SOCIO-ECONOMIC STATUS, DIETARY HABITS AND HEALTH-RELATED OUTCOMES IN VARIOUS PARTS OF THE WORLD: A REVIEW

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SUMMARY

It is generally accepted that socio-economic status (SES) influences dietary habits as well as human health. Three main parameters have been most often used to define SES, i.e. occupation, education and income. These characteristics cover different aspects of the socio-economic structure of people. The aim of this review is to present the current knowledge regarding the relationships between SES, dietary habits and health-related outcomes in various parts of the world.

Key words: socio-economic status, diet, disease, health, education, occupation, income

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INTRODUCTION

Socio-economic status (SES) is a well-established term often included in dietary studies as an explanatory variable in the analysis of another dependent variable such as health status (1). The definition and measurement of SES with respect to diet and health research has been critically examined in recent years (1–5). In order to characterise SES, three variables have been used most often: occupation, education and income. Although these variables measure the same concept it has been suggested that they cover different aspects of the socio-economic structure contributing individually to the relationship between SES and diet (4, 5).

Education is considered to be related to health outcomes through its influence on lifestyle behaviours (e.g., exercise, diet), problem-solving capacity and values (e.g. importance of preventive health behaviours) (1). Moreover, education may facilitate the acquisition of positive psycho-social and economic skills and may provide protection from adverse influences (6). The main advantages of education are that it is relatively easy to assess in self-administered questionnaires and response rates to educational questions tend to be high as these can be obtained from everybody independently of age or working circumstances (3).

Occupation in developed societies measures prestige, responsibility, physical activity and work exposures (6). Occupation may also affect diet by creating environmental or social networks that can influence behavioural health habits (4). Finally, more advantaged occupational levels permit increased access to medical care, enable one to have the funds for better housing and better nutrition, to live in safer neighbourhoods and increase his/her opportunity to engage in health-promoting behaviours (7).

Income is likely to mirror the availability of economic and material resources, and therefore influences dietary quality by making healthy food more or less affordable and accessible (8). The choice of socio-economic indicator often reflects which data are obtainable. In the US, measures based upon education have been widely used, because such information is the main socio-economic indicator contained in various national data sets (9). The Registrar General's classification of social class based on occupational status has traditionally been used to describe 'inequalities' of health in Great Britain (10).

The relationship between SES and diet or disease has been investigated by studying mortality rates for chronic diseases, food and nutrient intake, dietary patterns and food behaviour. It seems that disadvantaged groups have dietary profiles that increase mortality and morbidity rates for chronic diseases and they do not comply with recommended daily nutrient intakes and dietary guidelines, thus increasing the risk for development of chronic diseases (11–18).

Analysis of dietary patterns, as an approach to investigating links between diet and disease or diet and SES in relation to health risks has received a lot of attention from researchers and is indeed important, since it recognizes that foods are consumed in many combinations that are likely to be complex, and that nutrient intakes are often highly correlated with certain nutrients having interactive and synergistic effects (19–22). Investigation of dietary patterns also provides advantages with respect to the development of public health nutrition messages (23). In addition, dietary patterns could be used as a covariate in the analysis of individual dietary factors to determine whether there is an effect of the dietary factor independent of the overall dietary pattern (24) but overall direct comparison of the dietary patterns identified by different studies is difficult due to methodological differences (23).

The aim of this review is to highlight the most characteristic types of studies relating SES with diet and/or disease according to geographical distribution, to discuss current limitations and to propose recommendations for future research.

WEST EUROPE, USA, AUSTRALIA, CANADA

Pomerleau J. et al. (25), in an effort to investigate health behaviour in a Canadian population used data from the 1990 Ontario Health Survey. The survey used a multi-stage cluster design to select a sample of about 1,000 households from each of 42 public health units. Data were collected using an interview with one knowledgeable member of the selected household (covering the socio-demographic characteristics, health status, contacts with health professionals, use of medication, medical insurance, and accidents and injuries of all household members; response rate = 87%) and self-administered questionnaires (covering lifestyle, health problems, and the use of prescription and non-prescription drugs of each individual age 12 years and over; response rate = 77%). The survey sample was 61,239 individuals (representing about 10 million persons). Information from all respondents 19 years (legal drinking age in Ontario) and over was used in the analyses (n=43,099). Four measures of socio-economic status were used: educational achievement, household income status, source of household income and occupational prestige, in order to explore the association with 'unhealthy' behaviours, like smoking, fat intake >30% of dietary energy, alcohol intake >14 units per week, and low level of leisure-time physical activity. Except for the positive relationship between income status and high alcohol intake, the investigated measures of 'unhealthy' behaviours were inversely associated with the above socio-economic indices, suggesting that individuals in lower socioeconomic groups were at an increased risk for health problems (25).

Hazuda HP. et al. (26) in the San Antonio Heart Study investigated the effects of acculturation and SES on obesity and diabetes among Mexican Americans. Subjects were selected from three socio-culturally distinct neighbourhoods in San Antonio, Texas: a low income, exclusively Mexican-American neighbourhood; a middle-income neighbourhood containing approximately equal numbers of Mexican Americans and non-Hispanic whites; and an upper-income neighbourhood consisting of approximately 10% Mexican Americans and 90% non-Hispanic whites. Persons eligible for study were defined as all 25 to 64 year-old men and non-pregnant women residing in households randomly selected within each neighbourhood. The overall response rate was 61.3% in the barrio, 60.1% in the transitional neighbourhood, and 69.5% in the suburbs. The report was based on 1,288 Mexican Americans and 929 non-Hispanic whites. SES was assessed by the Duncan Socio-economic Index and acculturation was assessed by three scales which measure functional integration with mainstream society, value placed on preserving Mexican cultural origin, and attitude toward traditional family structure and sex-role organisation. The results of this study support the hypothesis that acculturation and SES exert parallel influences on obesity and diabetes in Mexican Americans. Increases in either component of socio-cultural status were, in general, associated with decreases in obesity and diabetes. However, acculturation appeared to exert a more powerful influence on these outcomes than did SES. The latter was significantly related to obesity and diabetes only in women, while acculturation was significantly related to these outcomes in both sexes (26).

Galobardes B. et al. (4) highlighted the functionality of education and occupation as individual but also synergistic SES indicators in a community-based random sample of men and women residents of Geneva canton, aged 35 to 74 years, who participated in a survey of cardiovascular risk factors conducted annually since 1993. Lifetime occupational and educational history and a semi-quantitative food frequency questionnaire (FFQ) were obtained from 2,929 men and 2,767 women. Subjects from lower education and/or occupation consumed less fish and vegetables but more fried foods, pasta and potatoes, table sugar and beer. Iron, calcium, vitamin A and vitamin D intakes were lower in the lower educational and occupational groups. The results showed that lower education and lower occupation independently contribute to determining differences in dietary habits and that the effect of the two indicators is cumulative for some nutrients suggesting that both indicators should be assessed so as to provide a full description of social inequalities in dietary habits (4).

Bolton-Smith C. et al. (17) in a cross-sectional study (Scottish Heart Health Study) of coronary heart disease (CHD) risk factors used food frequency questionnaire and socio-demographic data that were collected from over 10,000 Scottish men and women aged 40–59 years, to assess dietary intake, including the antioxidant vitamins C and E and β-carotene, for different socio-economic groups. Classification by occupation was performed according to the coding index of the Office of Populations, Censuses and Surveys (OPCS), 1980 and by grouping into non-manual (N; I, II, IIIN) and manual (M; IIIM, IV, V) occupations. Women were grouped according to their husband's occupation and the currently unemployed by their last job. The overall response rate was 74%. Overall, men and women in manual occupations had a poorer quality diet than did those in non-manual occupations. The coincident low P:S ratios and low antioxidant vitamin intakes in manual groups may contribute to an increased risk of CHD (17).

In Netherlands, Hushof KF. et al. (27) in a cross sectional study based on data of three Dutch National Food Consumption Surveys (a total of 6,008 men and 6,957 women aged 19 years and over) studied the differences in dietary intake between adults with different SES and trends over time. Dietary intake was assessed with a two-day dietary record and SES was based on educational level, occupation and occupational position and was categorized into (very) low, middle and high. Analysis of variance with age as co-variable was used to explore the effects of SES on dietary intake and anthropometry. The prevalence of obesity and skipping of breakfast was higher among people with a low SES. Regarding nutrient intake, in all surveys a higher SES was associated with higher intake of vegetable protein, dietary fibre and most micronutrients. In general, dietary intake among subjects in higher SES groups tended to be closer to the recommendations of the Netherlands Food and Nutrition council and this phenomenon was quite stable over a decade (27).

In a different cross-sectional self-report population survey, Mishra G. et al. (19) used data provided by 6,680 adults aged 18–64 years who participated in the 1995 Australian National Nutrition Survey (NNS) to describe dietary patterns among men and women in the Australian population, and to explore how these varied according to SES. Employment was used as an index of SES. The measure of employment used in the present analyses was a multi-dimensional item derived empirically through gender-specific factor analyses of demographic and socio-economic variables included in the National Health Survey. Items encompassed by the employment factor included measures of employment status, oc-

cupation and hours worked. The employment factor was split into tertiles, with the lowest representing the most disadvantaged, and the highest representing the most socio-economically advantaged. Factor analyses were used to analyse data from a FFQ completed by participants. Separate factor analyses of the FFQ data for men and women revealed 15 factors, accounting for approximately 50% of the variance in both men's and women's dietary patterns. Several gender and SES differences in food patterns were observed. Lower SES males more frequently consumed 'tropical fruits', 'protein foods', and 'offal and canned fish', while high SES males more often ate 'breakfast cereals' and 'wholemeal bread'. Lower SES females more often ate 'traditional vegetables', 'meat dishes' and 'pasta, rice and other mixed foods', while high SES females more frequently ate 'ethnic vegetables' and 'breakfast cereal – muesli'. These findings highlight the complexity of the associations between SES and different components of dietary intake and contribute to a better understanding of the dietary patterns that underscore gender-specific SES differences in nutrient intakes (19).

A recent study by Turrell G. and Kavanagh A.M. (8) examined the association between education level and food purchasing behaviour and the contribution of dietary knowledge to this relationship, the association between household income and purchasing behaviour and the contribution made by subjective perceptions about the cost of healthy food. The study was conducted in Brisbane City (Australia) in 2000. The sample was selected using a stratified two-stage cluster design. Data were collected by face-to-face interviews from residents of private dwellings (n=1,003), and the response rate was 66.4%. Dietary knowledge was measured using a 20-item index that assessed general knowledge about food, nutrition, health and their interrelationships. Food cost concern was measured using a three-item scale derived from principal components analysis (α=0.647). Food purchasing was measured using a 16-item index that reflected a household's purchase of grocery items that were consistent (or otherwise) with dietary guideline recommendations. Food shoppers with low levels of education, and those residing in low-income households, were least likely to purchase foods that were comparatively high in fibre and low in fat, salt and sugar. Socio-economic differences in dietary knowledge represented part of the pathway through which educational accomplishment exerts an influence on diet and also that food purchasing differences by household income were related to diet in part via food-cost concern. Findings suggest that socio-economic differences in food purchasing behaviour may contribute to the relationship between socio-economic position and food and nutrient intakes, and, by extension, to socio-economic health inequalities for diet-related disease (8).

Finally, a cross sectional survey linked with environmental data by Ball K. et al. (28) employed a multilevel design to test the contribution of individual, social and environmental factors to mediate SES inequalities in fruit and vegetable consumption among women. In total, 1,347 women from 45 neighbourhoods in Melbourne provided survey data on their SES (highest education level), nutrition knowledge, health considerations related to food purchasing, and social support for healthy eating. These data were linked with environmental data on the density of supermarkets and fruit and vegetable outlets in local neighbourhoods and it showed that fruit and vegetable intakes tended to be higher among women with higher levels of education, older women, and (for vegetables only) women who were married or living in de facto relationships. Intakes were also higher among women reporting greater health considerations, those with higher nutrition knowledge scores (vegetables only), and those with greater family and friend support for healthy eating. Store density did not mediate the relationship of SES with fruit or vegetable consumption. Multilevel modelling showed that individual and social factors partly mediated, but did not completely explain, SES variations in fruit and vegetable consumption (28).

EAST EUROPE

In East Europe, socio-economic status and its relation to health have been investigated mainly in Poland (29–31) and the Czech Republic (32–35) with few exceptions such as Russia (36) and Hungary (37, 38). However, studies relating diet, socio-economic and health status are limited (39).

For example, in a recent study, Murphy M. et al. (36) examined trends in the relation between educational level and adult mortality in the Russian Federation in the period 1989 through 2001. A convenience cohort based on survey respondents' information about age, survival status, and educational level of close relatives was used and modified indirect demographic techniques to stratify mortality rates by educational level in the study period was applied. A random sample of 7,172 respondents (response rate= 61%) provided full information on 10,440 relatives. The well-documented mortality increases seen in Russia after 1990 have predominantly affected less-educated men and women, whereas the mortality of persons with university education has improved, resulting in a sharp increase in educational-level mortality differentials (36).

ASIA

Islam MZ. et al. (40) in a cross sectional study used three-day dietary records to estimate habitual calcium intake in two socio-economic groups (high and low) in women in Bangladesh (a total of 191 subjects of Bangladeshi women aged 16–40 years). The mean dietary calcium intake was significantly higher in the high income group but even in the high income group 47% of subjects failed to meet the lowest level (400–500 mg/day) of WHO recommended dietary allowances (RDA) of calcium for adult women. No subject in the low-income group was found to meet the RDA level. Moreover, 63% of the women in the low-income group had calcium intake lower than 200 mg/day. The results of the study suggested that low calcium intake could reduce the bone accretion rates and increase the risk of osteoporosis in the subjects of the present study concluding that calcium rich food may be recommended for women in both groups (40).

In addition, Le Ngoc Dien et al. (41) investigated Vietnamese food consumption patterns, in terms of food quantity and total energy intake, and examined how these food patterns differ by demography and SES. Data used in this study were derived from the Vietnam Living Standards Survey national cross-sectional study in 1997–1998. Descriptive and regression analyses identified different food consumption patterns among 5,999 participating households. The regression models identified place of residence,

family income, household size, education of the head of household, ethnicity, and ecological region to be significantly associated with energy intake. Characteristically, 46% of the whole population consumed less than 2,100 kcal/day. It was concluded that socio-economic and demographic status must be considered in developing national strategies and implementing plans of action to improve nutrition and it is important to establish a food subsidy program to provide more food, particularly animal products, to the poor, the ethnic minorities and the rural residents (41).

Hui-Guang Tian et al. (42), studied the relationship between dietary sodium, potassium, socio-economic status and blood pressure in a Chinese population. In all, 1,804 men with mean age 38.4 years and 1,878 women with mean age 38.8 years were studied. The participant's educational level was classified into one of three categories according to years of education and occupation was classified into five categories: farmer, blue-collar worker, white-collar worker, housewife or retired person, and service worker. Both household inventory and consecutive three-day individual food records were used to collect dietary data in the survey. Sodium intake decreased with increasing level of education in men but both intakes exceeded dietary recommendations. More educated men and women had lower intakes of salt and soy sauce and higher intake of monosodium glutamate (MSG) compared with less educated persons, except for soy sauce intake in women. The associations were stronger when men with highest and lowest levels of education were compared ($p<0.001$). An inverse relationship between blood pressure and education was found in both genders but the association was stronger in women than in men. Average systolic blood pressure in men with the highest education was 3 mmHg lower than among men with the lowest education ($p<0.05$), this difference being 7 mmHg in women ($p<0.001$). The results suggested that information on SES is valuable for identifying those populations at risk of high blood pressure and in the design and implementation of appropriate intervention measures such as reduction in sodium intake for nutritional control of hypertension in population-based interventions aimed at all social classes (42).

In a cross sectional survey in China by Shi Z. et al. (43) an effort to identify the differences in food habits and preferences among adolescents according to socio-demographic characteristics was made using a self-administered questionnaire containing questions on food and meal frequencies, food preferences and socio-demographic characteristics in 824 young adolescents (12–14 years). Socio-demographic characteristics included household SES, parent's educational level, urban/rural and family size and multivariate linear regression analysis (stepwise) was performed to model the association between food intakes and socio-demographical factors. High SES and urban residence was positively associated with intake of high-energy foods, such as foods of animal origin, Western style foods and dairy products. Daily fruit consumption was fairly common, but with clear differences by SES. Only about 42% of the boys and 55% of the girls from low SES families ate fruit daily, compared with 66% and 72%, respectively belonging to the high SES families. Although the sample size was very small, results suggested that nutrition education for adolescents and parents is needed to promote healthy eating considering that although the present intake of Western foods is low, one may expect that with the development of the economy this number may increase dramatically and health authorities should strengthen the monitoring of food intake and its association with overweight/obesity (43).

REST OF THE WORLD

In a study by Larrea C. and Kawachi I. (44) the association between economic inequality and child malnutrition in Ecuador was examined. Economic inequality was measured by the Gini coefficient of household per capita consumption, estimated from the 1990 Census. Childhood stunting, assessed from height-for-age z scores, was obtained from the 1998 Living Standards Measurement Survey (LSMS). Both maternal education and housing conditions affect child nutrition, and are indicative of household socio-economic status. Maternal education was assessed by the number of years of schooling, while housing conditions were summarized by a multivariate index, based mostly on living conditions and facility availability. Results showed that maternal education, basic housing conditions, access to health services, ethnicity, fertility, maternal age and diet composition was independently associated with stunting. However, after controlling for relevant covariates, economic inequality at the provincial scale had a statistically significant deleterious effect on stunting [44].

CONCLUSIVE REMARKS

SES is a complex phenomenon predicted by a broad spectrum of variables that is often conceptualised as a combination of financial, occupational, and educational influences (6). It is not useful to search for a single 'best' indicator of SES as each indicator covers a different area of social stratification, which may be relevant to different health outcomes and at different stages in the life course (3). However, if financial and time parameters leave no choice but to use one SES variable, the study of Winkleby MA. et al. (6) suggests that education, rather than income or occupation, may be the strongest and most consistent predictor of good health.

Given the respective limitations of each of these indicators and the lack of agreement over how best to combine different measures into a single index (1), four separate variables were used to assess SES in the study of Pomerleau J. et al. (25). Of these, educational achievement appeared to be the strongest and most consistent predictor of 'unhealthy' lifestyle behaviours whereas in the San Antonio Heart Study (26) which was based on individual level data and used separate measures of acculturation and socioeconomic status showed that cultural factors play a more pervasive role in the development of obesity and diabetes among Mexican Americans than do purely socio-economic factors. Moreover, Galobardes et al. (4) using education and occupation as SES indicators showed that lower education and lower occupation contribute independently to determining differences in dietary habits and that their effect is synergistic thus highlighting that several indicators are needed to fully capture someone's socio-economic status. However, results of Turrell G. and Kavanagh AM. (8), suggest that simultaneous adjustment for multiple socio-economic indicators can introduce its own inherent problems as analytical models that are not clearly specified run the risk of 'over-adjusting'.

A potential limitation of most nationwide population surveys

Table 1. *Socio-economic status, dietary characteristics and health outcomes around the world*

Study	Design	SES characteristics	Dietary characteristics	Health characteristics	Conclusion
Studies evaluated the association between SES, dietary habits and health outcomes in West Europe, USA, Australia and Canada					
Pomerleau J. et al., 1997	Cross-sectional survey n=43,099 men and women 19+ years Data from the 1990 Ontario Health Survey	Educational achievement, household income, source of household income, occupational prestige	Unhealthy behaviours (smoking, fat intake >30% of dietary energy, alcohol intake >14 units per week, low level of leisure-time physical activity)		↓SES ↑risk for unhealthy behaviours, educational achievement appeared to be the strongest and most consistent predictor of '*un*healthy' lifestyle behaviours
Hazuda H. et al., 1988 (The San Antonio Heart study)	Population-based n=1,288 Mexican Americans and 929 non-Hispanic whites 25- to 64-year-old men and non-pregnant women	SES: Duncan Socioeconomic Index Acculturation: Functional integration with mainstream society, value placed on preserving Mexican cultural origin, and attitude toward traditional family structure and sex-role organization	Obesity and diabetes prevalence	Increased obesity and diabetes prevalence for low SES and acculturation	Men:↑Acculturation ↓obesity and diabetes No effect of SES Women: ↑SES↑Acculturation ↓obesity and diabetes
Galobardes B. et al., 2001 (Bus Sante 2000 Survey)	Community-based random sample of men and women from Geneva canton aged 35–74 years (n=2,929 men n=2,767 women)	Education (low, medium, high) Occupation (British Registrar General's Scale)	Self-administered, semi-quantitative food frequency questionnaire (FFQ) (100 food items and serving sizes), dietary habits	Increased health risk for low SES groups	Men: ↓SES ↓fish and vegetables↑pasta, potatoes, fried foods and beer Women: ↓SES ↓fish and vegetables↑pasta, potatoes fried foods, meat, table sugar Independent but also cumulative effect of education and occupation
Bolton-Smith C. et al., 1991 (Scottish Heart Health Study)	Cross-sectional study n=10,359 men and women aged 40–59 years	Occupation: coding index of the Office of Populations, Censuses and Surveys (OPCS) (non-manual, manual occupations). Women were grouped according to their husband's occupation and the currently unemployed by their last job. Alternative classification according to housing tenure (owner, occupier, local authority rented (LAR) and private rented) and by level of education (primary, secondary, professional and university)	Questionnaire (social factors, health, smoking, exercise and diet). Diet was assessed using a modified version of the food frequency questionnaire (FFQ) which was established by the Medical Research Council Cardiff Group Physical examination (weight, height, blood pressure measurement and a non-fasted venous blood sample) Half of the sampling was carried out during the summer months and another half during the winter months	CHD risk factors	↓SES ↓low P:S ratios and low antioxidant vitamin intakes ↑ risk of CHD

Table 1. *cont.*

Hushof KF. et al., 2003	Cross-sectional study n=6,008 men and 6,957 women 19+ years. Data obtained from three Dutch National Food Consumption Surveys (DNFCS-1 1987=88; DNFCS-2 1992; DNFCS-3 1997=98)	Education, Occupation Occupational position (high medium, low and very low)	The food intake data were collected through a 2 day dietary record method (food consumption data on the individual level were converted into energy and nutrients using the most up-to-date version of the Dutch food composition table) Background information was obtained by structured questionnaire	Obesity prevalence for low SES groups	↑ SES Dietary intake tended to be closer to the recommendations of the Netherlands Food and Nutrition Council (quite stable over a period of 10 y)
Mishra G. et al., 2002	Cross-sectional survey n=6,680 adults (3,111 men and 3,569 women) aged 18–64 years Australian National Nutrition Survey (NNS)	Gender-specific employment factor including employment status, occupation and hours worked	Self-reported FFQ assessed usual frequency of intake of 100 food and non-alcoholic beverage items over the last 12 months. 15 dietary-pattern factors identified accounted for around 50% of variance for both males and females		Men: ↓SES ↓ 'breakfast cereals' and 'wholemeal bread'↑ 'tropical fruits', 'protein foods' and 'offal and canned fish' Women: ↓SES ↓ 'ethnic vegetables' and 'breakfast cereal/muesli'↑ 'traditional vegetables', 'meat dishes' and 'pasta, rice and other mixed foods'
Turrell G. and Kavanagh AM. 2006	n=1,003 (Brisbane City Australia, 2000) using a stratified two-stage cluster design and interview the person within each dwelling who was primarily responsible for most of the food shopping	Education Household Income	Dietary knowledge (pre-coded structured question comprising 20 statements) Food cost concern (16 statements that pertained to health and financial factors that may have influenced the household's food purchasing decisions) Food purchasing (examined on the basis of 16 grocery foods including meat and chicken)		↓SES less likely to purchase grocery foods that were high in fibre and low in fat, salt and sugar In ↓SES food-cost concern represented a barrier to the purchase of healthy food
Ball K. et al., 2006	Cross-sectional survey women n=1,347 from 45 neighbourhoods in Melbourne, Australia using a stratified random sampling procedure	Education (highest education level)	Self-report survey data on fruit and vegetable intakes, nutrition knowledge, health considerations related to food purchasing, and social support for healthy eating. These data were linked with objective environmental data on the density of supermarkets and fruit and vegetable outlets in local neighbourhoods		↑ Fruit and vegetable intakes in ↑SES, older women, in women reporting greater health considerations, those with higher nutrition knowledge scores (vegetables only), and those with greater family and friend support for healthy eating. Multilevel modelling showed that individual and social factors partly mediated, but did not completely explain, SES variations in fruit and vegetable consumption. Store density did not mediate the relationship of SES with fruit or vegetable consumption

Table 1. *cont.*

Studies evaluated the association between SES, dietary habits and health outcomes in East Europe					
Murphy M. et al., 2006	A random sample of 7,172 respondents provided information on 10,440 relatives a convenience cohort based on survey respondents' information about age, survival status, and educational level of close relatives, and applied modified indirect demographic techniques to stratify mortality rates by educational level	Education		Mortality rate	↓SES ↑ mortality ↑educational-level mortality differentials
Studies evaluated the association between SES, dietary habits and health outcomes in Asia and rest of the world					
Islam MZ. et al., 2003	Cross sectional study n=191 Bangladeshi women aged 16–40 years	Family income (high, low)	Dietary intake of calcium using a 3 day dietary record	Osteoporosis risk	↓SES ↓ dietary calcium intake
Le Ngoc Dien et al., 2004	Cross sectional study Data used from the Vietnam Living Standards Survey (VLSS) 1997-1998 n=5,999 households	Income quintile, household size, education of household-head	Dietary data of the VLSS 97–98 used a standard array of 45 food items to collect the estimated food quantity consumed by the household over the twelve-month period prior to the survey (through a dietary recall interview)		↑family income, ↑energy consumption from animal products, ↑energy intake The percentage of energy from carbohydrates was too high (75.4% in rural areas and 68.2% in urban areas)
Hui-Guang Tian et al., 1996	Dietary survey using a stratified multilevel cluster sampling n=3,682 (1,804 men 1,878 women) aged 15–64 years in Tianjin, China	Education (low, middle, high) Occupation	Household inventory and consecutive 3 day individual food records to assess intakes and sources of dietary sodium and potassium. Anthropometric data (height, weight) and weighed food records were collected	Blood pressure	↑education ↓lower intakes of salt and soy sauce↑intake MSG, ↓average systolic blood pressure
Shi Z. et al., 2005	Cross-sectional, cluster design survey in 2002 n=824 young adolescents aged 12–14 years in Jiangsu Province, China	Household SES score, parents educational level and family size	Self-administered food frequency questionnaire containing questions on food and meal frequencies and food preferences		↑SES, ↑intake of high-energy foods, such as foods of animal origin, Western style foods and dairy products,↑ intake of fruits
Larrea C. and Kawachi I., 2005	N=5,801 households. Anthropometric measures from 3,054 children younger than 5 years	Housing, education, employment and access to health services	Detailed questionnaire for SES dietary characteristics including food consumption and aggregate household consumption		Maternal education, basic housing conditions, access to health services, ethnicity, fertility, maternal age and diet composition were independently associated with stunting. However, after controlling for relevant covariates, economic inequality at the provincial scale had a statistically significant deleterious effect on stunting

is that the poor are usually not well presented, because homeless, unemployed or migrants not speaking the dominant language are difficult to reach (27). Additionally, from data based on cross sectional surveys it is not possible to determine whether the associations observed are causal (28). Also, in studies that use self-reported data, social desirability reporting bias is possible (28) especially in the higher SES since the better-educated class is more likely to be conscious of desirable eating habits (27). Finally, it is clear that the majority of the studies regarding SES have been conducted in the western world resulting in lack of data from different socioeconomic structures such as East Europe, Asia, South America and Africa.

One alternative approach explaining the causal mechanisms through which SES generates health differences is life course framework SES (3). Establishing whether the social distribution of a disease occurs at different stages of life course using indicators that show accumulation of social disadvantage or examining whether one particular measure of SES relates more closely to an outcome, can point to the ephemeral nature of exposures related to a specific health outcome (3).

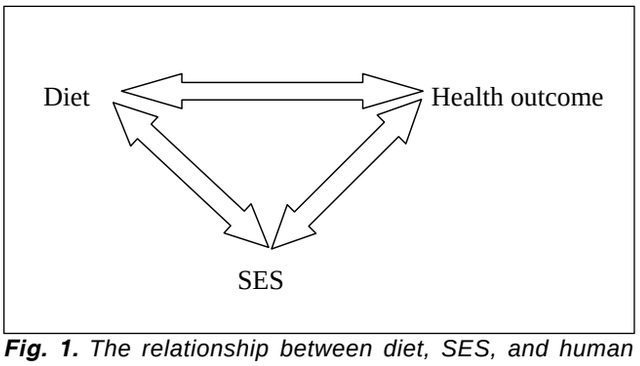

Fig. 1. *The relationship between diet, SES, and human health*

Finally, the role of SES as a mediator between diet and health has not been clearly investigated yet, as the majority of the studies directly relate SES with health outcomes or dietary habits. Then, indirectly, assume whether SES affects the causal relationship between diet and health (sequential relationship). For example, a lower SES is positively associated with a lower consumption of both fruit and vegetables (direct relationship with SES) and that suggests that an "unhealthy" nutrition pattern exists increasing the risk of chronic disease (indirect relationship with SES). Establishment of a model between SES (providing that it is adequately measured), diet and disease will clearly contribute to the understanding of SES as an explanatory variable in a direct and complex relationship between the three factors (Fig. 1.).

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