THE RELATIONSHIP BETWEEN FOOD CONSUMPTION AND SOCIO-ECONOMIC STATUS: EVIDENCE AMONG BRITISH YOUTHS

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ISER Working Paper
2005-21

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The support of both the Economic and Social Research Council (ESRC) and the University of Essex is gratefully acknowledged. The work reported in this paper is part of the scientific programme of the Institute for Social and Economic Research.

Acknowledgement:

This paper is an extract of my PhD thesis. It would not have been possible without the outstanding supervision which I have been receiving from Marco Francesconi. Thanks are also due to Stephen P. Jenkins, Andrew Chesher, Federico Perali and the participants at the 97th EAAE Seminar for helpful suggestions. I am grateful to the data depositors of the NFS (Department for Environment, Food and Rural Affairs), and to the UK Data Archive, University of Essex, for providing access to the data. Finally, I would like to thank Chimera, Institute for Socio-Technical Innovation and Research at the University of Essex for funding. The author alone is responsible for errors and opinions.

Readers wishing to cite this document are asked to use the following form of words:

De Agostini, Paola (October 2005) 'The relationship between food consumption and socio-economic status: evidence among British youths', ISER Working Paper 2005-21. Colchester: University of Essex.

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ABSTRACT

This paper investigates the relationship between nutrition and socio-economic status among British youths. It describes the dynamics of consumption over age and time using data from the British National Food Survey (NFS) covering the period 1975-2000. Daily calories-age relationships for men and women are estimated by solving a non-linear least square model with a roughness penalty function approach. Focusing on young age groups, trends of consumption over the 25-year period of study and the cohorts effect have been explored across three classes of age. Finally, an exploration of specific trend variations in eating habits has been implemented controlling for income distribution.

1 Introduction

The main concerns about eating habits variation are health and increasing costs of health care services. Overweight and obese people are at risk of a number of health problems, such as heart disease, diabetes, high blood pressure, and some forms of cancer. Moreover, considering the time lag between the onset of obesity and related chronic diseases, researchers expect that the rise in obesity that has been occurring in the last 20 years will have a substantial impact on future costs (Summary of Intelligence on Obesity, 2004).

The main causes of obesity have been identified as excessive consumption (unbalanced diet) and lack of physical activities for which popular justifications are the modern sedentary life, the growing number of fast food outlets and restaurants, technological changes and women's participation in the labour market (Lakdawalla & Philipson 2002; Cutler et al. 2003; Chou et al. 2001; Curry & Bhattacharya, 2000).

Poor diet and health are also associated with poverty because it is often a consequence of poor likelihood of growth and development, with a raised risk of infection. But also a low level of education is associated with poor health behaviour and a rise in overweight and obesity (Curry & Bhattacharya 2000; Chou et al. 2001; Case et al. 2002).

The object of this paper is to carry on a first exploration of calorie consumption[1] by gender and age, by gender and time for all age groups and particularly for children aged 0-17, and by generation in the United Kingdom. There may have been many forces that have affected people's (especially children's) food habits. This paper will simply describe patterns without testing one explanation against another. Moreover, we will try to shed light on the importance of social and economic environment to nutrition changes, considering the effect of income separately using cross sectional data from the National Food Survey covering the period 1975-2000. In doing so, we adopt Chesher's methodology (1997) for providing a thorough decomposition of household data into individuals' consumption using a non-parametric model.

This work is organized as follows. Section 2 introduces the non-parametric techniques for the estimation of average daily calorie consumption. Section 3 describes the data. Section 4 presents the results. Conclusions are summarized in Section 5.

2 Methods

The theoretical model follows Chesher (1997). The expected consumption of individual p is assumed to be a function of individual characteristics x_p (e.g. sex and age) and household

[1] Although other nutrient intakes and food groups have been analyzed, because of space restrictions they are not presented here.

characteristics z.

The total quantity of nutrient entering the household is the total amount of nutrient contained into total food purchased. In the long term it is reasonable to assume that the total amount of food entering the household is equal to the total amount of food consumed by each family. Thus the expected value of total food purchased is assumed to be equal to the expected value of total food consumed.

The model estimates the average consumption of nutrient for a person p of age a and sex s. Therefore, identical individuals in different households consume the same amount of nutrient independently of their family structure u_z. The assumption that the function expressing the total quantity of nutrient entering the household is a separable function with respect to individual characteristics x_p and household characteristics z, makes calculations easier without changing the original assumption that the amount of food consumed by a person p depends from her own characteristics and from the characteristics of her family.

Following Chesher, we use a non-parametric approach to define individual characteristics and add household characteristics in parametric form and we formalize the expected value of household nutrient consumption as follows:

$$E[y|x,z] = E[c|x,z] = \left[\beta_0 + \sum_{p=1}^{P}\sum_{a=0}^{A}\left[n_{pa}^{M}\beta_a^M + n_{pa}^{F}\beta_a^F\right]\right] \cdot exp(z'\gamma)$$

Where y represents the total quantity of food entering the household, c the total quantity of food consumed and P denotes total household members. β_a^S are the coefficients estimated at each age for $S = M, F$. They represent the amount of nutrient consumed by a person p of age a and sex S. And $\sum_{p=1}^{P}\sum_{a=0}^{A} n_{pa}^{S}$ represents the number of people of age a and sex S living in the household. A is the maximum value taken by the variable age. β_0 is included to capture flows of nutrients into households that are unrelated to the number of household members (e.g. food for pets).

In order to estimate β^M, β^F and γ capturing the smoothness of the relationship between age and consumption, we apply a discrete version of the roughness penalty function to the non-linear regression model (Green & Silverman 1995).

3 Data

Data come from the National Food Survey (NFS) for the period 1975-2000. It contains year and month specific information about all food entering the household, such as physical quantities of food purchased among more than 200 food items listed. Each member, aged 11 and over, is requested to collect information on personal expenditure on snacks, meals, sweets, and drinks consumed outside the home. In addition, the survey records some demographic characteristics and some household characteristics. The total number of observations[2] of this database are 130,789 households and 353,989 individuals.

Individual characteristics are introduced by means of a variable of number of people of age a and sex S present in the household. The vector z contains weekly net family income per capita, region of residence, household composition and presence of children.

The NFS provides some information about food eaten out and by visitors. Although it does not record the amount of food obtained other than from household supplies, for each person a measure of the number of meals taken from the household during the survey week is available[3].

In order to control for meals eaten out, we interpret the net balance as the proportion of food coming from household supplies for each person (b_p). If β_a^S are interpreted as total food supplies from the household and from outside the house, then the total amount of food coming from the household is $b_p \cdot \beta_a^S$ and x_p in the initial model is a vector containing the net balance for each individual at each year of age.

The net balance information is available also for each visitor. Using this information, the model treats each visitor as an additional member of the household, by age and sex, who takes from the household the proportion of food indicated by his net balance.

The dependent variables used in this paper are quantities of calories consumed[4], computed from the basic data using the conversion factor tables available from the Department for Environmental Food and Rural Affairs (DEFRA, 1999). This paper focuses on calorie consumption, but considering that governmental guidelines set targets for the proportion of energy from fats to be no more than 35% by 2005, we will also present some results in terms of proportion of energy from fats (PEF)[5].

[2]After controlling for missing values, dropping people over 91 years because their number was not enough to produce significant figures, and dropping households from Northern Ireland whose data have been collected only from 1996.

[3]Information on eating out are summarized from the net balance variable. This variable varies for each person from 0 and 100. It takes value zero if the person always eats out; it takes value 100 if the person eats every meal at home. When a person eats outside the household, his net balance is diminished by 3, 4 or 7 points depending on which of the three main meals he/she did not take from the household (respectively breakfast, lunch or dinner).

[4]A more detailed discussion of the data and a larger number of nutrient intakes and food groups have been analyzed and results are available upon request.

[5]The total amount of energy from fat is obtained by multiplying the total amount of fats by 9.00. The proportion of energy from fats is the ratio between the total amount of calories from fat and the total amount of calories.

4 Results

With the aim here of providing a thorough decomposition of the NFS data and to identify original regularities for basic demographic subgroups, the relationship between calories and age have been estimated separately by each sample year, controlling age and gender as well as for other household characteristics such as income. This section investigates nutrition curves with the objective of seeing how they have changed by gender and age over the recent period, by gender and time for children aged 0-17 and by cohorts. We also consider the effect of income separately.

Figure 1 represents graphically estimated coefficients on calories for males and females separately. The distribution of calorie consumption over the life cycle show an inverse U shape for both male and female, increasing rapidly until age 14 for girls and 16 for boys and increasing again after that but with a lower slope showing a peak at age 55 for females and 60 for males. After that there is a steady decline.

The estimates show that on average males consume more then females at any age. The steep rise during puberty is consistent with consolidation of body height and weight during the adolescent period. Similarly, the fall in consumption after middle age can be explained by the fact that elderly people lose weight and spend less energy.

It is important to note the steady rise in calorie consumption from puberty until 55. The period after 30 usually coincides with a period in life when people exercise less and put on weight. However, when we do not control for eating out and the presence of visitors, calorie consumption decreases after puberty and rises more quickly after age 30. Instead, when controlling for the presence of visitors and eating out, the resulting estimates are higher for young adults (18-30) consequently making the calories-age curves appearing flatter[6]. However, at this point it is difficult to say whether eating out or the presence of visitors might be driving the individual consumption estimation. Moreover, this paper simply describes calorie consumption patterns by age and over time, without testing which forces might have affected food habits.

Trends of calorie consumption among British youths by age groups (0-6, 7-12, 13-17) are represented in Figure 2. Panel a) shows average daily consumption for boys, while panel b) shows estimates for girls. In general younger children consume less than older children. The variation of consumption by different age groups, shown by the distance between the respective curves remains consistent over age.

Trends of consumption do not show huge differences within the time period under analysis, appearing quite flat. It shows a jump upward at the beginning of the 1990s when soft

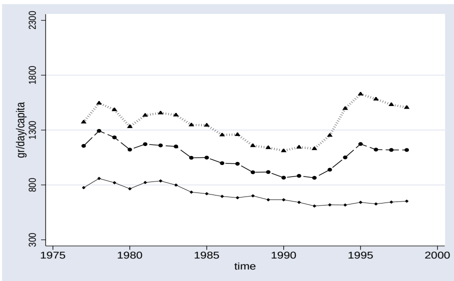
[6] The results from the linear model are available from the author upon request

Figure 1: Estimated calories-age curves using non-linear model with roughness penalty λ =100 - weighted average over 1975-2000.

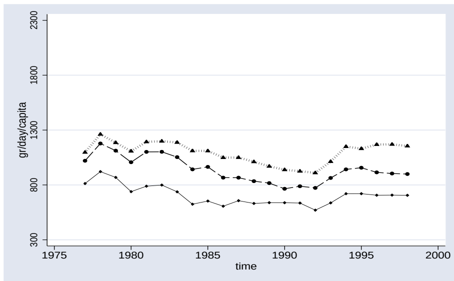
drinks, alcohol and confectionary were introduced into the survey. For girls the effect is small. If this discontinuity in the trend captures the effect of soft drinks and confectionary among youth, then it is interesting to note that the effect is bigger for boys than for girls (they show bigger differences between the curves) and it affects their diet very early in life (no effect on the youngest group 0-6).

On the contrary, the proportion of energy obtained from fats has increased along the time period especially from 1985. The differences across age groups do not change a lot, but they increase with time. PEF results are slightly higher for girls than for boys and quite flat around 35 percent since the 1990s.

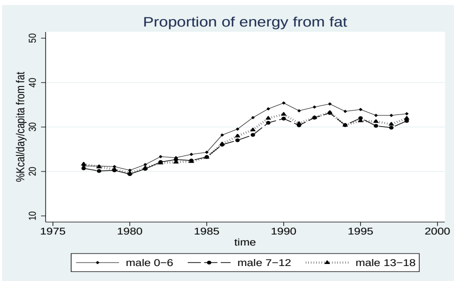
Figure 2: Estimated intakes-year curves for children using non-linear model with roughness penalty λ =100 - weighted average by class of age (boys and girls).



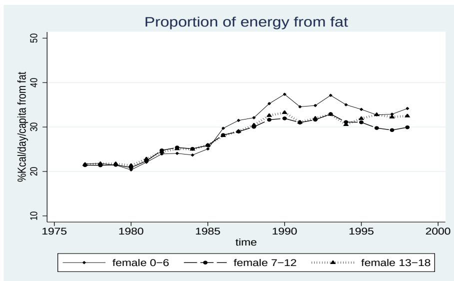
(a) Calories - boys.



(b) Calories - girls.



(c) Proportion of energy from fat - boys.



(d) Proportion of energy from fat - girls.

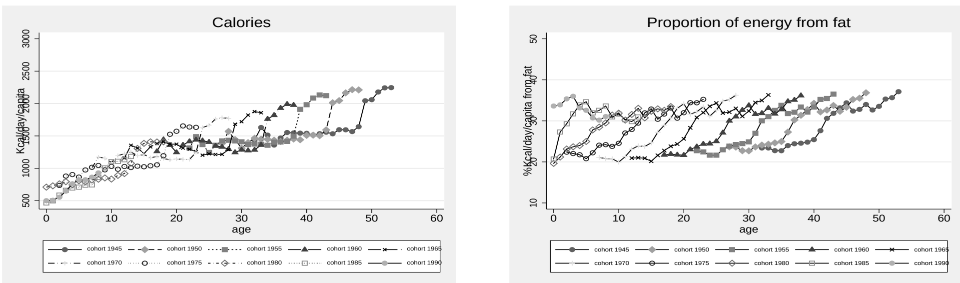
Figure 3 shows calorie consumption curves by ten cohorts[7], beginning with those born in 1990. The first line segment connects the average consumption of calories by those who were zero years old in 1990 to the average consumption of calories of 1-year-old in 1991, until the last observation of the cohort in 2000, when they were 10 years old. The second line segment repeats the exercise for those who were five years older until the last cohort considered in this graph of those born in 1945.

There is a visible life-cycle pattern rising with age, as we saw from the previous sections. With few exceptions at older ages, the lines for the younger cohorts are very often but not always above the lines for the older cohorts, even when they are observed at the same age.

Comparing the nutritional habits of different generations at the same age, calorie consumption is slightly different for different cohorts at different ages. Between age 0 and 10 the younger generation consumed less than older ones, while between age 10 and 18 they consume slightly more calories than their older counterparts.

When observing the patterns of the proportion of energy from fats, it is interesting to note that younger generations consume a higher amount of fats at all ages. In particular looking at children between 0 and 10 years old we compare cohorts from 1975, 1980, 1985 and 1990. Children born in 1990 obtain from age 4 more calories from fats than those born earlier.

Figure 3: Estimated intakes-cohort curves using non-liner model with roughness penalty λ =100.



(a) Calories.

(b) Proportion of energy from fats.

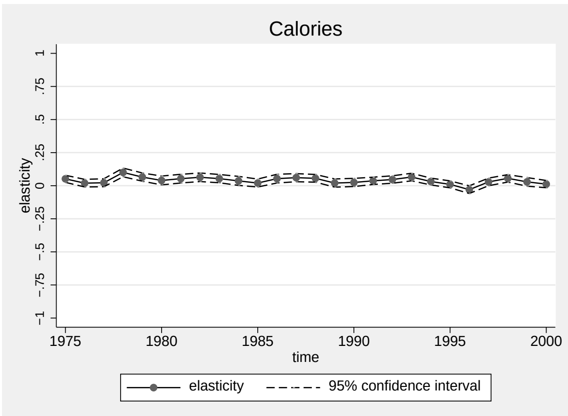
An important factor that might have played a role in the way people eat is the increase

[7]The NFS is a series of household cross sectional data and, thus, it does not follow the same individuals over time. In order to see whether there exists some generational effect on differences between people born at different times, we consider ten cohorts (1945, 1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985 and 1990). Cohorts are constructed by the date of birth of each individual (Deaton 1985). For each survey we estimate the average calorie consumption by age and then track the sample from the same cohort one year older in the next survey. We do not distinguish here by gender. People who were born in 1975 are observed from age 0 (in 1975) to age 25 (in 2000), while cohort 1985 is observed from age 10 to age 35, and so on.

in household income. The estimated coefficients (γ) on log net family income per capita[8] represent elasticities of calories consumption with respect to income. They measure the proportionate rate of change in the quantity of calories consumed from household supply due to a unit proportionate change in household income per capita, other individual and household characteristics held constant.

Figure 4 shows the estimated income elasticities trend. The results indicate that calories are "normal" goods: the quantity purchased increases as income rises at a slower rate than the rate at which income increases (elasticity less than 1). Elasticity of calories with respect to income varies in a range between -0.029 and 0.10, being negative only in 1996. Therefore, in general, an increase in family income would have augmented daily calorie consumption. However, the magnitude of the elasticity being quite low, the effect of variation in income is quite slow in producing a variation in calories consumption. This may reflect the fact that consumers, at different income levels, substitute between food groups in a way that results in very little substitution within nutrients (Subramanian & Deaton 1996). Possible drivers of such effects might be sought in changes through time in the nature of food and in the way it is presented to households, changes in the technology available for preparing foods, changes in household circumstances including increased labour market participation and cost of time.

Figure 4: Estimated calories elasticity trend, λ =100.



[8]Per capita family income derived from net family income divided by the number of members of the household. The model also controls for family composition. Therefore, we do not use equivalence scales to compute income per capita.

5 Conclusion

This paper has started to explore how the eating habits of people in Britain, in particular children, changed over the last twenty-five years of the twentieth century. Using data from the National Food Survey, this paper reports an extensive descriptive analysis that investigates the relationship between average calorie consumption across ages and over time.

We stress four main results. First findings demonstrated that, in general, calorie consumption varies over age and by gender. Males eat more than females. Calorie consumption strongly increases during childhood until puberty, after that it continues to rise but more slowly and starts decreasing when people get older.

The second finding focuses on changes in calorie consumption over time among British youth by three age groups. There is no evidence of strong variation in calorie consumption which results in a degree of stability over the period of study. However, there is some evidence of an increase in the proportion of energy from fats after 1985. These results are confirmed also when we look at different generations' eating habits. Although calorie consumption does not change a lot across generations, younger generations obtain a higher amount of calories from fats than older generations at the same age.

Finally, we consider the effect of income on eating habits. The findings highlight that changes in calorie consumption due to income variations are relatively low (elasticity close to zero) but in general positive, meaning that as income rises, consumption rises as well, but less than proportionally. However, at this moment it is not possible to say whether a positive variation in family income improves nutrition and therefore health status. In general the sensitivity of consumption to income variation becomes smaller with the elasticity trend tending to zero. However, this is not surprising because, as households become richer, substitution between foods is much quicker than the variation of diet through substitution within nutrient consumption (Subramanian & Deaton 1996). In other words, it is much easier for people to change food than the quantity of intake.

6 References

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