Supplementary material

Do supermarkets contribute to the obesity pandemic in developing countries?

Table 1S Descriptive statistics for variables used in adult nutrition models

Variable	Mean	Standard deviation
BMI	24.893	4.845
Overweight (dummy)	0.270	0.444
Obese (dummy)	0.143	0.350
Underweight (dummy)	0.039	0.194
Joule consumption per day (kJ)	14019.65	5553.162
Calorie consumption per day (kcal)	3350.776	1327.238
Share of joules/calories from processed foods (%)	48.51	16.21
Food expenditure (Ksh per AE and month)	6099.922	4628.725
Buys in supermarket (dummy)	0.580	0.494
Supermarket purchase share (% of total food expenditure)	9.671	11.596
Distance to nearest supermarket (km)	15.105	20.478
Age (years)	34.763	11.905
Female (dummy)	0.641	0.480
Heavy work (dummy)	0.460	0.499
Leisure-time physical activity (hours per week)	8.806	7.221
Household expenditure (Ksh per AE and month)	12005.460	10041.010
Education of person responsible for food (years)	9.724	3.778
Household size (AE)	2.642	1.233
Married household head (dummy)	0.735	0.442
Household does farming (dummy)	0.654	0.476
Household owns television (dummy)	0.598	0.491
Distance to nearest district hospital (km)	10.426	7.171
Number of observations	615	

Ksh, Kenyan shillings; AE, adult equivalent.

Table 2S Descriptive statistics for variables used in child/adolescent nutrition models

Variable	Mean	Standard deviation
Height-for-age Z-scores (HAZ)	-1.049	1.296
Stunted (dummy)	0.208	0.407
BMI-for-age Z-scores (BAZ)	-0.308	1.000
Overweight/obese (dummy)	0.097	0.297
Joule consumption per day (kJ)	10138.46	5082.24
Calorie consumption per day (kcal)	2423.15	1214.68
Share of joules from processed foods (%)	48.22	17.29
Buys in supermarket (dummy)	0.509	0.501
Supermarket purchase share (% of total food expenditure)	8.480	11.204
Distance to nearest supermarket (km)	15.489	19.763
Age (months)	115.755	43.717
Female (dummy)	0.481	0.501
Physical education at school (hours per week)	1.473	2.076
Leisure-time physical activity (hours per week)	16.589	9.504
Malaria or respiratory infection during last month (dummy)	0.093	0.291
Height of female adult measured in household (cm)	158.126	5.845
Age of female adult measured in the household (years)	35.213	10.513
Age of female adult when the child was born (years)	25.567	9.791
Female adult is the mother (dummy)	0.833	0.374
Household treats drinking water (dummy)	0.477	0.501
Household expenditure (Ksh per AE and month)	9223.462	6193.470
Education of person responsible for food (years)	8.769	3.833
Household size (AE)	3.228	1.196
Married household head (dummy)	0.75	0.434
Household does farming (dummy)	0.699	0.460
Household owns television (dummy)	0.537	0.500
Distance to nearest district hospital (km)	9.747	7.050
Distance to nearest health care center (km)	2.087	2.159
Number of observations	216	

Ksh, Kenyan shillings; AE, adult equivalent.

Table 3S First-stage results of instrumental variable models for impact of supermarket purchase on adult nutrition

Explanatory variables	Buys in supermarket (dummy)	Supermarket purchase share (%)
Distance to nearest supermarket (log of km)	-0.502*** (0.04)	-2.272*** (0.19)
Age (years)	-0.021** (0.01)	-0.097** (0.04)
Female (dummy)	-0.115 (0.43)	-1.249 (2.19)
Female-age interaction	0.007 (0.01)	0.033 (0.05)
Heavy work (dummy)	-0.177 (0.14)	-0.249 (0.72)
Leisure-time physical activity (hours per week)	0.016* (0.01)	-0.008 (0.05)
Household expenditure (1000 Ksh per AE and month)	0.072*** (0.01)	0.183*** (0.04)
Education of person responsible for food (years)	0.048** (0.02)	0.411*** (0.11)
Married household head (dummy)	0.676*** (0.17)	0.788 (0.96)
Distance to nearest district hospital (log of km)	0.004 (0.05)	-1.363*** (0.33)
Constant	-0.401 (0.44)	11.065*** (2.34)
Number of observations	615	615
Chi-squared test statistic	242.159***	--
F statistic	--	44.73***

Ksh, Kenyan shillings; AE, adult equivalent. *$P<0.1$, ** $P<0.05$, ***$P<0.01$. Coefficient estimates are shown with robust standard errors in parentheses.

Table 4S First-stage results of instrumental variable models for impact of supermarket purchase on child/adolescent nutrition

Explanatory variables	Buys in supermarket (dummy)		Supermarket purchase share (%)
	BAZ model	HAZ/stunted models	
Distance to nearest supermarket (log of km)	-0.547*** (0.07)	-0.567*** (0.07)	-3.092*** (0.28)
Age (months)	-0.007** (0.00)	-0.009*** (0.00)	-0.017 (0.01)
Female (dummy)	0.073 (0.24)	0.044 (0.24)	-1.241 (1.16)
Household expenditure (1000 Ksh per AE and month)	0.092*** (0.03)	0.080*** (0.03)	0.347*** (0.11)
Education of person responsible for food (years)	0.024 (0.04)	0.028 (0.04)	0.169 (0.21)
Married household head (dummy)	0.206 (0.28)	0.163 (0.28)	-0.362 (1.49)
Malaria or respiratory infection (dummy)	--	0.144 (0.40)	-0.675 (2.15)
Height of female adult (cm)	--	-0.010 (0.02)	-0.024 (0.08)
Age of female adult when child was born (years)	--	-0.007 (0.01)	0.015 (0.06)
Household treats drinking water (dummy)	--	0.281 (0.24)	1.464 (1.16)
Distance to nearest health care center (log of km)	--	0.052 (0.13)	-1.812** (0.71)
Physical education at school (hours per week)	0.036 (0.05)	--	--
Leisure-time physical activity (hours per week)	0.018 (0.01)	--	--
Age of female adult (years)	-0.006 (0.01)	--	--
Distance to nearest district hospital (log of km)	-0.029 (0.10)	--	--
Constant	0.033 (0.79)	2.219 (3.02)	13.296 (12.68)
Observations	216	216	216
Chi-squared test statistic	96.365***	111.231***	--
F statistic	--	--	22.2***

BAZ, BMI-for-age Z-score; HAZ, height-for-age Z-score; Ksh, Kenyan shillings; AE, adult equivalent. *$P<0.1$, **$P<0.05$, ***$P<0.01$. Coefficient estimates are shown with robust standard errors in parentheses.

Table 5S Impact of supermarket purchase on child/adolescent mild and severe stunting

	Mildly stunted (HAZ < -1)		Severely stunted (HAZ < -3)	
Buys in supermarket (dummy)	-0.131 (0.09)	--	-0.231*** (0.05)	--
Supermarket purchase share (%)	--	-0.009** (0.00)	--	-0.016*** (0.00)
Age (months)	0.003*** (0.00)	0.003*** (0.00)	0.001** (0.00)	0.001*** (0.00)
Female (dummy)	-0.021 (0.06)	-0.032 (0.06)	-0.004 (0.03)	-0.025 (0.03)
Household expenditure (1000 Ksh per AE and month)	-0.007 (0.01)	-0.005 (0.01)	0.003 (0.00)	0.004 (0.00)
Education of person responsible for food (years)	-0.006 (0.01)	-0.004 (0.01)	-0.012*** (0.00)	-0.012* (0.01)
Married household head (dummy)	-0.087 (0.07)	-0.099 (0.07)	-0.033 (0.03)	-0.063* (0.03)
Malaria or respiratory infection (dummy)	0.097 (0.10)	0.095 (0.10)	0.177*** (0.04)	0.185*** (0.05)
Height of female adult (cm)	-0.019*** (0.00)	-0.019*** (0.00)	-0.005 (0.00)	-0.005 (0.00)
Age of female when the child was born (years)	-0.010*** (0.00)	-0.010*** (0.00)	-0.003* (0.00)	-0.003* (0.00)
Household treats drinking water	-0.105* (0.06)	-0.096* (0.06)	-0.017 (0.04)	-0.009 (0.03)
Distance to nearest health care center (log of km)	-0.052* (0.03)	-0.065** (0.03)	0.048** (0.02)	0.037* (0.02)
Number of observations	216	216	216	216

HAZ, height-for-age Z-score; Ksh, Kenyan shillings; AE, adult equivalent. *$P<0.1$, ** $P<0.05$, ***$P<0.01$. Marginal effects are shown with robust standard errors in parentheses. Estimates are based on instrumental variable probit models with the supermarket purchase variables instrumented.

Table 6S Causal chain model to explain the impact of supermarket purchase on adult BMI

Explanatory variables	BMI (Kg/m^2)	Joule consumption per day (kJ)	Share of joules from processed foods (%)	Supermarket purchase share (%)
Joules consumption per day (kJ)	0.0005*** (0.00)	--	--	--
Share of joules from processed foods (%)	0.118*** (0.04)	--	--	--
Age (years)	0.112*** (0.02)	--	--	--
Female (dummy)	1.344 (1.23)	--	--	--
Female-age interaction	0.040 (0.03)	--	--	--
Heavy work (dummy)	-0.672* (0.37)	--	--	--
Leisure-time physical activity (hours per week)	-0.041* (0.02)	--	--	--
Supermarket purchase share (%)	--	64.61* (35.68)	0.330*** (0.11)	--
Household expenditure (1000 Ksh per AE and month)	--	163.42*** (24.16)	-0.241*** (0.07)	0.144*** (0.04)
Education of person responsible for food (years)	--	-53.473 (63.00)	0.755*** (0.19)	0.448*** (0.11)
Household size (AE)	--	-128.079 (174.86)	-0.990* (0.52)	--
Household does farming (dummy)	--	752.541* (452.02)	-4.230*** (1.37)	-2.522*** (0.79)
Household owns television (dummy)	--	--	3.075** (1.29)	2.274*** (0.80)
Distance to nearest supermarket (log of km)	--	--	--	-2.564*** (0.18)
Constant	6.996** (2.88)	11799.16*** (835.84)	44.416*** (2.48)	6.420*** (1.22)
Number of observations		615		
Chi-squared		130.044***		

Ksh, Kenyan shillings; AE, adult equivalent. *$P<0.1$, ** $P<0.05$, ***$P<0.01$. Coefficient estimates are shown with standard errors in parentheses. The system of simultaneous equations was estimated with three-stage least squares.

Table 7S Causal chain model to explain the impact of supermarket purchase on child/adolescent HAZ

Explanatory variables	HAZ	Joule consumption per day (kJ)	Share of joules from processed foods (%)	Supermarket purchase share (%)
Joule consumption per day (kJ)	0.0001* (0.00)	--	--	--
Share of joules from processed foods (%)	0.025* (0.01)	--	--	--
Age (months)	-0.009*** (0.00)	--	--	--
Female (dummy)	0.105 (0.15)	--	--	--
Malaria or respiratory infection (dummy)	-0.436* (0.26)	--	--	--
Height of female adult (cm)	0.059*** (0.01)	--	--	--
Age of female adult when the child was born (years)	0.019* (0.01)	--	--	--
Household treats drinking water (dummy)	0.364** (0.16)	--	--	--
Supermarket purchase share (%)	--	72.133 (55.42)	0.447** (0.18)	--
Household expenditure (1000 Ksh per AE and month)	--	206.177*** (67.44)	-0.358 (0.23)	0.331*** (0.11)
Education of person responsible for food (years)	--	-98.650 (127.08)	-2.356** (0.96)	0.201 (0.18)
Household size (AE)	--	-175.239 (290.47)	0.876*** (0.33)	--
Household does farming (dummy)	--	-172.916 (731.21)	-6.007** (2.42)	-1.456 (1.28)
Education of household head (years)	--	-137.456 (115.50)	--	--
Age of female adult (years)	--	14.507 (33.03)	--	--
Household owns television (dummy)	--	--	1.918 (2.17)	0.566 (1.28)
Distance to nearest supermarket (log of km)	--	--	--	-2.830*** (0.30)
Constant	-12.428*** (2.40)	9974.228*** (1879.18)	50.831*** (4.52)	7.586*** (1.84)
Number of observations		216		
Chi-squared		65.561***		

HAZ, height-for-age Z-score; Ksh, Kenyan shillings; AE, adult equivalent. *$P<0.1$, ** $P<0.05$, ***$P<0.01$. Coefficient estimates are shown with standard errors in parentheses. The system of simultaneous equations was estimated with three-stage least squares.