation likely explains the changes in community prices of various goods.

Table 2 about here

Figure 2 below breaks down dietary intake and consumption by major food groups between children who are the only child and those who have sibling/s. From these, we can see a significant increase in percent energy from fat and prevalence rates of being overweight, particularly among only children. It also appears that only children tend to consume a higher percentage of animal foods, but lower proportion of vegetables and fruits compared to children with siblings. Therefore, it is possible that the nutrition transition is occurring not simply across the country, but also varies based on household composition.

Figure 2 about here

Estimation results

The full results from the model described above are shown in Table 3, and provides insight to the three main questions this paper seeks to answer.

1) *Does a child in a one-child household eat differently?*

The results from all three specifications show that the diets of those who are an only child consume 0.6 - 0.8 percentage points more energy from fat on average than children who have siblings, holding all else constant and controlling for various time, individual, household and community effects. This supports previous studies have found that there have been greater increases in fat intake as a percent of total energy over time, in place of reduced levels of energy from carbohydrates such as cereals and grains (Du, Lu, Zhai et al., 2002). Non-significant results were seen with regards to energy from protein in all three specifications.

From the results, we can also see that the effect of being an only child increases the proportion of animal food consumed by 0.5 – 0.7 percentage points across the first two specifications. However, when all the interaction terms are controlled for the effect is

no long significant. Meanwhile the results are not statistically significant for vegetable and fruit intake between only children.

2) Does residence in an urban area matter?

The second question of interest is whether being an only child in an urban or rural area makes a difference. The results shows that children in urban communities have between 6.2 and 6.5 percentage points more energy coming from fats, and negligible difference in energy from protein on average than children from rural communities. However, only children residing in urban areas on average consumed another 0.2 percentage points more energy from protein.

Little emperors or empresses in urban China eat between 6.5 to 8 percentage points more animal foods than their rural counterparts even after accounting for household income and community prices of goods. In addition, only children in urban areas consume another 1 to 2 percentage points more animal food. This might suggest that child pampering might be stronger in urban areas than rural areas. No significant results were found for vegetable and fruit consumption.

3) Is there gender preference?

The last question regards potential gender differences. Results showed that being only children who were boys or girls did not have significant differences in their diet in terms of dietary fat and protein intake, and animal foods. This might not be surprising given that Burgess and Zhuang had found that looking at total food and caloric intake, there were no gender differences (Burgess & Zhuang, 2002). It is also in line with arguments that daughters who are only children enjoy parental support because they do not have to compete with brothers for parental investment (Fong, 2004; Hesketh & Zhu, 1997). However, vegetables and fruits make up a lower proportion of their food for sons.

Tables 3A & 3B about here

Simulations: How will these results affect overall dietary intake for the average child?

Figure 3 depict predictions for dietary intake for the total effect of: i) being a male only child in an urban area versus one in a rural area; ii) being a male child of a non-single child household in an urban area versus one in a rural area; iii) being a single child that is female in a urban area versus a single child that is female in a rural area. The predictions show that children living in urban areas have a higher proportion of their total energy from fat compared to children living in rural areas, but particularly so among children who come from single-child households. In addition in the daughters in general regardless of whether living in an urban or rural area get a slightly higher proportion of their energy from fats.

Figure 3 about here

Figure 4 provide similar predictions for animal food intake. Again, children living in urban areas have higher animal food consumption levels compared to children living in rural areas, but significantly more so among children who come from single-child households. Only daughters, in urban areas consume a slightly higher percentage of animal foods, while only daughters in rural areas consume slightly less animal foods.

Figure 4 about here

VI) Discussion

This paper looks at the differences in dietary structure and food intake among Chinese children and youth. Results show that dietary composition is strongly related to China's one-child policy in both urban and rural areas, but particularly in the urban areas. The diets of Chinese children, especially the "little emperors and empresses" are quickly moving towards high-fat, low fiber diets, most of which come from animal foods. Similar trends are noted among Chinese adults as well in previous studies (Du, Lu, Zhai et al., 2002).These are all worrying trends as China continues to develop economically and gains access to the Western diet. Contrary to Li's (Li, 2003) findings, however, we did not find a significant difference in caloric composition between sons and daughters. Nonetheless, there is still a growing sex-ratio imbalance due to the one-child policy. This gender imbalance will bring about other demographic problems in the future especially due to a declining birth rate.

Few studies (Hesketh, Qu, & Tomkins, 2003; Li, 2003; Wang, Kato, Tango, Yoshida, Kusaka, Deguchi et al., 2000) have looked in detail at the relationship between being an only child and nutrition. However, these studies usually only use Body Mass Index (BMI) as the dependent variable of interest. This paper shows one of the key behaviors that cause increased energy imbalance is being affected by these demographic shifts. By looking at household behavior as it affects the child, this study begins to pinpoint a critical issue that must be addressed—family feeding behaviors. This paper looks at percentage energy from fat and protein and animal food intake and vegetable and fruit intake in order to provide a better understanding of what Chinese youth consume. Another difference is that past studies limit their sample to preschool children or children below 6 years of age. The analysis conducted in this paper includes children and adolescents between 2 and below 18 years of age since eating habits are formed throughout this period. In addition, previous studies are also limited to particular small areas or provinces and therefore provide a more limited perspective of China. The CHNS covers households in areas that vary substantially in geography, public policy, economic development, public resources and health indicators and collects data from 198 randomly selected communities.

Nonetheless, this paper has certain limitations. It does not test for differences in diet over time because there was not sufficient variation over the four waves included to do so. Hence, additional waves of the data will be useful for continued exploration and

analyses. The analysis here also only provides a glimpse at the interaction between China's one-child policy and child nutrition. Uncovering the black-box of the various mechanisms that contribute towards the differences would be a challenging task without extensive and reliable data on various factors at the individual, household and community level, many of which would involve measurements of preferences, perceptions, expectations and details on policy implementation. Moreover, the data does not actually measure and instead relies on self-reported food intake outside the home, so even this best approximation will have some reporting error. Lastly, this paper only looks at diet and does not account for physical activity, which is an important component in determining changes in health.

China's population control policy while ideal in the late 1970s, may be creating a situation whereby unless remedial education efforts are initiated, adverse health effects will result. Therefore, if China hopes to sustain its development, the Chinese government will have to institute changes before a less healthy workforce results in a slow down of China's economic growth.

Admittedly, China's one-child policy is only one of the mechanisms behind the change in diet composition and health among Chinese youth. Since population control policies are unlikely to change in the near future, and will take time to show its impacts, the challenge is to work within the current demographic and family planning constraints to use this research to target one critical group at greater risk of poor nutritional health. Focus should be given to nutritional promotion and education across all generations. Parents and grandparents need to be educated on importance of transferring funds to more nutritional sources of food such as high-fiber grains, fruits and vegetables, while limiting their children's consumption of high-fat foods. Parents should also understand the importance of physical activity, and be examples to their children in their own diet and activities. In addition, given the vast difference in cultural, economic and political structure between the urban and rural parts of China, suggested policies or initiatives need to be appropriate for each setting.

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Endnotes:

1. This is a generalization as there are policy and implementation differences across geographic regions, provinces, local governments, rural versus urban areas, as well as among the various ethnic groups.

2. Based on the 1982 Census, 21 percent of the population was classified as urban. Based on the 2000 Census, 63.91 percent of the Chinese population resides in rural areas.

3. The first wave of the CHNS was conducted in 1989. However, some items of interest were not covered in the 1989 wave and therefore analysis in this paper is limited to surveys conducted in 1991 and after.

4. Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Liaoning, and Shandong provinces.

5. Detailed household food consumption data were collected over 3 consecutive days and was determined by examining changes in inventory from the beginning to the end of each day. In addition, all purchases, home production, and processed snack foods were recorded. At the end of the survey, all remaining foods were again weighed and recorded. The number of household members and visitors were recorded at each meal. Individual dietary intake for the same 3 consecutive days was recorded based on daily self-reported 24-hour recalls on all food consumed away from home and at-home. Over 99 percent of the sample was available for the full 3 days of data. The collection of both household and individual dietary intake allowed for quality checks. Where significant discrepancies were found, the household and the individual in question were revisited and asked about their food consumption in order to resolve these discrepancies.

6. The internal controls on quality of measurement are based on collecting measures of selected factors from multiple perspectives and then using these data to refine measurement. For example, fat intake was estimated by using the average amount of fat used on a dish-by-dish basis. This procedure is also used for other condiments and minor food elements. In addition, household measures allow us to develop household-specific measurements for factors which truly vary by such an

amount as to change energy intake for family members by 12-15 percent, depending on the use of average or household-specific measures.

7. Chinese children usually attend primary school between 6 and 12 years of age, and secondary school between 12 and 18 years of age.

8. There are at least 55 other ethnicities, which in total add up to about 9.2% of the total population in mainland China in 1990 (International Data Base website: http://census.gov/ipc/www/idbnew.html). Non-Han ethnic minorities are generally allowed to have up to three children (Hesketh & Zhu, 1997).

9. Owns a car or motorcycle. Does not include motorized farming equipment.

10. While specification tests show that fixed effects might statistically be more appropriate, individual-invariant factors such as gender, ethnicity, urbanicity and individuals who were the only child during the survey periods will be dropped from those models. Therefore, a random effects model is used.

11. For the analysis of food groups, we also considered using a two-step procedure, since the decision to consume any given food might differ from the determinants of how much to consume (Haines, Guilkey, & Popkin, 1988).The first-step was a logistic regression on whether animal food was consumed using the same covariates as above. The second-step models the amount consumed conditional on having any consumption of the particular food group, following a random effects model as described above. However, descriptive data showed that there were very few observations where vegetable and fruits intake was zero. Also, results looked similar for animal food intake using the two-step model and the random effects model. For the sake of simplicity and consistency, we report the random effects model in all cases here.

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TABLES

Table 1: Distribution of Children[b] between Urban and Rural Communities in China

	1991 (n=3942)			2000 (n=2828)			4 waves (n=13550)		
	Urban	**Rural**	**Diff. [c]**	**Urban**	**Rural**	**Diff. [c]**	**Urban**	**Rural**	**Diff. [c]**
Number of children	1.3	1.5	-0.2**	1.2	1.3	-0.1**	1.3	1.5	-0.2**
1 child (%)	71.8	57.2	14.6**	81.6	71.8	9.8**	74.4	61.9	12.5**
2 children (%)	24.6	32.5	-7.9**	16.6	23.7	-6.9**	22.2	29.8	-7.6**
3 or more children (%)	3.6	10.3	-6.7**	1.8	4.4	-2.6**	3.4	8.3	-4.9**
Son/s (%)	51.8	51.9	0.1	49.6	55.1	5.6**	51.2	53.3	2.1*
Age (years)	9.3	9.4	-0.1	11.2	10.7	0.5**	10.1	10.0	0.1
0 – less than 2 years old (%)	2.9	4.0	-1.1*	2.2	2.0	0.2*	2.9	3.0	-0.1
2 – less than 7 years old (%)	33.3	32.0	1.7	16.7	19.1	-2.4*	25.1	25.9	-0.8
7 – less than 13 years old (%)	36.8	36.9	-0.1	42.1	45.8	-3.7*	41.6	41.9	-0.3
13 – less than 18 years old (%)	27.0	27.2	-0.2	39.0	33.2	5.8	30.4	29.3	1.1

[b] Children are defined as below 18 years of age at any wave of the survey.
[c] Comparisons conducted using unpaired t-tests with unequal variances.
** denote significance at the 1% level, * denote significance at the 5% level

Table 2: Analysis Sample Descriptive Statistics[d, e]

	1991 n = 3796	2000 n = 2771	4 Waves n = 13148
Dependent Variables			
Percent Energy from Fat (%)	21.8 (10.4)	29.1 (12.0)	24.6 (11.8)
Percent Energy from Protein (%)	11.4 (2.2)	11.7 (2.9)	11.6 (2.4)
Percent consumption from Animal foods (%)	12.1 (14.9)	17.8 (17.7)	14.1 (15.4)
Percent consumption from Fruits and Vegetables (%)	27.8 (12.9)	28.1 (12.7)	28.4 (12.6)
Independent Variables			
Individual Level			
Son (%)	51.8 (50.0)	53.4 (49.9)	52.7 (49.9)
Ethnic Non-Han (%)	4.4 (20.5)	4.4 (20.5)	4.4 (20.5)
2 to below 7 years old (%)	33.6 (47.2)	18.8 (39.1)	26.5 (44.1)
7 to below 13 years old (%)	38.3 (48.6)	45.7 (49.8)	43.1 (49.5)
13 to below 18 years old (%)	28.2 (45.0)	35.5 (47.9)	30.5 (46.0)
Household Level			
Only Child Household (%)	60.9 (48.8)	74.4 (43.6)	65.0 (47.7)
Number of adults in household	1.5 (1.2)	1.4 (1.1)	1.5 (1.2)
Household Income (1000 Yuan)	4.7 (3.1)	5.0 (4.0)	5.2 (4.0)
Has color television (%)	20.0 (40.0)	64.8 (47.8)	37.1 (48.3)
Has motorized vehicle (%)	3.6 (18.5)	24.8 (43.2)	11.7 (32.2)
Community Level			
Urban (%)	26.5 (44.1)	27.9 (44.9)	27.1 (44.4)
Nominal price of natural gas (yuan/liter)	27.4 (7.1)	44.2 (18.3)	39.0 (20.6)
Nominal price of common rice (yuan/kg)	1.1 (0.3)	1.8 (1.0)	1.5 (0.7)
Nominal price of common flour (yuan/kg)	1.2 (0.3)	1.9 (0.6)	1.6 (0.7)
Nominal price of sugar (yuan/kg)	3.1 (0.4)	4.2 (0.8)	3.9 (0.9)
Nominal price of eggs (yuan/dozen)	3.7 (2.5)	5.4 (1.8)	5.2 (2.4)
Nominal price of fatty pork (yuan/kg)	5.6 (0.8)	9.5 (1.9)	8.7 (3.5)
Nominal price of lean pork (yuan/kg)	7.0 (1.8)	12.7 (2.7)	11.1 (4.6)
Nominal price of vegetables (yuan/head)	0.5 (0.3)	0.9 (0.5)	0.8 (0.5)

[d] Limited to children between two and below eighteen years of age.

[e] Standard Deviations in parenthesis

Table 3A – Random Effects Regression Results for Dietary Intake[a]

	Percent Energy from Fat			Percent Energy from Protein		
	(1)	(2)	(3)	(1)	(2)	(3)
Only Child	0.69 **	0.60 **	0.83 **	0.06	0.02	-0.005
	(0.19)	(0.19)	(0.28)	(0.04)	(0.04)	(0.06)
Lives in Urban Community	6.50 **	6.21 **	6.26 **	0.79 **	0.65 **	0.70 **
	(0.57)	(0.66)	(0.75)	(0.15)	(0.16)	(0.17)
Son	-0.26	-0.26	-0.14	0.004	0.004	- 0.001**
	(0.17)	(0.17)	(0.28)	(0.05)	(0.04)	(0.06)
2 to below 7 years old	1.27 **	1.27 **	1.27 **	0.25 **	0.25 **	0.24 **
	(0.22)	(0.22)	(0.22)	(0.05)	(0.05)	(0.05)
13 to below 18 years old	-1.47**	-1.46 **	-1.46 **	-0.18 **	-0.18 **	-0.18 **
	(0.20)	(0.20)	(0.20)	(0.04)	(0.04)	(0.04)
Ethnic Non-Han	-0.78	-0.78	-0.78	-0.10	-0.11	-0.11
	(0.46)	(0.46)	(0.46)	(0.09)	(0.09)	(0.09)
Number of Adults in Household	-0.32 **	-0.32 **	-0.32 **	0.01	0.01	0.01
	(0.07)	(0.07)	(0.07)	(0.02)	(0.02)	(0.02)
Deflated adjusted household income (in thousand yuan)	0.15 **	0.15 **	0.15 **	0.03 **	0.03 **	0.03 **
	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)
Nominal price of natural gas (in yuan/liter)	0.02 **	0.02 **	0.02 **	0.004 **	0.004 **	0.004 **
	(0.01)	(0.01)	(0.01)	(0.002)	(0.002)	(0.002)
Nominal price of rice (in yuan/kg)	-0.25	-0.25	-0.25	0.05	0.05	0.05
	(0.16)	(0.16)	(0.16)	(0.04)	(0.04)	(0.04)
Nominal price of flour (in yuan/kg)	-0.12	-0.12	-0.12	0.01	0.003	0.003
	(0.23)	(0.23)	(0.23)	(0.05)	(0.05)	(0.05)
Nominal price of lean pork (in yuan/kg)	-0.08	-0.08	-0.08	0.01	0.01	0.01
	(0.06)	(0.06)	(0.06)	(0.01)	(0.01)	(0.01)
Nominal price of fatty pork (in yuan/kg)	0.28 **	0.28 **	0.28 **	0.03	0.03	0.03
	(0.09)	(0.09)	(0.09)	(0.02)	(0.02)	(0.02)
Nominal price of eggs (in yuan/dozen)	-0.0001	0.001	0.001	-0.02 *	-0.02 *	-0.02 *
	(0.05)	(0.05)	(0.05)	(0.01)	(0.01)	(0.01)
Nominal price of vegetables (in yuan/kg)	0.18	0.18	0.18	0.14 **	0.14 *	0.14 *
	(0.26)	(0.26)	(0.26)	(0.06)	(0.06)	(0.06)
Nominal price of sugar (in yuan/kg)	-0.33	-0.33	-0.33	-0.12 **	-0.13 **	-0.13 **
	(0.20)	(0.20)	(0.20)	(0.04)	(0.04)	(0.04)
Household with a color television	2.27 **	2.27 **	2.27 **	0.43 **	0.44 **	0.44 **
	(0.25)	(0.25)	(0.25)	(0.05)	(0.05)	(0.05)
Household with a motorized vehicle	0.21	0.21	0.21	0.32 **	0.32 **	0.32 **
	(0.31)	(0.31)	(0.31)	(0.07)	(0.07)	(0.07)
1993	1.18 **	1.18 **	1.19 **	0.14 *	0.13 *	0.13 *
	(0.27)	(0.27)	(0.27)	(0.06)	(0.06)	(0.06)
1997	2.51 **	2.51 **	2.53 **	-0.14	-0.17	-0.17
	(0.82)	(0.82)	(0.82)	(0.20)	(0.20)	(0.20)
2000	5.98 **	5.98 **	6.0 **	-0.07	-0.09	-0.09
	(0.53)	(0.53)	(0.53)	(0.12)	(0.12)	(0.12)
Only child living in an Urban	-	0.38	-0.06	-	0.19 *	0.17

	Percent Energy from Fat			Percent Energy from Protein		
	(1)	(2)	(3)	(1)	(2)	(3)
community	-	(0.46)	(0.64)	-	(0.09)	(0.14)
Only child is a Son	-	-	-0.42	-	-	0.05
	-	-	(0.38)	-	-	(0.08)
Son living in an Urban Community	-	-	-0.07	-	-	-0.10
	-	-	(0.73)	-	-	(0.15)
Only Child is a Son living in an Urban Community	-	-	0.81	-	-	0.02
	-	-	(0.88)	-	-	(0.19)
Constant	19.16**	19.21**	19.17 **	10.92 **	10.93 **	10.93 **
	(0.88)	(0.88)	(0.88)	(0.20)	(0.20)	(0.20)
Observations	13130	13130	13130	13135	13135	13135
Rho	0.12	0.12	0.12	0.15	0.14	0.14
Wald Chi-square	1591.65	1591.44	1593.60	376.06	387.38	390.39

[a] Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 3B – Random Effects Regression Results for Food Group Intake [a]

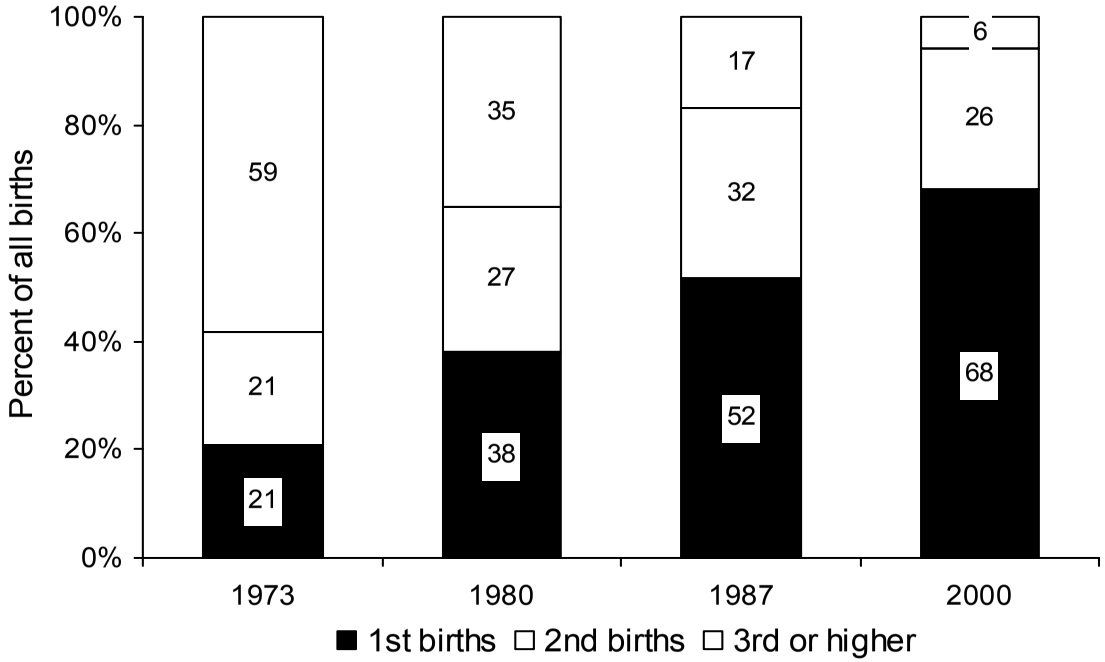
	Percent Consumption from Animal Foods			Percent Consumption from Vegetables and Fruits		
	(1)	(2)	(3)	(1)	(2)	(3)
Only Child	0.69 **	0.47 **	0.25	-0.10	-0.06	0.07
	(0.16)	(0.18)	(0.26)	(0.21)	(0.24)	(0.34)
Lives in Urban Community	8.00 **	7.18 **	6.51 **	0.96	1.11	1.68
	(0.58)	(0.65)	(0.71)	(0.70)	(0.80)	(0.89)
Son	-0.03	-0.03	-0.26	-0.45 **	-0.45 **	-0.16 **
	(0.15)	(0.15)	(0.28)	(0.20)	(0.20)	(0.37)
2 to below 7 years old	2.79 **	2.79 **	2.78 **	-0.51 **	-0.51 **	-0.51 **
	(0.19)	(0.19)	(0.19)	(0.24)	(0.24)	(0.24)
13 to below 18 years old	-1.33 **	-1.32 **	-1.32 **	-0.34	-0.34	-0.35
	(0.18)	(0.18)	(0.18)	(0.23)	(0.23)	(0.23)
Ethnic Non-Han	-0.15	-0.15	-0.15	-1.51	-1.51	-1.52
	(0.42)	(0.42)	(0.42)	(0.55)	(0.55)	(0.55)
Number of Adults in Household	-0.11	-0.11	-0.11	-0.04	-0.04	-0.04
	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)	(0.09)
Deflated adjusted household income (in thousand yuan)	0.24 **	0.24 **	0.24 **	-0.09 **	-0.09 **	-0.09 **
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Nominal price of natural gas (in yuan/liter)	0.02 **	0.02 **	0.02 **	-0.02 *	-0.02 *	-0.02 *
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Nominal price of rice (in yuan/kg)	0.06	0.06	0.06	-0.58 **	-0.58 **	-0.58 **
	(0.14)	(0.14)	(0.14)	(0.19)	(0.19)	(0.19)
Nominal price of flour (in yuan/kg)	0.05	0.05	0.05	-0.35	-0.35	-0.35
	(0.20)	(0.20)	(0.20)	(0.26)	(0.26)	(0.26)
Nominal price of lean pork (in	0.05	0.05	0.05	-0.13 *	-0.13 *	-0.13 *

yuan/kg)	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)	(0.07)
Nominal price of fatty pork (in yuan/kg)	0.08	0.08	0.08	0.61 **	0.61 **	0.61 **
	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)	(0.09)
Nominal price of eggs (in yuan/dozen)	-0.14 **	-0.13 **	-0.13 **	0.10	0.10	0.10
	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Nominal price of vegetables (in yuan/kg)	0.64 **	0.65 **	0.64 **	-1.71 **	-1.71 **	-1.71 **
	(0.22)	(0.22)	(0.22)	(0.28)	(0.28)	(0.28)
Nominal price of sugar (in yuan/kg)	-0.17	-0.17	-0.17	-0.47 *	-0.47 *	-0.47 *
	(0.16)	(0.16)	(0.16)	(0.21)	(0.21)	(0.21)
Household with a color television	2.87 **	2.88 **	2.87 **	-1.45**	-1.45**	-1.45**
	(0.21)	(0.21)	(0.21)	(0.27)	(0.27)	(0.27)
Household with a motorized vehicle	1.34 **	1.35 **	1.35 **	-0.51	-0.51	-0.51
	(0.26)	(0.26)	(0.26)	(0.34)	(0.34)	(0.34)
1993	0.39	0.38	0.38	1.76 **	1.76 **	1.76 **
	(0.25)	(0.25)	(0.25)	(0.32)	(0.32)	(0.32)
1997	0.72	0.66	0.66	-0.05	-0.06	-0.07
	(0.73)	(0.72)	(0.72)	(0.94)	(0.94)	(0.94)
2000	2.92 **	2.88 **	2.89 **	0.92	0.92	0.90
	(0.46)	(0.46)	(0.46)	(0.59)	(0.59)	(0.59)
Only child living in an Urban community	-	1.04 **	2.08 **	-	-0.19	-0.66
	-	(0.39)	(0.54)	-	(0.51)	(0.70)
Only child is a Son	-	-	0.42	-	-	-0.25
	-	-	(0.36)	-	-	(0.47)
Son living in an Urban Community	-	-	1.40*	-	-	-1.20
	-	-	(0.63)	-	-	(0.93)
Only Child is a Son living in an Urban Community	-	-	-2.08**	-	-	0.99
	-	-	(0.74)	-	-	(0.97)
Constant	6.14 **	6.23 **	6.35 **	28.37 **	28.34 **	28.20 **
	(0.79)	(0.78)	(0.79)	(1.01)	(1.01)	(1.02)
Observations	13148	13148	13148	13148	13148	13148
Rho	0.18	0.17	0.17	0.15	0.15	0.11
Wald Chi-square	1931.18	1951.32	1958.54	234.76	234.90	237.22

[a] Robust t statistics in parentheses

* significant at 5%; ** significant at 1%

Figure 1. Share of First, Second, and Third or Higher-Order Births in China, Selected Years, 1973-2000



Note: Total may not equal to 100 due to rounding

Sources: S. Greenhalgh, Population Council Research Division Working Papers, No.8 (1989); and special tabulations, China 2000 Census

Figure 2. Change in Child Dietary Structure and Food Intake by One Child

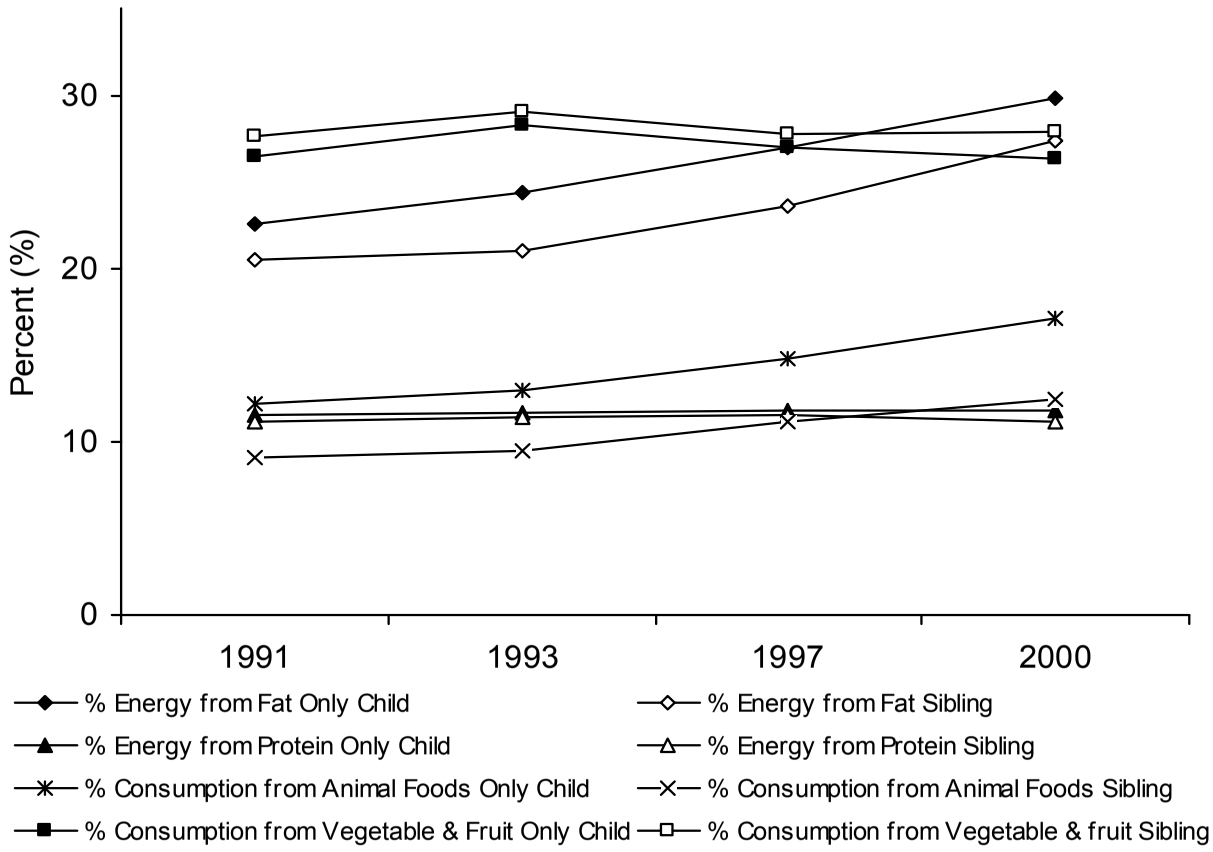


Figure 3. Dietary Fat Predictions

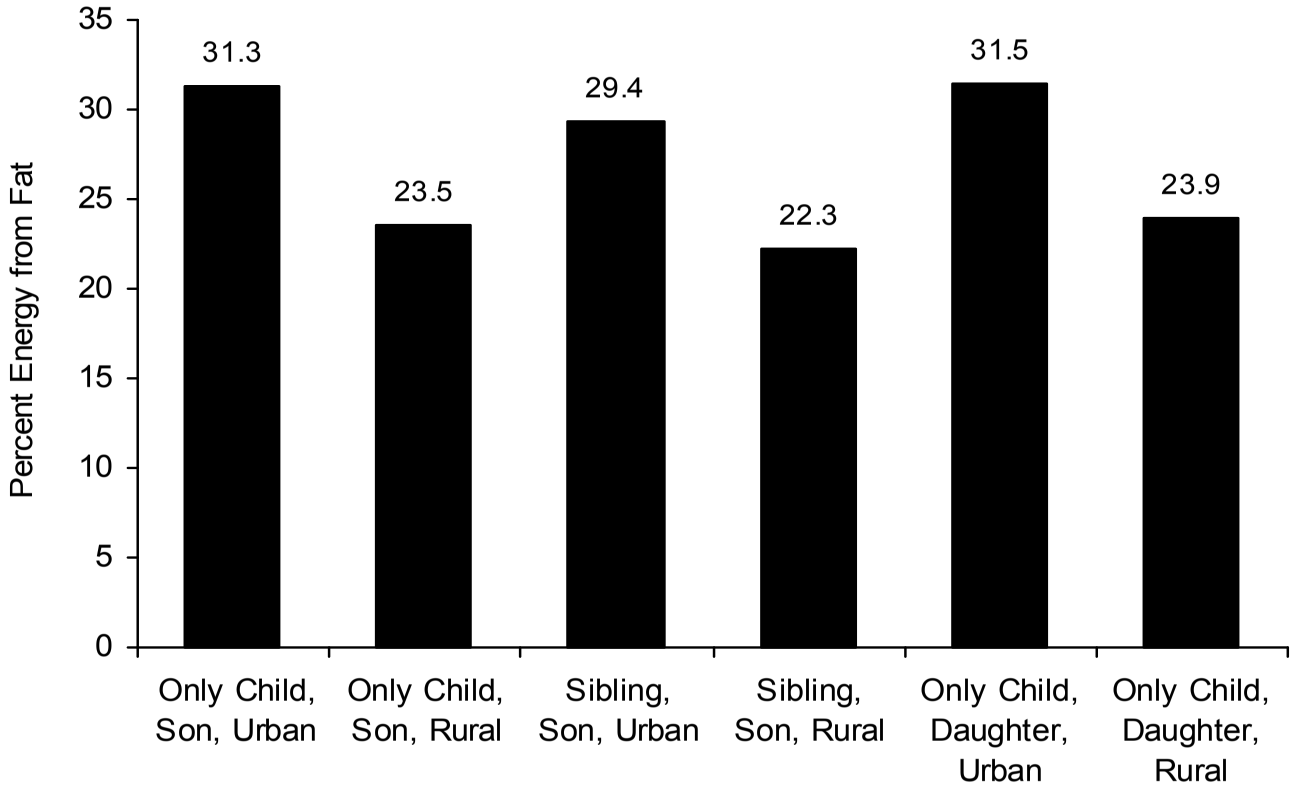


Figure 4. Animal Food Consumption Predictions