

Assessment of Socio-economic Status in the Context of Food Insecurity: Implications for Field Research

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Abstract

Measures of socio-economic status (SES) were compared with a measure of physical well-being, mid-upper arm circumference (MUAC), in the food insecure regions of Ethiopia. Income, housing conditions and education had the greatest correlation to MUAC, and significant differences in these measures were observed between malnourished and adequately nourished individuals. Findings indicate that in rural Ethiopia, income, education and housing quality may be better indicators of SES than wealth and measures encompassing home and landownership.

Introduction

Socio-economic status (SES) usually refers to components of economic and social status that distinguish and characterize people (Morris et al. 2000). While the relationship between SES and health has received increasing notice over the past 50 years, relatively little attention has been devoted to defining SES, validating existing definitions or evaluating existing measures. Lack of conceptual clarity and the bypassing of standard techniques have retarded the measurement of SES (Oakes and Rossi 2003). Indicators of SES are meant to reflect access to social and economic resources that may vary over time (Duncan et al. 2002). Many indicators of SES exist (see Oakes and Rossi 2003 for complete description); however, there is little agreement over which indicators are most

useful (Winkleby et al. 1992). In the context of developing countries, even greater challenges exist in measuring SES, because many indicators are unreliable and insensitive in the framework of developing world economies.

Frequent measures of SES in developing countries include proxies of wealth, income, expenditures, education and housing conditions (Morris et al. 2000). Recent research in Africa alone uses a multitude of indicators, suggesting there is little consensus within the research community. In addition to controlling for educational attainment and housing conditions, studies used self-reported income, asset ownership, expenditures and indices built on a combination of these factors or principal components analysis (Kannae and Pendelton 1998; Groenwald and Tilahun 1990; Manunebo et al. 1994; Kuate Defo 1994; Morris et al. 2000; Carme et al. 1994; Mock et al. 1993; Gage 1997; Omar et al. 1994; Schellenberg et al. 2003). While measures of SES are consistently associated with health outcomes, indicators are not interchangeable because they measure different components of SES (Adler et al. 1994; Krieger et al. 1997; Williams and Collins 1995; Winkleby et al. 1992). Most field research employs indicators that measure only one or two components of SES; consequently, certain elements of SES are not represented and the degree and significance of correlations between SES measures and health outcomes varies by the components of SES that are assessed.

In many contexts, particularly program evaluations and field research where assessment of SES is not the primary objective, SES is measured by a proxy of one of its components (i.e., income, wealth, education, etc.). Few studies assess multiple components of SES unless at least one indicator is used as a control variable. Consequently, SES is estimated based on a variety of proxies, which may not have relationships with each other, calling in to question the validity and comparability of commonly used indicators. While it is clear that indicators measuring different components of SES are not equivalent, researchers are faced with the challenge of selecting measures of SES that are most relevant to the outcomes of study, and they face limitations in terms of the reliability and practicality of potential indicators.

All proxies are imperfect measures of SES. The principal drawback of income indicators is they are usually self-reported. Inaccuracies are related to reporting biases from (1) motives to report increased or decreased incomes due to misconceptions (such as the belief that survey responses will qualify respondents for aid; (2) the seasonal nature of incomes in agricultural economies results in an increased likelihood of measurement error when monthly income is reported; (3) rapid inflation may increase the difficulty of estimating income over extended periods of time and result in recall bias; (4) in traditional societies where barter is common, the concept of an annual income is unfamiliar to individuals who live day-to-day and may not be able to accurately approximate annual income.

Wealth is a component of SES that is often estimated using material assets. Incorporation of home and landownership in wealth measures is important to consider because of their importance in agricultural economies. However, estimating the value of land is difficult because of varying land quality and other factors. Most homes are constructed with a combination of purchased and gathered goods using household labour, making it difficult to attach a monetary value to the home. Valid proxies of wealth that include home and landownership may be difficult to construct in many contexts; alternatively, housing conditions may serve as a useful proxy for wealth, because in most cultures, there is a relationship between wealth and quality of housing.

Universal problems affecting estimation of SES are the issues of inclusion and weighting of components in the development of indices and composite variables. Weighting of indices and scores could be viewed as arbitrary, as their relative importance is difficult to ascertain, particularly when it may vary by the outcome of study. Methods such as asset-based approaches are dependent on the selection of items included in the measure; however, there is no clear and universally accepted methodology for selection of items, nor are there definitive guidelines for use of a wider set of assets. Ultimately, issues of component inclusion and weighting are a basis for arguments questioning the validity of composite indicators and indices that are frequently used proxies of SES.

Finally, it should be noted that measures of income, wealth and housing conditions ignore intangible non-material assets of social and human capital, both of which are important components of

social well-being and SES (Morris et al. 2000). Educational attainment is a common measure of human assets; however, it fails often to directly measure skills associated with income generation. In developing countries where unemployment and underemployment are prevalent, educational attainment may be a poor measure of SES because of lack of employment opportunity. Similarly, occupational class may inadequately measure SES, particularly in rural areas where reported occupational class is likely to be homogeneous.

The present study was conducted in Southern Ethiopia after a period of drought that resulted in inflation of staple food prices and regional food insecurity. As part of a study of coping strategies in the context of chronic drought and food security, we attempted to measure SES using a variety of indicators. Ideally, an objective measure of well-being could be used to define SES and commonly-used proxies of SES could be compared to this reference; however, no gold standard indicator exists. In addition to comparing associations between different components of SES, the study examined mid-upper arm circumference (MUAC), an objective measure of physical well-being that is recommended for assessing acute adult malnutrition (FANTA 2003). Nutritional status is a plausible biological measure of physical status in the context of food insecurity, because people with better SES are likely to have enhanced nutritional status because they have more resources to meet nutritional needs. In Ethiopia, where food insecurity is prevalent, variation in MUAC by SES is anticipated because access to food is most limited in poorer segments of the population.

Methods

A survey of 819 households was conducted in April 2003 in two predominantly rural sites in southern Ethiopia. A severe drought occurred in the region in 2002/2003, and the two locations were selected because they were affected by drought. The survey was primarily intended as an assessment of population coping capacity in chronic drought conditions and microfinance program outcomes. The primary survey site was the town of Sodo and three surrounding districts in the Southern Nations, Nationalities and Peoples Region (SNNPR) of southern Ethiopia. Three-quarters of the sample was drawn from the Sodo survey site (N=614). The remaining sample (N=205) was drawn from the town of Nazareth and two adjacent districts. Nazareth is located in the East Shewa Zone of the Oromiya region, approximately 100 kilometres southeast of Addis Abba in central Ethiopia. Participants were systematically selected from client lists of the microfinance organization (i.e., every n^{th} client) or were randomly selected neighbourhood controls that were matched by proximity of residence and sex to microfinance clients that were participating in the survey.

Measures of SES included putative proxies of income, wealth, living conditions and education. Selected indicators allowed for the measurement of multiple components of SES and were developed based on commonly used measures. Specific indicators were: reported monthly household income; per capita monthly household income; household asset and livestock value; household asset and livestock index score; housing conditions index score; housing conditions and home/landownership index score; household head educational attainment. Income and asset values were originally reported in Ethiopian Birr and later converted to US\$ at a rate of 8.60 Birr per one US dollar (Universal Currency Converter 2004).

Household income was estimated (on a monthly basis) by asking the respondent about economically active members of their household and the money- or product-generating activities in which they were engaged during the year preceding the survey. The monetary value of products produced for barter was used when goods produced were traded and not sold. Because wage income is not frequent in rural areas of Africa, and because work for products is common, income estimates may have relatively low validity due to the difficulty in estimating the monetary value of what is exchanged or produced as the result of labour. In the case of agricultural households where income is largely seasonal, the total harvest income was divided by 12 to obtain an estimate of average monthly income from seasonal sources. Per capita monthly household income was also used as a measure of SES because it incorporates household size (which is often related to SES) and allows for better comparison of income between households. A concern with using per capita income as indicator in

the context of food insecurity is that household size may decrease in times of food shortage (resulting in an artificially elevated per capita income). This is because a common coping mechanism is for household members to leave, either to seek food or work elsewhere in times of food shortage.

Household assets ownership was assessed using an index of 19 currently owned household and productive assets: mosquito nets, shoes, pots and pans, kitchen utensils, table, chairs, cupboard, buffet, refrigerator, television, radio/tape recorder, mattress and bed, sofa, bicycle, cart, animal-drawn plow, agricultural hand tools, metalworking machine and woodworking tools. Assets in the index were those commonly included in asset indices used to estimate wealth in rural Africa and were established based on previous studies (Morris et al. 2000; Schellenberg et al. 2003), as well as preparatory work in the survey region that identified locally important assets. The market value of each item in the index was estimated by averaging values reported from the primary market locations in both survey sites. Ownership of livestock and small animals was also recorded, as these are often principal assets in agricultural households. Seven types of livestock were included: horses, donkeys, oxen, cows, goats, sheep and poultry. In the case of livestock, market surveys were completed in regional markets using animals of average nutritional status (nutritional status was a more important predictor of animal value than animal sex).

Household assets and livestock were assessed independently and were later combined because the pooled measure better represented wealth across urban and rural households. Two measures of household wealth were developed using reported asset ownership and data from market surveys: (1) the total value of household assets and livestock (Ethiopian Birr) and (2) a household asset and livestock index. The asset and livestock index was derived using a methodology developed by Morris et al. (2000), which is based on the assumption that wealthier households will purchase and own more durable goods. Assets are weighted according to frequency in the survey population, and the index score is based on a weighted sum of items owned by the household. The index scores provide a way to estimate household wealth that is independent of item value. In the context of this study, the index approach is advantageous because the values of assets and livestock were obtained via market surveys and may be affected by measurement error. The total value of household assets and livestock was calculated by determining the value of each type of asset, and summing the value of all asset types included in the index.

Housing conditions were recorded by interviewer observation when possible. Measures of housing conditions included: roofing material, flooring material, primary energy source for cooking, household water source and sanitation facilities. Home and landownership were recorded based on respondent-reported information. Two indices for prediction of SES were developed based on dwelling characteristics. One considered home and landownership status in addition to housing conditions, while the other was based only on housing conditions. A total of seven variables contributed to the index score. Measures of housing condition and home/landownership were weighted to reflect their relative importance, because family home and landholdings are the most important assets in most households in rural Ethiopia.

All housing condition predictor variables were originally continuous; however, roofing and flooring material and energy measures were reduced to dichotomous variables, because the prevalence of some characteristics was extremely low (<2%), decreasing the need for an ordinal variable. In the case of energy source, a dichotomous variable was employed to reduce measurement error where the indicator failed to demonstrate access to electricity (it cannot be assumed that if a household had electricity it would be considered the primary source of energy). The value of a dichotomous measure of energy is limited; however, it was included based on the assumption that the poorest households are likely to use dung instead of wood or charcoal as cooking fuel. Home ownership and landownership/leasing were considered in the index as dichotomous measures. The index had a range of 0–20. Land and home ownership each accounted for a maximum of five points; roof type, floor type and primary water source corresponded to a maximum of two points; sanitation facilities and energy source were afforded a maximum of three and one points, respectively, in the index.

Mid-Upper Arm Circumference

MUAC was selected as the anthropometric measure because it is commonly used for nutrition screening in emergency situations, and because it is recommended for assessing acute adult malnutrition and prevalence of under-nutrition at the population level (FANTA 2003). Arm circumference measurements are considered as practical alternatives to BMI in multi-purpose surveys and field studies, and a robust linear correlation between MUAC and BMI has been observed in multiple international settings (WHO 1995a). In the Ethiopian context, previous research demonstrated multiple difficulties in using BMI as an indicator of nutritional status and has indicated that prevalence of malnutrition between ethnic groups has less variation when estimated using MUAC as compared to BMI (Teller and Yimer 2000; Alemu and Lindtjorn 1997). MUAC had been previously used in the Ethiopian context to assess adult nutritional status in multiple surveys with acceptable results (Tilstone 2001; Bohmer et al. 1994). MUAC was measured on each adult respondent. Because distributions of mid-upper arm circumference differ by sex, internal z-scores were employed as a measure of relative nutritional status using a sex-specific reference population. Malnutrition status was determined using sex-specific cut off points of 22.0 cm for females and 23.3 cm for males with severe or moderate malnutrition (WHO 1995b).

Data analysis was performed using SPSS Version 10.0 and STATA Version 8.0. Most indicators of SES had distributions that were skewed to the right. Measures of SES with a skewness value (g_1) more than twice its standard error were interpreted as asymmetric and converted to a logarithmic scale for comparison purposes. Proxies of SES were compared using the Pearson correlation coefficient with two-tailed significance tests to assess strength of association.

The study was approved by Johns Hopkins Bloomberg School of Public Health Committee of Human Research and by local authorities in Ethiopia.

Results

Household income in Sodo was US\$39 (95 CI: 36–42) as compared to US\$32 (95 CI: 28–37) in Adama. Median household income was US\$23 per month in both sites, suggesting that distribution of income, and thus inequality, may be greater in Sodo than Adama. The distribution of monthly household income was skewed such that it did not approximate a normal distribution ($Q_1=10$, $Q_2=23$, $Q_3=55$). While total household income is a common measure of SES, per capita income is useful because it provides a standardized way of comparing resource availability for individuals. Household size differed significantly by survey site: average household size in Sodo was 6.3 as compared to 5.6 in Adama ($p=.002$). Per capita monthly income was similar in the two sites, at US\$9 (95 CI: 8–10) in Sodo and US\$10 (95 CI: 8–12) in Adama. Median per capita monthly income values were much lower than mean values and were approximately US\$4 per person per month in both survey sites. Per capita income distributions did not approximate a normal distribution and were skewed to the right ($Q_1=2$, $Q_2=4$, $Q_3=12$). A strong correlation between the two income measures was observed ($r=.894$, $p=.000$, $n=802$) suggesting that either variable can be used for estimation of SES.

Household assets and livestock value were used to estimate wealth. The distribution of asset and livestock values were similar between the two survey sites and skewed to the right ($Q_1=396$, $Q_2=579$, $Q_3=814$). Mean combined asset values were US\$635 (95% CI: 579–692) in Adama and US\$646 (95% CI: 615–677) in Sodo; median asset and livestock values were US\$556 and US\$583 in Adama and Sodo, respectively. Asset and livestock index scores ranged from 1.1 to 1,028, with a mean value of 60.6 (SD=40.9). The distribution of index scores was also skewed right ($Q_1=28$, $Q_2=43$, $Q_3=64$). The relationship between the asset and livestock index and the total value of household assets and livestock was relatively strong, as indicated by the Pearson correlation ($r=.649$; $p<0.01$, $n=808$). Compared to total monetary value of household assets and livestock, the combined asset and livestock index produced slightly different estimates of wealth that reduced inequalities between urban and rural populations.

Table 1. Correlations between measures of socio-economic status and arm circumference

	Log Asset & Livestock*	Log Assets & Livestock ⁺	Housing Conditions ⁺	Log Home/landownership ⁺	HH Head Education	MUAC Score (N=807)
Log Monthly HH Income (N=802)	.061	.055	.537*	-.029	.418	.231*
	p = .092	p=.129	p=.000	p=.487	p=.000	p =.000
	N=761	N=774	N=579	N=564	N=650	N=791
Log Per Capita Monthly HH Income (N=802)	.054	.041	.509*	-.104*	.410*	.230*
	p=.136	p=.253	p=.000	p=.014	P=.000	p=.000
	N=761	N=774	N=70	N=564	N=650	N=791
Log Asset and Livestock Value (N=808)			.060	.013	.032	.082*
			p=.157	p=.758	p=.425	p=.000
			N=548	N=543	N=629	N=765
Log Asset and Livestock Index (N=808)			.086*	.005	.045	.088*
			p=.033	p=.899	p=.262	p=.014
			N=558	N=553	N=638	N=778
Housing Conditions Ind. (N=574)					.507	.308*
					p=.000	p=.000
					N=572	N=577
Log Home/landownership Index (N=659)					.069	.089
					p=.101	p=.035
					N=557	N=562
HH Head Education (N=794)						.244*
						P=.000
						N=783

* Monetary value in Birr

+ Index score

Housing Conditions were employed as a measure of SES by developing indices based on observable dwelling characteristics and home and landownership status. Two separate indices were constructed; one that was based solely on housing conditions and another that included both housing conditions and home and landownership. Participant scores for the housing conditions index approximated a normal distribution and ranged from zero to 10 (the scale range), with a mean value of 5.5 (SD=2.4). The housing condition and home/landownership index had a potential range of zero to 20; however, the range for the survey population was 3 to 19. The distribution was slightly skewed to the left ($\gamma_1 = -0.44$, SE=0.10) with a mean score of 11.7 (SD=3.1). Correlation between the two indices based on housing conditions was relatively low, with a Pearson correlation coefficient of $r = .173$, ($p < .001$), indicating that housing conditions are not a good predictor of home ownership (or vice versa).

Educational attainment among household heads averaged 7.2 years (SD=4.4). The distribution did not approximate the normal curve because of the large proportion of respondents with no formal education (N=135 or 17.0%), and modes at the endpoints of primary and secondary school (8 and 12 years of education). Education level ranged from no formal schooling to 16 years of education. Mean educational attainment in males was greater than in females, with males averaging 7.4 years (SD=4.3) of education as compared to 5.4 years (SD=4.5) among females.

Mid-upper arm circumference for adult males and females, respectively, was 25.6 cm (95 CI: 25.3–25.8 cm) and 26.7 cm (95% CI: 26.3–27.1 cm). Mean MUAC in both survey locations was greater in females than in males. Overall prevalence of malnutrition was 9.3%. Prevalence of malnutrition in males was greater than in females in both survey sites: 12.9% (95 CI: 9.6–15.7) of males and 3.9% (95 CI: 2.3–5.3) of females, respectively, were malnourished. The odds of malnourishment were 3.8 times greater in males than in females (95 CI: 2.0–7.7).

Correlations Between Proxies of SES and MUAC

Few significant correlations were observed between the eight proxies of SES; however, MUAC was significantly correlated with all SES measures (Table 1). As expected, proxies of the same component of SES were highly correlated; however, this is a result of (1) being measures of the same theoretical component of SES and (2) that indicators were sometimes constructed based on the same data. Correlations between variables derived from the same data (i.e., variables that measure the same component of SES such as asset score and asset value) are reported in Table 1 and will not be further discussed.

Significant correlations ($p < 0.05$) were observed in 14 of 25 or 56% of comparisons. In general, strength of correlation between the measures of SES was relatively low. Only three of the 14 correlations had coefficients greater than 0.50, and five of the statistically significant correlations had coefficients of 0.10 or less. In general terms, associations between monthly income, per capita monthly income, housing conditions, household head educational attainment were the strongest. Asset and livestock value, asset and livestock index score and the combined housing conditions home/landownership index did not correlate well with other variables; correlations were either insignificant or coefficients were very small ($r \leq 0.10$).

Statistically significant correlations were observed between MUAC (an objective biological indicator) and all measures of SES. Regardless of the relatively low strength of correlation between MUAC score and other proxies, the fact that all correlations were statistically significant suggests that the selected measures of SES do relate to actual physical well-being when MUAC is used as an objective measure of physical/nutritional status. Strength of correlation to MUAC was the strongest for housing conditions, household head educational attainment and income indicators, respectively. Asset-related indicators and the combined housing condition home/landownership index had statistically significant correlations; however, the strength of association was very weak ($r \leq 0.10$).

Measures of SES and Malnutrition

Significant differences in both income measures were observed between malnourished and adequately nourished individuals (Table 2). Mean monthly household income and per capita income, respectively, were US\$20 and US\$6 greater in households with adequately nourished respondents as compared to those with undernourished respondents. No significant differences in mean asset and livestock value or mean asset and livestock index score were observed between the adequately nourished and malnourished. Significant differences in housing conditions indicators were observed when the population was divided by nutritional status. As compared to malnourished individuals, the mean housing conditions index and the mean combined housing conditions and home/landownership index in adequately nourished individuals, respectively, were 1.0 and 1.1 points greater. On average, household head educational attainment was 2.9 years greater among the adequately nourished group as compared to those that were malnourished.

Table 2. Nutrition and proxies of socio-economic status

	Malnourished (N=71)	Not Malnourished (N=722)	Mean Difference	95% CI for Difference
Mean Monthly Income (US\$)	18.8	39.3	20.6*	15.1–25.9
Mean Per Capita Monthly Income (US\$)	4.0	9.5	5.6*	3.6–7.5
Mean Asset and Livestock Value (US\$)	577.8	648.9	71.1	-22.9–165.0
Mean Asset and Livestock Index Score	49.0	62.1	13.1	-6.1–32.3
Mean Housing Conditions Index Score	4.6	5.6	1.0*	0.4–1.6
Mean Home/Landownership Index Score	10.7	11.8	1.1*	0.2–2.0
Mean HH Head Educational Attainment	4.5	7.4	2.3*	1.8–4.0

* Significant difference ($p < 0.05$)

Discussion

Prevalence of malnutrition (9.3%) was substantially lower than previously reported rates. Acute malnutrition among women in SNNPR (the primary survey site) was estimated at 14.0% in 1997 using MUAC and the same cut off of 22.0 cm to define malnutrition (Teller and Yimer 2000). Other recent studies placed national malnutrition rates for males and females at 24% and 30%, respectively (Demisse et al. 2003 Kaluski et al. 2001; Central Statistics Authority 2001). Low malnutrition rates observed in the study are likely due to the survey design where the sample was not intended to be representative of a regional population. In addition, it is likely that prevalence of malnutrition has changed, with changes being either seasonal in nature or longer-term trends over a period of years.

Asset-based measures and the combined housing conditions home/landownership index had low correlations with other SES indicators. These findings suggest that in the context of Ethiopia, and perhaps other regions in Africa where populations depend primarily on subsistence agriculture, asset-based measures and those considering home and landownership may not be ideal proxies of SES. Correlations between measures of income, housing conditions and household head educational attainment were all statistically significant and relatively strong ($r > 0.40$) when compared to correlations observed between other SES proxies. Because measures of income, housing quality and educational attainment were significantly correlated to one another and, in most cases, to a measure of wealth, these indicators of these components of SES may be more ideal for measuring SES in field situations where only a limited number of indicators can be employed.

In the present study, adequately nourished individuals were from households with significantly greater living conditions, household head educational attainment and income. These findings are aligned with previous research in the Ethiopian context, which found that household economic status and education were positively associated with nutritional status in (Demisse et al. 2003; Teller and Yimer 2000). No differences in household wealth, as measured by assets, were observed by nutritional status. Other malnutrition studies in southern Ethiopia have also documented that land holdings and livestock (a common asset among rural households) were not associated with adult malnutrition (Demisse et al. 2003). Findings of the present study, where living conditions, income and education appear to be better measures of SES than household assets, are not surprising in the context of food security and an agricultural economy.

While asset ownership in the early stages of food insecurity may contribute to increased coping capacity, in later stages of crisis, assets are often sold in order to purchase food. In addition to the

expectation that household asset value would decline among households that were using assets sales as a coping mechanism to procure food, household asset value is often in flux and may vary throughout the year, particularly in agricultural economies where harvest and livestock value evolve seasonally. Consequently, an association between household asset ownership and nutritional status would be difficult to ascertain by a cross-sectional comparison of nutritional status and wealth because of the large expected variation in household asset value and the documented relationship between coping capacity and wealth. Relative wealth (i.e., current asset value as compared to asset value before the onset of food insecurity) would be a more ideal measure; however, it is difficult to assess without a longitudinal study.

A well-documented relationship exists between SES and health, and in the context of food insecurity, nutritional status is a good descriptor of current well-being. Comparison of proxies of SES and the relationship of SES measures to physical well-being is important, because many researchers and non-government organizations in the fields of health and development use a variety of indicators as measures of SES. Indicators of SES commonly used in developed countries are not always useful or feasible in the context of developing countries and become difficult, if not impossible, to employ for a variety of reasons. In most developing countries, a large proportion of the population, between 20–70%, does not participate in the formal economy and rely on self-employment or microenterprise as a primary source of income (Wilson 2001).

Several implications are apparent for the validity and relevance of standard measures of SES when a large percentage of the population subsists in the informal economy: (1) the assumed association between education, occupation and income does not apply, particularly in countries where unemployment and underemployment are highly prevalent; (2) the validity of measures of income may be low because reliable sources of income data are not available for participants in the informal economy; (3) in countries where a large degree of inequality exists in the population, common measures of SES are likely to be useful in distinguishing between classes; however, the ability to assess differences in SES within the poorest sectors of the population may be limited due to the fact that SES is more likely to be dependent on participation in the informal economy and less tangible human and social assets. Schellenberg et al. (2003) note that signs of social or economic stratification in rural Africa are often hard for outsiders to recognize and suggest that many health researchers have an erroneous perception of relative homogeneity of SES in rural Africa.

Limitations

It should be noted that previous research in Ethiopia documented low intra-household correlations on nutritional status (Lindtjorn and Alemu 1997). This suggests that low associations between individual nutritional status and household level measures of SES may be expected. Of the SES measures assessed in the study, quality of housing conditions had the greatest correlation with physical well-being of participants as measured by MUAC followed by household head educational attainment and household income. The magnitude of the coefficients observed in the present study was less than 0.50 for nearly all comparisons, indicating that measures of different components of SES are only weakly correlated, limiting the strength of our findings in terms of recommendations of proxies of SES. The relatively weak correlations observed suggest that commonly used SES indicators are not uniform measures, and that the socio-economic position of households and individuals within households may vary by the indicator used to measure SES.

Conclusions

When compared to MUAC, strength of correlation was greatest among indicators of income, education and housing conditions, and weakest among asset-based measures and the proxy including home/landownership. Measures of assets or wealth are not ideal indicators of SES in the food insecure context because they are often difficult and time consuming to obtain, may not be able to accurately reflect a diverse population, and may be depleted (as a coping strategies) in periods of prolonged food insecurity. Measures of income, housing conditions and educational attainment as

indicators of SES may be useful in providing a quantitative indication of a household's or individual's relative SES in the context of food insecurity. Significant differences in mean household income, housing conditions and household head educational attainment was observed between malnourished and adequately nourished individuals. These findings suggest that, in Ethiopia, and perhaps other food insecure areas of Africa, measures of income, education and living conditions may be better proxies of SES than measures of wealth such as assets or home/landownership. Validation of existing measures of SES and the exploration of other potential indicators are important future steps in advancing the measurement of SES in the context of developing world economies.

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