Economic growth and obesity: An interesting relationship with world-wide implications

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Abstract

The prosperity of a country, commonly measured in terms of its annual per capita Gross Domestic Product (GDP), has different relationships with population levels of body weight and happiness, as well as environmental impacts such as carbon emissions. The aim of this study was to examine these relationships and to try to find a level of GDP, which provides for sustainable economic activity, optimal happiness and healthy levels of mean body mass index (BMI). Spline regression analyses were conducted using national indices from 175 countries: GDP, adult BMI, mean happiness scores, and carbon footprint per capita for the year 2007. Results showed that GDP was positively related to BMI and happiness up to ~$US3000 and ~$5000 per capita respectively, with no significant relationships beyond these levels. GDP was also positively related to CO2 emissions with a recognised sustainable carbon footprint of less than 5 tonnes per capita occurring at a GDP of <$US15,000. These findings show that a GDP between $US5 and $15,000 is associated with greater population happiness and environmental stability. A mean BMI of 21–23 kg/m², which minimises the prevalence of underweight and overweight in the population then helps to define an ideal position in relation to growth, which few countries appear to have obtained. Within a group of wealthy countries (GDP > $US30,000), those with lower income inequalities and more regulated (less liberal) market systems had lower mean BMIs.

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1. Introduction

We have previously proposed an ecological model for understanding obesity, which suggests that changes towards a more 'obesogenic' environment explain the rise of the obesity epidemic over the past three decades (Egger and Swinburn, 1997). While this concept is now widely accepted (Katan et al., 2009; Sassi, 2009), there are clearly layers of environmental influence, which Rose (1992) referred to as the 'causes of the cause'. The immediate or proximal environments, which influence changes in energy intake and physical activity levels,
include the food environment, the built environment, and the entertainment environment – especially small screen technology. These food and activity environments can operate close to people in settings (such as homes, schools, supermarkets, neighbourhoods) or at more of a distance in sectors (such as food production, food marketing, transportation systems) (Swinburn et al., 2009). The next layers of environments, the medial drivers, are generally societal in nature.

1.1. Obesity and inequality

Several researchers have studied the effects of socio-economic position as a key determinant of chronic disease, including obesity. Marmot and colleagues, for example (Marmot et al., 1991; Eloainio et al., 2009; Stringhini et al., 2010, 2011), have shown the impact of income inequality on a range of health and social problems. More specifically, Pickett et al. (2005) and Wilkinson and Pickett (2010) have shown a relationship between income inequality, as measured by the ratio of the difference between the richest and poorest 20% of income earners (RP20) and obesity in OECD countries, but no relationship between obesity and average income.

1.2. Obesity and economic insecurity

More recently, Offer et al. (2010) used 96 data sets from 11 high-income countries over the ten years from 1994 to 2004 to test the effects of inequality and other factors relating to the connection between affluence, welfare regimes and obesity. They showed that while income inequality, and the relative price of ‘junk food’ (food ‘shock’), were related to population obesity prevalence, the relationship was much stronger using a measure of economic insecurity based on a weighted composite of four sub-indices: insecurity from unemployment, illness, single parent poverty, and poverty in old age. Offer et al. also showed that economic insecurity and obesity prevalence were greater in a group of wealthy (mainly English speaking) countries they classify as ‘market-liberal’ (US, Australia, Canada, NZ, UK, Ireland) compared to a group they rate as ‘non-market liberal’ (Norway, Sweden, Finland, Denmark, France, Germany). Market liberalisation here refers to the level of regulatory constraint on commerce and level of social spending and market governance, which predominate within a country.

Offer et al. (2010) suggest that market-liberal reforms stimulate greater competition in both labour and consumption markets, and that this undermines personal stability and security, affecting body weight, particularly amongst those lower down the social scale. A mediator hypothesised for this is stress, stemming from class inequalities and lack of trust. Offer et al. propose that inequality, which is a social attribute, and economic insecurity, which is a personal one, could be different, but inter-relating mediators predisposing to obesity within a country, driven by the form of market governance (‘liberal’, or minimally regulated vs ‘non-liberal’ or more regulated) of that country.

1.3. Obesity and economic growth

This type of evidence points to an even deeper layer of distal environmental driver of obesity. Modern, market-based economies have at their core a drive for economic growth, so much so that increasing the annual per capita Gross Domestic Product (GDP), the most commonly used indicator of national improvements in prosperity, has become a dominant political objective. A common way of achieving this is through increasing consumption (including eating more, and buying more entertainment and energy saving devices). But the more effective companies become at selling products and services (and thus contributing to GDP), the higher the likelihood that beneficial consumption could tip over into over-consumption. The links from here to obesity, through an over-consumption of food energy (Hall et al., 2009; Swinburn et al., 2009), and to climate change, through over-consumption of fossil fuel energy (Delpeuch et al., 2009; Egger, 2008; Egger and Swinburn, 2010), appear obvious, but have barely been explored. Socio-economic inequalities and economic insecurity for substantial proportions of the population also so appear to be an outcome of less regulated or more ‘liberal’ market-based economies (James, 2008).

Clearly, economic growth is currently a primary means by which low-income countries can lift themselves out of poverty. It has also undoubtedly been one of the single biggest influences on health improvements throughout human history (Riley, 2001). However, by the law of diminishing returns, beyond a point, the benefits from continued economic growth start diminishing and ‘costs’ start rising (Egger, 2009). We have thus postulated that there may be a theoretical GDP which is high enough to produce good health, sufficient prosperity and happiness, but not so high that it produces the overconsumption problems of obesity and an unsustainable carbon footprint (Egger and Swinburn, 2010). The primary aim of this paper is thus to examine the possible relationship between GDP and obesity, using cross-sectional data from 175 countries. A secondary aim is to identify an ideal level of per capita GDP within a country for optimal levels of body weight, human happiness and sustainability. A third aim is to assess the effects of different forms of market governance on obesity. Because of the available data, this latter analysis is confined to upper income countries.

2. Materials and methods

2.1. Data sources

GDP and social inequality data were obtained from the Human Development Report (UNDP, 2010) and mean national body mass index (BMI) data from the Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (Imperial College, 2011). Social inequality values were calculated as the ratio between the richest and poorest quintiles (RP20) of average income as reported in the Human Development Index (UNDP, 2010). The analysis year was 2007 unless otherwise indicated. Countries used in the analysis (n = 175) were
those where both mean BMI and mean per capita GPD measures were available for 2007 (or the closest possible year). Happiness measures by country were obtained from the Happy Planet Index (HPI) of the New Economics Foundation (2010). Carbon footprint figures were obtained from the International Energy Agency (2010), Meinshausen et al. (2009) and Nationmaster.com.

2.2. Defining the ideal GDP

A proposed ideal for GDP was defined as meeting the three following criteria:

A. Having minimal prevalence of both underweight and overweight. (The range of mean population BMI that minimises underweight and overweight is 21–23 kg/m² (James, 2004). A BMI above 23 kg/m² is used by WHO (2011) in its analyses of the burden of high BMI.)
B. Being above a GDP where further gains in human happiness do not appear to be related to increases in GDP.
C. Being below a GDP where the average carbon footprint begins to rise above the estimated sustainable level of ~5 tonnes per person per year for a 2007 world population of ~7 billion (Meinshausen et al., 2009).

2.3. Data analysis

The relationships between GDP and BMI, and GDP and happiness (HPI) were analysed using spline regression techniques. These were performed to identify the highest GDP level beyond which there was no significant relationship between per capita GDP and average BMI (males and females combined) and happiness. The GDP level for a per capita carbon footprint of ~5 tonnes per person was obtained from Nationmaster.com. The findings were plotted onto the GDP–BMI scatter plot to identify countries in or near a proposed ideal GDP that would satisfy these optimal conditions.

To examine the relationship between obesity, market governance type, and social and environmental factors at high levels of per capita GDP (e.g., >$30,000) extra data were collected from a number of sources. The proportion of GDP allocated to social spending came from the World Social Security Report of the ILO (2010). A measure of individualism vs collectivism in a country was obtained from Hofstede’s Index (Hofstede, 2001).

There were 26 countries with GDPs >$30,000 pa. Five (Cyprus, UAR, Iceland, Kuwait and Brunei) were not included in further analyses either because of lack of available data in at least one variable, or a population of <3 million (Brunei, Cyprus). This left 21 countries for analysis. In line with findings by Offer et al. (2010), the six English-speaking countries (US, UK, Australia, NZ, Ireland and Canada), which also had the highest mean BMIs were compared on various other indices with the remaining 13 non-English speaking European countries, and two Asian counties (Singapore and Japan) with GDP >$30,000. Mean values were analysed using one-way ANOVA with the option of least significant difference (LSD) to show the difference between pair groups of countries.

3. Results

The scatter plots of GDP vs mean BMI for males and females in 174 countries are shown in Fig. 1. (Samoa, as an extreme outlier was omitted from further analysis.) These suggested an initial close relationship between BMI and GDP at low levels of GDP, followed by a levelling off at higher levels. A spline analysis confirmed this with the best-fit intersection of two linear relationships occurring at a GDP of ~$3000. Below a GDP of $3000, 72 countries had a significantly positive linear relationship ($\beta$: 0.0014431; 95% CI: 0.0010158, 0.0018704, $r = 0.567$; $p < 0.001$) whereas above this level (i.e. >$3000), 102 countries showed no significant relationship between GDP

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Footnotes:

1. Pacific Islanders have a very high food energy intake associated with cultural factors, religious and daily social activities, and a negative attitude to unnecessary physical activity, the need for which can otherwise be negated by energy-saving technology such as motor vehicles. Cultural factors are beyond the scope of the current analysis, but clearly need to be considered (Ulijaszek, 2003).
and BMI ($\beta$: 9.10e–06 (95% CI: –6.08e–06, 0.0000243, $r = 0.130; p = 0.18)).

The relationship between per capita happiness as measured by the Happy Planet Index (HPI) and GDP is shown in Fig. 2 ($n = 168$). The vertical line at $\$5000$ represents the intersection of the two linear relationships from the best-fit spline analysis. With GDP per capita <$5000$, 92 countries showed a positive relationship between GDP and HPI scores ($\beta$ = 0.0041906; 95% CI: 0.0026263, 0.005755; $r = 0.479, p < 0.000$), whereas the 76 countries with GDP > $5000$, showed no significant relationship between HPI and GDP ($\beta$ = 0.0000879; 95% CI: 0.0002119, 0.0000361, $r = –0.171; p = 0.164$). At very low levels of GDP, happiness is more strongly associated with GDP than appears in the figure.

The relationship between GDP and the per capita carbon footprint is shown in Fig. 3 for 174 countries.

The horizontal line is the carbon footprint of $\sim$5 tonnes per person per annum, which is considered the upper limit for sustainability for a global population of 7 billion people (Allen and Frame, 2007; Meinshausen et al., 2009). No countries above a GDP of $\sim$30,000 have a sustainable per capita carbon footprint.

Several countries had a mean BMI within the optimal range specified by WHO (21–23 kg/m$^2$). Japan and Singapore were the only high-income countries within that bracket. A number of lower income countries, such as the Philippines, India, Indonesia and Uganda were in the optimal BMI range, but below the mean GDP for optimal happiness.

A theoretical ideal for happiness, sustainability and health was therefore defined as having a per capita GDP between $5000 and $15,000 and a mean population BMI between 21 and 23 kg/m$^2$.

Indices for the wealthiest countries (GDP > $30,000) are shown in Table 1. These form three distinct groups (English-speaking, European and Asian – although there were only 2 countries in the Asian grouping). One-way ANOVA showed significant differences on all measures except GDP amongst the country groupings.

A diagrammatic representation of results from Figs. 1 to 3 and Table 1 is shown in Fig. 4. The theoretical ideal is shown as the intersection of a mean BMI of 21–23 kg/m$^2$ and GDP of $5000–15,000$. This is the hypothetical zone for an optimally happy, healthy-weight population living in a sustainable environment. No countries strongly met these criteria. Forty countries (not all shown here) were within the optimal BMI zone and their range of GDPs was $\sim$US$264 (Guinea-Bissau)–US$39,000 (Japan/Singapore). Thirty-seven countries were within the optimal GDP zone and their range of mean BMIs were 22.45 (Angola)–27.7 kg/m$^2$ (Barbados). Within the wealthy countries, Japan and Singapore were within the optimal BMI range with South Korea not far from the limit.

4. Discussion

4.1. The relationship between GDP and BMI

The data presented here, although cross-sectional show a relationship between body weight and economic development as measured by the per capita GDP of a country.

4.2. Identifying a GDP ideal

We analysed the relationship between GDP and three other indices to identify the boundaries of a theoretical ideal for population happiness, body weight and economic sustainability. Our main dependent variable here was BMI, but other measures such as life expectancy, infant mortality etc. could have been used. Only two countries (Malaysia and Angola) sat on the edges of this zone. Four countries (India, Indonesia, The Philippines, Uganda) were on the verge of moving into the zone with increased prosperity (but only if mean BMI increases minimally). Several others (China, Thailand, Cameroon, Mongolia etc.) had already passed the optimal mean national BMI at a level of prosperity below that defined for optimal ‘happiness’. Two Asian countries (Japan and Singapore) on the other hand were within the BMI/happiness zone, but beyond the level of GDP associated with sustainable CO$_2$ emissions (Table 1). All developed countries were outside this zone, Sweden (5.1 t/pp/py), Switzerland (5.6 t/pp/py) and France (5.8 t/pp/py) come close to sustainable emissions (see Table 1), and are within the happiness and income boundaries, and are therefore closest to the ideal amongst wealthy countries, but well outside the limit for optimal healthy body weight as defined for populations (WHO, 2011). In popular parlance this suggests the populace of these wealthy countries is unhealthily fat and (marginally) unsustainably polluting – but happy enough!

It is worth considering more closely the measure of happiness used here. Coyle (2011) points out the inconsistencies in the vast research on happiness and wealth and the fact that the relationship may be more linear with increasing wealth than shown in our Fig. 3, depending on the measure used.

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Footnote:

1. It should be stressed that this ‘zone’ has been created based on three measures only and is not meant to not imply any level of political or social perfection.
4.3. BMI, social factors and forms of market governance

We found that at high levels of national wealth, body weight may be influenced by factors other than just GDP. Our three groups of countries; English-speaking, European and Asian, and the market governance and social factors associated with these, suggests that those with a more market-liberal form of governance, with greater emphasis...
on individualism and less on social spending have a greater body weight (and presumably accompanying health problem) than those with a more collectivist approach and greater emphasis on equality, as first suggested by Ofer et al. (2010). The variance and limited number of Asian countries makes it difficult to draw conclusions about these in relation to this thesis. However our findings concur with those of Marmot et al. (1991) and Wilkinson and Pickett (2010), and extend the findings of Ofer et al. (2010), with a larger number of countries.

4.4. Reducing obesity: the big picture

There are a number of possible implications from these findings. It seems unlikely that any country has, or will ever pass through the theoretical ideal that we have proposed during its development. If this is the case, then it is not just a matter of halting poorer countries as they pass through this ideal, or returning wealthy countries to it. The paradigms and structures that appear to have created the observed patterns in the first place cannot be expected to get countries to another healthier, sustainable pattern without major interventions that foster sustainable technological change.

New paradigms and approaches will be needed and some of these would apply to achieving sustainable economies, some would apply to reducing the prevalence of obesity, some to increasing wealth and happiness and some to all of these objectives. The prospects of an increasing global population and runaway climate change due to the over-consumption of fossil fuels, has markedly increased the focus in recent years on achieving sustainable economies. However, the power of the current business model, which is based on unsustainably high consumption and perpetual growth, does not allow other paradigms such as ‘prosperity without growth’ (Jackson, 2009), or ‘ecological economics’ (Daly and Farley, 2004) to gain public or political traction. Events such as global financial crises may only serve to force politicians to maintain the status quo, which creates over-consumption, in a desperate bid to maintain GDP growth. Reducing national carbon footprints, which might reduce consumption-based GDP, is still anathema to most politicians, businesses and the public. Several economists are now considering other models for sustainable prosperity (Coyle, 2011; Heinberg, 2011), and it is likely that a transition to these models will be needed as part of the response to reducing greenhouse gas emissions.

Are there approaches to reducing population levels of obesity? The findings from our analysis support previous studies (Pickett et al., 2005; Wilkinson and Pickett, 2010; Ofer et al., 2010) that have shown the influence of social inequality and economic insecurity on health outcomes, including obesity, at least at higher levels of income. It seems that a constellation of factors distinguish countries with ‘market-liberal’ and ‘market non-liberal’ versions of capitalism (Hall and Soskice, 2001). The former is characterised by a more individualistic orientation, philosophy associated with a strong growth ethos, less government influence in the market economy, less social spending and regulation, and tax structures which favour wide gaps in incomes. In contrast, a more social (market non-liberal) humanistic capitalism (Komlos, in press) is characterised by a greater collective ethos, more government constraints on the market, higher social spending and more even distribution of wealth. The latter form of capitalistic governance is not only associated with a lower prevalence of obesity, but also with better health and social outcomes for such disparate indicators as teenage pregnancies, incarceration rates, mental illness, life expectancy, infant mortality etc. (Wilkinson and Pickett, 2010). Thus, for those countries with ‘market-capitalism’ models, a shift towards the governance, economic and social policies of the ‘social-capitalism’ form might produce health and social and environmental dividends – at least at this level of economic development – for already wealthy countries.

4.5. Strengths and weaknesses

The strengths of this study include incorporating high, middle and low-income countries in the analysis to show the full range of the relationships, rather than restricting the analyses to wealthy countries. We have incorporated the big issues of economic development, carbon footprints, human happiness and over- and under-nutrition on one canvas to identify the relationships between key indicators and characterise the directions in which countries should be heading in order to optimise health, happiness, sustainability and economic development. The weaknesses are those of using cross-sectional data, using only a limited number of indices and making assumptions about changes over time and the usual risks related to misattribution of causality with ecological data.

5. Conclusion

Economic growth, under- and over-nutrition, and environmental sustainability are interlinked. Consumption-driven increases in GDP may be beneficial in the developing economies, but the detrimental impacts of the over-consumption they have created in wealthy countries are now becoming apparent. While specific policies can counter the obesity epidemic and high greenhouse gas emissions, new paradigms will be needed to influence the underlying economic and political structures, which are the ‘causes of the cause’ of over-consumption. A more controlled form of capitalism may need to be part of newer approaches to maximising sustainability, health and happiness in an increasingly developed world.

References


