Gender Empowerment, Inequalities, and the Prevalence of Adult Female Obesity: An Empirical Analysis Using New Data, 1990-2013

Abstract:

Aims: Do gender inequality and gender discrimination explain female obesity? Discrimination denies access to choose and constrains agency. *Scope:* Using the *Global Burden of Disease* data on overweight and obesity share of the adult female population for almost 160 countries over a 24-year period, we find that female empowerment has no effect on the population share that is overweight, but it reduces the obese share of women. The substantive impact is, however, slight, and the results are not robust to testing a sample of only developing countries. Political freedoms for women in general, however, show positive effects on the prevalence of obesity, results that are again substantively meagre. Higher levels of income inequality and a measure of health inequality predict lower levels of female obesity independently of the controls, which raises some doubt about large arguments linking generalized inequality to obesogenic environments. *Results:* In so far as our measures of female empowerment capture greater access to rights and agency, they are poor predictors of the prevalence of obesity. The results suggest that local-level idiosyncrasies matter a lot more than do macro-level factors. The conclusions should be treated tentatively given the short temporal domain examined here and uncertainties in the data. While promoting rights and equity for women are still intrinsically valuable and moral, the task of reducing obesity *per se* may require more targeted public action promoting healthier lifestyles and consumption among vulnerable groups.

Key words: gender empowerment, discrimination, obesity, income inequality, health inequality, obesogenic environments

1. Introduction

Income and other societal inequalities are identified as major causes of health-related welfare and morbidity [1]. Indeed, some identify income inequality as a fundamental cause of the obesity epidemic sweeping the world because inequalities determine "obesogenic" environments. Societies, however, are burdened with many inequalities. Gender inequality, for example, is ubiquitous around the world, particularly in many developing countries [2]. Indeed, it is observed that females gain more weight than males in general across the world, and preliminary evidence suggests that gender-based inequality, among other factors, might explain the difference [3]. According to the World Health Organization (WHO), of all the estimated overweight (1.9 billion) and obesity sufferers (600 million) across the globe, women make up roughly 60% of the total [4]. Is the prevalence of obesity among women, thus, also a reflection of gender disparity and discrimination, which would make fighting obesity not just an issue of development but also a matter of human rights?

Using the latest available data on the prevalence of female overweight and obesity together with unique data on the empowerment of women, this study estimates the effect of gender empowerment and socioeconomic inequality on female overweightness and obesity between the years 1990 and 2013 (24 years) for a global sample of countries and a sample restricted to only developing countries. Our results are easily summarized. We find some evidence linking higher female empowerment to a lower prevalence of obesity. General freedoms and empowerment in terms of greater democracy and greater per capita wealth, however, robustly increase the prevalence of overweight and obese among women independently of each other. Despite heavy theorizing about the impact of income inequality on obesity, we find that a measure of gender inequality and social inequality measured as access to quality health care between rich and poor (health inequality), lower the incidence of obesity among females. Our results suggest that unmeasured, local-level

factors within individual countries seem to matter a whole lot more for explaining obesity than do large, macro-level factors, such as gender empowerment and political freedoms. While empowerment of women is intrinsically valuable and moral, reducing the prevalence of obesity may need a host of other measures, such as the promotion of healthier consumption and lifestyles and a better understanding of local-level, culturally-driven factors that may determine female weight gain.

2. Social inequities and health

The obesity pandemic is no longer just a problem of Western, industrialized-countries. Obesity is growing rapidly across the world; also, among the poor in the poorest countries [4]. The cost of obesity in poor countries is potentially massive because obesity leads to the development of debilitating non-communicable diseases (NCDs), such as heart disease, high blood pressure, diabetes, and many forms of cancer [5]. Moreover, because of the critical role women play in the development of human capital, which is vital for a country´s economic growth, the health and welfare of women are critical issues for development. In other words, the health of females, who make up roughly 50% of any society, is intrinsically and instrumentally valuable. Ending discrimination, thus, is not just morally valuable, but it is practically important for insuring better development outcomes.

With some recent exception, the larger portion of the public health literature focuses on economic inequality, but discrimination of targeted groups, such as women, whatever their economic standing in a society, receives less attention [6]. Most observers treat gender and other forms of inequities as part of the same structural process, often related to income inequality. Kawachi and Kennedy argue that income inequality explains a large portion of health outcomes and general wellbeing within societies [1]. They point to various correlational studies that find higher

rates of inequality predicting adverse health outcomes. Wilkinson and Pickett offer a similar argument about income inequality and public health, particularly the obesity epidemic [7]. They argue that inequality leads to obesogenic environments that trap people in vicious cycles of poor consumption patterns and lifestyles. Such large arguments, however, have little to say about why women, relative to men, might be more susceptible to making poor choices. Of course, factors that drive both inequality and lower socio-economic outcomes, such as health, might have common causes, such as bad social institutions that discriminate against women and exclude women from socio-economic and political life [8].

The question of obesity as a health outcome presents some interesting paradoxes, however. Obesity is viewed as a problem for the rich and affluent, but within rich countries, it is poorer people, particularly poor women, who are forced to consume low quality, weight-gaining calories [9]. However, in poorer countries, it is the rich that are often thought to be gaining weight and becoming obese, whilst the very poor are either undernourished or of normal weight. Why this paradox might exist has little explanation. In poor countries, thus, higher inequality should predict less weight gain and obesity, and this should be most pronounced among women because they are generally the most disadvantaged. Why the processes of weight gain should be inverse in these two settings is a theoretical mystery. Thus, one needs first to identify the causal mechanisms from discrimination to weight gain before empirical tests of the hypotheses can proceed in a disciplined manner.

If we are to uncritically accept the explanation that generalized inequality leads to higher obesity among women, then the natural corollary to this argument is that women are predisposed to make poorer choices than men. We do not believe this to be true, particularly because we believe that in most settings, women are constrained from making better choices because of patriarchal hierarchies that exclude women from power. If better education is what allows wealthier people to

manage ideal body sizes while the poor are becoming obese, then systematic patterns of excluding women from gaining access to such "public goods" as education might be the underlying problem, not a natural predisposition for gaining weight.

We suggest that the overly economic focus on inequality and health outcomes adds unnecessary confusion around the dual paradox of wealth and obesity and the question of greater female obesity. Indeed, why women should be more affected by obesogenic environments due to structural factors, such as income inequality, is very poorly specified, particularly in relation to rich versus poor countries and rich versus poor women in both settings. Given rising obesity among women in even very poor countries, the idea that women get relatively more calories than men or are more likely to be psychologically affected by "relative deprivation" to be inactive and lethargic are unclear. Indeed, the suggestion that women are more susceptible to poorer choices like "binge eating" and adopting unsuitable lifestyles not only jars against good sense, but it also contradicts what we know about the relative benefits of empowering females in the poor world for obtaining favourable outcomes in the household and at the level of the community.

It is generally observed that in patriarchal societies, women lack similar rights as men in economic, political and social life. Empowerment of women is thus recognized as a progressive step, valuable both intrinsically and instrumentally. The question of empowerment (autonomy) and freedom etc., however, is not unproblematic. The definition of autonomy is not easily measured, and the result of autonomy might have ambiguous consequences, depending on whether one thinks of empowerment as "self-indulgence" or as "responsibility" [10]. Suppose that a woman is deemed free from the traditional mores against drinking alcohol, this autonomy she enjoys may or may not lead to raising the welfare of a woman and her family if she follows the path of self-indulgence. Indeed, one of the main arguments suggesting why wealthier women in poor countries gain weight is that these women have the *autonomy* to enjoy leisure and indulge in luxuries, whereas poorer

women possibly get "worked to the bone" and receive less access to calorie-rich foods. In this case, the lack of autonomy for a woman in terms of wealth, leisure, and choice might not be bad in terms of weight gain and obesity [11]. Next, we briefly examine some theoretical avenues through which discrimination of women can explain their excess weight, referring particularly to discrimination and disempowerment of women.

3. Discrimination and female obesity

The effect of patriarchy on female weight gain and obesity levels is not straightforward. On one hand, in a patriarchal society, women may have to endure harder physical work and lower consumption, both of which may keep women from gaining weight. On the other hand, women may only receive very low-quality consumption possibilities and very little access to mobility due to social constraints that keep her at home. We argue, however, that in a patriarchal society, women as a group are likely to feel less self-worth merely because of their identity as females. We present below three possible pathways by which environments that discriminate against women, or constrain the autonomy of women, might affect women´s weight gain and general health adversely. The theory is based on three different health-damaging consequences that females in a patriarchal society may experience because of discrimination, namely (1) psycho-social consequences and apathy (2) the lack of access to information and knowledge (3) barriers to exercise and physical activity and other health related lifestyle choices.

3.1 Mental health and obesity

Blaine states that patriarchal societies have a higher rate of females with psychological problems, and that these problems can be underlying sources of eating disorders and obesity [12]. Others report that the link between mental health, or more specifically depression and demoralization, and

obesity, is likely to be strongest among females [13]. Processes against women in patriarchal society, such as abuse, cause demoralization among women in a variety of ways. Females with restricted choices, particularly in terms of access to education, access to rights in terms of choosing one's own partner for marriage, the ability to inherit property and own a business, and domestic violence etc. are factors that affect the mental health of women. Under these conditions, it is not unreasonable to believe that women would do less for themselves to prevent excessive weight gain. One of the most odious aspects of how patriarchal societies might lead to female depression and obesity might be through physical and sexual abuse. Women are likely to have faced violence and abuse during childhood as well as when adults. Under these conditions, women are likely to neglect their physical appearances, withdraw from society, and suffer health-effecting mental debility, which are preconditions for obesity [14].

3.2 Access to knowledge and obesity

One of the most common discriminatory regulations in a male dominated society is the gender disparity in school enrolment and the opportunities for accessing education [15]. Denying education to girls is a conscious strategy of limiting the mobility of females, both in terms of physical mobility and access to the outside world through learning. Denying education to girls disempowers them by limiting choice. Kebede-Francis states that once girls are denied primary education, serious and irreversible consequences for their health and wellbeing follow (29). Not only does the lack of education deprive girls of future earnings and meaningful participation in public life, but more fundamentally, it denies women the opportunity to learn the fundamentals of healthy living and adopting healthy lifestyles. Learning about the importance of regular exercise, nutritious food consumption, and self-respect is denied to girls due to the lack of schooling. Indeed, Kebede-

Francis' research shows that when girls complete primary school education, their health and nutrition improve (29).

3.3 Access to physical activity and obesity

As well as obstructing the ability to learn about healthy food consumption and life styles, females in a patriarchal society are usually deprived the opportunity to participate directly in physical activities. Social mores that restrict women may actually constrict physical movement. Studies show that school enrolment can increase participation in leisure-time physical activities, which are very important avenues for socializing young girls in ways that increase their participation in healthy recreational activities [16]. Unequal access to schooling contributes to unequal access to organized physical activity between the genders and may in many cases determine lifestyle choices of women in relation to those of men. The family role that females are ascribed in male dominated societies (and societies in general) also limits a woman´s ability to control her own body via the allocation of time to healthy physical activity. In a patriarchal society, thus, a female's agency about looking good and conforming with global cultural mores might be also be circumscribed.

To illustrate that discrimination may trump some aspects of empowerment, consider the case where a rich woman has access to luxuries, including calorie-rich food and leisure time to indulge, but she may not have the freedom to indulge in looking well, perhaps exercising to lose weight. In this case, some forms of empowerment, such as economic empowerment, are trumped by discrimination, an accusation often levelled at many strict Islamic countries in the Arab world where obesity among women is recognized as a serious problem [17]. Given the many pathways though which discrimination might affect the health of women, we propose the following hypothesis:

H1: Greater female empowerment reduces the incidence of adult female obesity

As discussed above, many claim income inequality and other social inequalities create obesogenic environments. All forms of inequality, particularly income inequality, could also drive gender inequalities if patriarchy and other inequalities exist together in vicious circles. Bad health and social policies as well as gender discrimination in patriarchal societies could then explain female excess weight gain in a cocktail of policies that perpetuate discrimination, across classes and the genders. In other words, the positive effect of discrimination on higher female weight gain might be mitigated by lower levels of inequality, since low inequality could capture conscious public policy effort to lower discrimination and improve health. To examine this proposition more closely, we test the following hypothesis using income inequality measured as the GINI coefficient and a measure of health inequality as coded by the Varieties of Democracy project to capture general societal inequalities:

> *H2: Greater female empowerment reduces the incidence of adult female obesity*
> *conditional on low levels of overall social inequality*

4. Data & Methods

This study uses the best available data and methods to examine the relationship between discrimination of women and female overweightness and obesity using a time-series, cross-sectional (TSCS) dataset. We find a similarly-motivated study that looks at gendered patterns in obesity, where 2 out of 3 measures of gender inequality correlate positively with the difference in the BMI between men and women [3]. Unlike them, we are interested in absolute weight gain and obesity among women rather than accounting for the gap between men and women since our theoretical propositions are aimed at explaining why women gain weight, regardless of what men´s body shapes are. Moreover, they use average BMI, whereas we use the share of the female population that exceeds the threshold for being overweight or obese. Clearly, the gap between men

and women´s weight varies if women gain more than men, if men lose weight compared with women, and vice versa, and the gap in terms of BMI does not capture why women put on weight above a biophysically-determined normal standard.

We believe that the share of women that are overweight above the age of 20 as well as the share of women that are obese above the age of 20 (age standardized weight) are superior indicators of the status of women´s weight within any given country because it captures the extent of the prevalence of overweight and obesity. The category "overweight" is determined as a BMI above 25, and the category "obese" is determined as a BMI above 30 [18]. We test both categories but report only the results for the share of women that are "obese" for brevity. The results are the same for both categories. We obtain this data from the Global Burden of Disease (GBD) database. The GBD data are the most comprehensive cross-sectional, time-series (TSCS) data on overweight and obesity. This data collection effort involved hundreds of researchers from across the world that estimated obesity rates by looking at all available studies on individual countries, household surveys, hospital records etc. to gather the most accurate, age-standardized estimates (33). These data are available for the years 1990 to 2013 for most countries in the world. Our study includes roughly 159 countries for which we have complete data on all variables covering the years 1990 to 2013 (24 years).

Our main independent variables are various measures of female empowerment, both relative to men in terms of the United Nation´s Gender Inequality Index and the absolute level of empowerment as measured by the Varieties of Democracy (VDEM) data. We also use the World Bank´s Gender Parity Index as measured by the secondary school enrolment ratio between girls and boys. Identifying the level of empowerment of women, or active and hidden gender discrimination within a society, is not an easy task. Using rigorous coding rules involving over 2600 researchers from around the world, the VDEM data are easily the most comprehensive data on female

political empowerment available. The data are generated with the help of advanced Bayesian factor analysis techniques to eliminate uncertainty and Bayesian item response theory modelling for validating the dozens of ordinal rankings by experts on each individual country on several dimensions of gender equality and empowerment. These data consciously evaluate the status of women in terms of their access to rights, choice, and agency [2]. Rather than most measures of gender empowerment or gender equality that look at economic equality with men, these data try to capture women´s ability "to make meaningful decisions in critical areas of their daily lives" (7: 3). The data capture women´s empowerment on variables measuring "freedoms" that allow women choice (freedom of movement, access to justice, access to property rights, and freedom from forced labour). Moreover, unlike some indices that look at rights on the books, these data try to capture as much of the realities of the lived experiences of women in terms of political, social and economic discrimination. We use two distinct measures from the VDEM data. The first is the overall gender empowerment index. From the index, which aggregates several dimensions of women´s rights, we also choose one that determines their "power" for accessing government relative to men. In many ways, women´s access to politics could be a critical determinant of other rights and choices available to women.

We also use a standard Gender Inequality Index (GII) used by many others, which measures the human development gap between men and women [3]. The United Nations Development Program (UNDP) generates the GII based on how women relate to men on 3 main dimensions—health (reproductive and mortality), political life and education (parliamentary representation and secondary school achievement), and employment (labour force participation) [19]. The inclusion of the health dimension is highly relevant for our purposes since mortality at birth should indicate not just the value of female lives in terms of policy, but also a government´s infrastructure in the health sector. The GII is available from 2000 until 2013 (14 years). Finally, we use the World Bank´s

gender parity in secondary school based on school enrolment rates [20]. This is possibly the weakest indicator of gender rights because governments can simply pack schools with girls without such enrolment parity reflecting greater rights and opportunities for women. The intercorrelations between our empowerment variables show high correspondence, especially the UN´s Gender Inequality Index (UNGII) with the two VDEM variables, the gender empowerment index and women´s access to political power resources ($r = -0.74$ and $r = -0.68$). However, these variables correlate rather weakly with the World Bank´s GPI based on secondary school enrolment (not shown). While we use the GPI data, we do not consider school enrolment parity to be as valid as the gender empowerment index because enrolment parity might be weak at capturing the degree of access to rights and levels of agency.

We use Ordinary Least Squares regression analysis (OLS) on pooled-time-series cross-section data (TSCS) following many similar studies. When using TSCS data, one needs to account for heteroscedasticity and autocorrelation. We use the Wooldridge test implemented in STATA for assessing whether the data contain first-order autocorrelation and find that we cannot reject the null hypothesis of no autocorrelation. Thus, we employ Newey-West standard errors that are robust to heteroscedasticity and serial correlation, computing both time and country fixed effects [21]. The data consists of repeated observations annually for a large number of countries (the number of countries and observations depend on data availability on all variables). In addition to temporal dependence, data such as ours might be plagued with cross-sectional dependence due to shared life styles and consumption patterns, or policy spill over across territorial borders. Not accounting for cross-sectional dependence can yield biased results, which previous studies have treated as a nuisance. Thus, we also employ estimations correcting for spatial dependence by computing Driscoll-Kraay standard errors robust to cross-sectional dependence [22].

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While we use regression analysis following Garawi et al., we include time and country fixed effects to control for trends in the data, and importantly, account for unit heterogeneity [9]. Countries may exhibit a host of idiosyncratic local-level factors, such as culture, which are unmeasured in the models. Several case studies show that local-level cultural factors matter when mapping obesity among women [23]. Not accounting for this heterogeneity could lead to biased estimates [24]. For example, a country such as Mauritania actively practices "gavage", where girls are force fed to gain weight because being overweight is considered a mark of beauty and enhances the prospects of women in the marriage market [25]. Country-level characteristics need to be accounted also because the body form of people differ widely across regions and even within a region due to genetic conditions. Since BMI is weight/height^2, differences in leg length, for example, can affect overall BMI scores without reflecting adiposity accurately [26]. Country fixed effects, thus, will account for all these fixed factors and other country-level local factors that affect weight gain that are unmeasured in our model. Several previous studies have neglected to account for fixed effects , which could lead to severely biased results [27].

The control variables are kept simple to highlight the results on the gender discrimination variables, without overfitting our models [28]. To eliminate the chance of spurious results, we control for the effects of the level of development by entering per capita income. Countries that are richer may have higher obesity and overweight, but they may also be less discriminatory of women. Per capita income also captures many other dimensions of life relevant to how people gain weight, such as lifestyle factors, public services, and health and social infrastructures. Income per capita data are obtained from the World Bank (WDI) in Purchasing Power Parity (PPP) adjusted dollars [20]. We log this variable to reduce the influence of extreme values. We enter the level of democracy as our second major control variable. Women´s rights conditions must be parsed out from the general conditions of political freedom in a country. For example, it stands to reason that more

women will be represented in parliament when democracy exists, as opposed to having no opportunity at all for engaging in politics. Democracies are likely also to increase basic freedoms for all, including women. The democracy measure is also taken from the VDEM data and measures the degree to which people are free to elect their leaders in competitive election without any form of coercion, violence, or fraud. The democracy score is available for states with a total population of over 500, 000 inhabitants.

Finally, for estimating conditional effects between gender empowerment and the general level of socio-economic inequality within a society, we employ two measures of inequality. First, we use the standard GINI index sourced from the WDI. The GINI coefficient captures the level of income disparity away from ideal equality based on the share of income earned by the poorest people. We also employ the VDEM data project´s "health equality" measure, which codes equality on a scale of 0 to 4 where coders evaluate the extent to which the poorest people in society have access to proper/adequate health services compared with the richest people (see appendix for details). A score of 0 means the poor do not have the same access as the rich, whereas a score of 4 suggest that they have equal access to health services as the richest people. We invert the score so that this variable now measures health inequality rather than equality. The GINI correlates at r = 0.4, which is fairly high but access to health care and income inequality do not seem to be capturing the same dimensions of social inequality. A regression plot of these two variables are revealing (see Figure 1).

********* FIGURE 1 ABOUT HERE***********

Costa Rica and Lesotho display fairly high income inequality measured by the GINI but lower than expected   health   inequality,   whereas Bangladesh, Nepal, and Azerbaijan display fairly

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low GINI scores but higher than normal health inequality. These differences may point to important ways in which inequities persist in a society due to poverty and the lack of state policies aimed at reducing inequality, such as the disparity in health between the rich and poor.

5. Results

Table 1 presents results of the estimations of each of our gender empowerment measures on the share of the obese population among females above 20 years of age between the years 1990 and 2013.

**********TABLE 1 ABOUT HERE*********

Column 1 in Table 1 reveals that greater levels of women´s empowerment reduce the share of the obese female population above 20 years, a result that is statistically highly significant. Thus, holding constant each of the controls at their mean values, a standard deviation increase in the gender empowerment index will decrease the share of the obese female population by roughly 4% of the standard deviation of the obese population. The substantive effect, therefore of increasing gender empowerment on overweightness using the standard deviation is quite small. Moving from no power at all to full empowerment (4 points) could reduce the share of overweight females by 87% of a standard deviation of overweight females. Thus, significant gains from female empowerment in terms of reducing obesity among women is only likely when non-empowered women become fully empowered, independently of factors such as wealth and democracy. Increasing income by a

standard deviation, holding all other variables at their means could reduce the share of obese females by roughly 11% of a standard deviation of the obese female population share.

A higher level of general freedoms, represented by greater democracy, increase the share of women that are obese. Increasing democracy by a standard deviation increases the obese share of the female population by 8% of the obese share of females. Since democracy empowers women as a matter of course, higher women´s empowerment above the effects of democracy brings fairly small substantive gains, suggesting that it may in fact not be freedoms and rights that determine weight gain among women, but that rights might be affected by offsetting effects of higher access to consumption possibilities and perhaps lifestyle changes. If democracy also means access to better health services and lower social inequities between social classes, then theory addressing obesity among women using inequality in terms of access is a subject that needs far keener examination and explanation.

In column 2, equality in the distribution of political power also shows a negative effect on higher female obesity. The more equality between the genders when it comes to access to political resources, the lower the share of adult females that are obese. These results are in line with the previous result on gender empowerment and overweightness. A standard deviation increase in equality in political power with men, holding the other variables at their mean values, decreases the share of obese females by roughly 2% of a standard deviation of the share of obese females. Once again, gender equality seems to show a very small substantive effect. Going from no equality with men to full equality will decrease the share of obese females by roughly 11% of a standard deviation of the obese population. Again, the gains from equality of political power with men is only substantively weakly associated with obesity among women, given that reaching full empowerment with men from 0 equality is likely to be a slow and arduous process in many countries.

Column 3 examines the effect of the UN´s GII. As seen there, gender inequality increases the share of obese females, a result that supports the previous results reported above as well as results reported by others that have used this measure with different weight-gain data [3]. Substantively, a standard deviation increase in the GII increases the share of adult females that are obese by roughly 7% of a standard deviation of obese females, which is again fairly small. A full increase in gender equality with men would only reduce the share of females that are overweight by roughly 30% of a standard deviation in the share of obese females. In column 4, the World Bank´s gender parity in school enrolment shows no statistically significant effect on the share of females that are obese. Estimating the Driscoll-Kraay standard errors robust to cross-sectional dependence confirms the results using the Newey-West method (not shown). Thus, our results on obesity among women are robust to differing estimating techniques, taking both temporal and spatial dependence into account.

*********** TABLE 2 ABOUT HERE*********

The results match across the two measures of the BOD data (analyses of the share of overweight are not shown). Interestingly, the effect of income changes between them, which suggests that many richer countries are able to avoid obesity despite showing higher than normal overweightness. The results taken together do lend support to the idea that empowered women might make better choices about severely unhealthy practices, but the effects are substantively quite meagre and not robust across some specifications, which leads to questions about how numerous potential offsetting factors matter for explaining the share of obesity among adult women. Greater access to consumption possibilities, modern amenities and other lifestyle choices that allow you to gain excess weight may offset the good effects from greater choice and agency and better

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knowledge. Thus, our results support some that suggest that obesity is linked to income gain in a curvilinear manner, where the most obesity is likely in middle-income countries. We estimate this potential quadratic effect by entering the squared term of income per capita in our basic model (results not shown). We do find support for claims of a curvilinear effect of income levels on obesity among women.

While higher incomes seem to reduce obesity, democracy increases it among women. The results on democracy may suggest that basic freedoms do not necessarily encourage people to be more responsible in so far as watching their waists go, as others using different data also find [29]. Indeed, the reverse is possible because democracies may in fact be more open to generating "high consumption" behaviour, ceteris paribus. Greater democracy may also give access to consumption possibilities through welfare for the poor, increasing obesity across the income spectrum. Our results contradict those who argue that democracies promote healthier lifestyles, and thereby reduce excess weight gain.

Interestingly, much of the variance seems to be explained by country fixed effects, where the clear majority of countries seem to explain the share of female weight gain due to local-level unmeasured country-specific factors. Previous studies that report negative effects between democracy and weigh gain do so because they fail to account for cross-country heterogeneity and spatial dependence. All in all, we can accept hypothesis H1 which states that female empowerment can reduce the prevalence of excess weight. In robustness tests, we test several alternative models. Importantly, we add a dummy variable capturing the effects of being a "Western" country by adding a dummy variable taking the value 1 if a country has European heritage. The Western dummy takes the value 1 if a country is situated in Western Europe, North America (USA & Canada) and Oceania (Australia & New Zealand) and 0 if not. Dropping 23 countries from the analyses and running fixed effects estimations made little difference to the basic findings (results not shown but available

upon request). The European dummy was always positive and significant, independently of per capita wealth and democracy. Next, we included public health expenditure as a share of GDP obtained from the WDI data to capture some aspects of a government´s commitment to health. This variable was largely not statistically significant, and it made little difference to the basic results.

Finally, we enter two measures of social inequality separately in the models (see Table 3)

**********TABLE 3 ABOUT HERE*********

In column 1, we test the effect of health inequality as coded by the VDEM project using the Newey-West estimator. As seen there, health inequality associates with the adult female share of obesity negatively, a result that is statistically not different from zero. In column 2, when the GINI measure of inequality is tested, the effect is again negative but this time it is statistically highly significant. Contrary to many that argue that structural inequality generates obesogenic environments, our results suggest the opposite in the case of the female obesity share. Substantively, however, the effect is small. A standard deviation increase in the GINI reduces the female share of obesity by 2% of a standard deviation of the dependent variable. In columns 3 and 4, when we use the Driscoll-Kraay estimator accounting for spatial dependence, both health inequality and the GINI are statistically significant and negative, albeit the substantive effects remain small.

We examine all our basic models reported above for robustness by testing alternative models by dropping some of the controls sequentially. Our basic results hold. Could the non-effect of our main variables of interest be due to multicollinearity caused by its association with one or another of the control variables? To examine this issue, we compute the variance inflation factor scores (VIF) after running our models with a basic OLS estimator. None of the variables showed VIF scores above the problematic threshold of 4. Next, we tested for unusual influence points by

estimating the Cooks D statistic for influence. Dropping per capita income and running our main variables of interest only with democracy made little difference to the basic results discussed above.

Next, we move on to testing H2, which is the proposition that gender inequality is likely to be steeply associated with greater obesity conditional on rising structural inequality. Even if inequality is negative independently and gender inequality is positive in the additive models, perhaps gender inequality´s effect is strongest when conditional on structural inequality? (Results not shown but available upon request). When we enter the UN´s GII interacted with VDEM´s measure of health inequality, the effect is negative, but statistically not significant. There does not seem to be interactive effects between gender and health inequality that increase the obesity share among females above the independent effect of gender inequality and the controls. In other words, the effect of gender inequality on obesity has the largest impact when health inequality is zero. The same effect is seen when the GII is interacted with income inequality measured by the GINI. The conditional effects are best assessed with a margins plot because the coefficients are not easy to interpret. Figure 2 shows the effect of the GII conditional on the values of health inequality where the effect is assessed according to the level of significance along a 95% confidence interval along the full range of health inequality. As seen there, obesity decreases as health inequality increases in GII.

**********FIGURE 2 ABOUT HERE***********

These results reject H2 and bring into question the strong theoretical statements linking generalized inequality to obesity.

Income level might also condition the effect of gender empowerment on the level of obesity. In the poorest countries, gender discrimination measured as inequality may increase obesity

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among women due to discrimination. We test this proposition by creating a dummy variable taking the value 1 if countries are considered very poor according to the United Nations' Development Program (UNDP) and 0 if not (not shown). The poorest countries are conditioned negatively by increasing values of the gender inequality index of the UN. The prevalence of obesity among women in the poorest countries does not depend on gender inequality.

Next, we test several disaggregated measures of the gender empowerment index presented by the Varieties of Democracy data, namely; women´s access to civil liberties, women´s access to justice, women´s freedom of discussion, and women´s freedom of movement. Interestingly, access to justice and freedom of discussion are positively related to the share of obesity among women, results at odds with the view that discrimination drives obesity. Much like democracy, women´s access to greater rights seem to increase obesity, albeit these results too are substantively negligible (Results not shown but available upon request). Interestingly, using a variable measuring access to political power based on social group (caste, ethnicity, race) collected by the VDEM project, we test to see if gender empowerment´s effects are sensitive to the inclusion of disempowerment of identity-based groups. The results remain unchanged if discrimination of social groups is entered in the model. This aspect of discrimination shows no statistically significant effect on female obesity rates. In any case, these extra tests suggest that female empowerment is not a robust indicator of overweightness and obesity among women. The local-level factors represented by country fixed effects seem to make all the difference, results also reported in previous research [23, 27].

6. Conclusion

There is a considerable focus on generalized income inequality as a major public health hazard [1, 7]. Some connect these insights to the obesity epidemic sweeping the world. These scholars have

argued that environments exhibiting high levels of social inequalities have considerable obesogenic influence on individuals. Others also suggest that inequalities do not just relate to income, vertically within societies, but inequality also exists horizontally, for example between the genders. We rely on the literature on gender rights and economic development that views the empowerment of women as instrumentally valuable and present propositions about how empowered women may generate better health outcomes for themselves, regardless of levels of income and inequality.

Our hypothesis that women in patriarchal societies face higher rates of overweightness and obesity is by and large supported in the data, albeit the substantive impact of this large, macro-level factor is meagre compared with unmeasured local-level factors, or high country heterogeneity. In many specifications, however, higher rights for women show positive effects on the prevalence of obesity. Strong democracy, where people face less repressive governments show higher propensity for excessive weight gain and obesity among females. Our results also lead to questions about the general propensity of inequality within society in terms of driving female obesity because democracies should have lower social inequities, *ceteris paribus*. The direct effects of two measures of social inequality in terms of income and access to health suggest lower obesity among females. Our hypothesis that increasing female discrimination´s positive effect is likely to be accelerated by increasing levels of inequality is not supported in the data. In fact, the positive effect of low gender rights is conditioned downwards on obesity among females by increasing levels of inequality, results that are at odds with large arguments about social inequalities and obesogenic environments. Our results support other that find similar evidence for a smaller sample of industrialized countries [30]. Neither do the poorest countries see higher obesity conditional on greater gender inequality, suggesting that gender discrimination does not drive higher obesity shares among women in the poorest countries.

Our strongest, most robust result, however, is that weight gain and obesity-related factors are likely to be best explained by local-level, country-specific factors, such as food and lifestyle habits, the local political economy of food policies and access, and local-level discriminatory practices, such as the practice of "gavage" in places such as Mauritania. Therefore, carefully constructed case studies are likely to reveal more about why women put on weight in some places rather than others. There is also a great deal of heterogeneity within the industrialized Western countries. If governments make a priority out of fighting obesity, particularly among women, locally tailored policies in terms of public action and the dissemination of health-related knowledge may matter a lot more than relying on large, macro-level factors. Women, much like men, most probably use empowerment and autonomy in ways that may not always be responsible in terms of personal health where over consumption might be preferable to self-denial. However, there is some evidence to suggest that greater empowerment of women lower obesity even if overall weight gain among women may increase with rising incomes and other factors of modernization, such as greater general freedoms. These effects, however, are meagre, and the issue of dangerous weight gain needs to be addressed with targeted public action among vulnerable groups, which would empower them to make informed choices on healthier consumption and lifestyles.

Table 1. Gender empowerment and share of the female population above the age of 20 that is obese estimated using Newey-West standard errors robust to temporal dependence and heteroscedasticity, 1990-2013

Dep var = % female obese females > age 20-	(1)	(2)	(3)	(4)
Gender empowerment (Vdem)	-2.17***			
	(0.75)			
Political Power Distribution (Vdem)		-0.28*		
		(0.16)		
Gender Inequality Index (UN)			3.89**	
			(1.57)	
Gender Parity in schools (WB)				-0.43
				(0.55)
log GDP per capita	-0.72***	-0.75***	-0.22	-0.11
	(0.25)	(0.23)	(0.32)	(0.30)
Democracy (vdem)	3.20***	2.29***	0.57	2.18***
	(0.49)	(0.40)	(0.42)	(0.49)
% urban population	0.02	0.01	0.05**	-0.02
	(0.01)	(0.01)	(0.02)	(0.02)
Constant	13.54***	13.69***	8.91***	10.82***
	(1.42)	(1.28)	(2.40)	(1.70)
Countries	159	159	143	154
Observations	3,457	3,613	1,731	2,456

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Year and country fixed effects estimated

Table 2. Gender empowerment and the share of the female population above the age of 20 that is obese estimated using Driscoll-Kraay standard errors robust to temporal and cross-sectional dependence, 1990-2013

Dep var = % female obese females > age 20-	(1)	(2)	(3)	(4)
Gender empowerment (vdem)	-1.68***			
	(0.55)			
Gender Power Distribution (vdem)		-0.22*		
		(0.11)		
Gender Inequality Index (HDI)			3.85***	
			(0.85)	
Gender Parity (school enrolment)				-0.59
				(0.43)
log GDP per capita	-0.64***	-0.70***	-0.15	-0.08
	(0.15)	(0.12)	(0.13)	(0.16)
Democracy (vdem)	2.91***	2.12***	0.63***	2.17***
	(0.36)	(0.34)	(0.21)	(0.49)
% urban population	0.01	0.01	0.05***	-0.02
	(0.01)	(0.01)	(0.00)	(0.01)
year	0.23***	0.22***	0.20***	0.20***
	(0.01)	(0.01)	(0.01)	(0.01)
Constant	-432.38***	-426.13***	-378.52***	-387.84***
	(16.52)	(14.29)	(28.81)	(17.81)
Observations	3,457	3,613	1,731	2,456
Number of countries	159	159	143	154

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3. Health and income inequality and the share of the female population above the age of 20 that is obese estimated using the Newey-West and Driscoll-Kraay standard errors robust to heteroscedasticity and temporal and cross-sectional dependence, 1990-2013

	(1) NW*	(2) NW*	(3) DK	(4) DK
Health Inequality (vdem)	-0.18		-0.29**	
	(0.26)		(0.13)	
GINI		-0.04**		-0.04***
		(0.02)		(0.01)
Income per capita (log)	-0.53	-0.38	-0.58***	-0.38
	(0.32)	(0.52)	(0.14)	(0.47)
Democracy (vdem)	4.08***	5.80***	3.91***	5.65***
	(0.63)	(0.82)	(0.83)	(1.28)
% Urban population	0.12***	0.18***	0.12***	0.18***
	(0.02)	(0.03)	(0.01)	(0.01)
year			0.33***	0.31***
			(0.01)	(0.02)
Constant	35.31***	37.50***	-621.28***	-582.62***
	(1.91)	(4.13)	(26.41)	(39.95)
Observations	3,613	2,183	3,613	2,183
Number of groups	159	142	159	142

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

*Time & country fixed effects estimated

Figure 1. Regression of Health Inequality on GINI scores

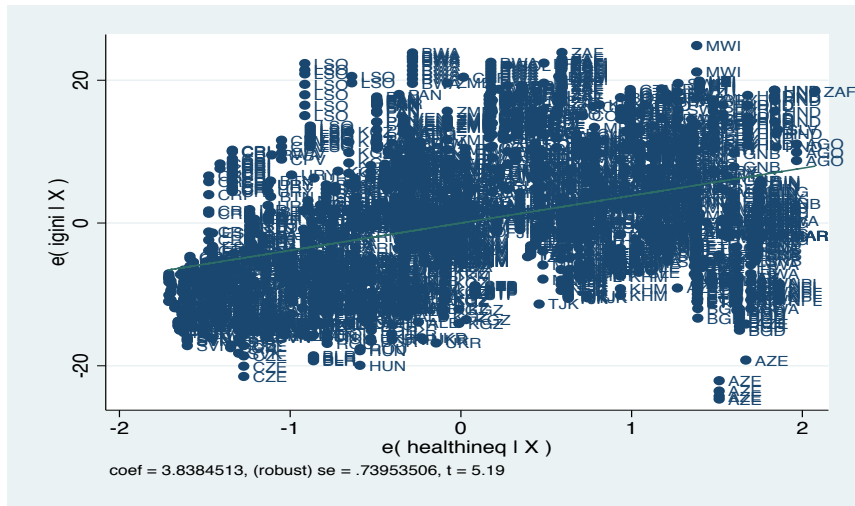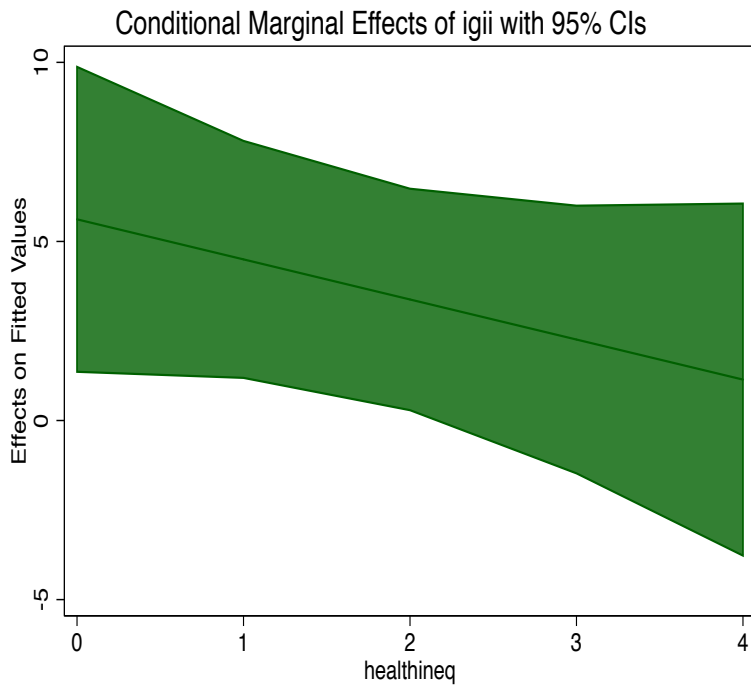coef = 3.8384513, (robust) se = .73953506, t = 5.19

Figure 2. Margins plots of the conditional effect between Gender Inequality Index and health inequality on the female share of the obese population (age > 20), 2000-2013

Conditional Marginal Effects of igii with 95% CIs

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