

SOCIAL DETERMINANTS OF OBESITY IN THE UNITED KINGDOM: A SYSTEMATIC REVIEW OF THE LITERATURE

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Abstract

Background: Obesity is a global public health problem. The increasing prevalence arise from complex and multifaceted determinants that relate to individual lifestyles, choices people make and the influence of social circumstances of the wider society in which they live. There is a worldwide phenomenon that obesity follows a social gradient that makes it possible for higher obesity risk to reflect lower level of socioeconomic profile (SEP) or socioeconomic status (SES). The levels of SEP or SES define the conditions of daily living which, are in turn shaped by the broader political, economic, social and cultural environment.

Aim: The aim of this study was to conduct a systematic review of published literature over a timeframe of 2000 to 2018 on lifestyle factors, economic conditions, environmental and socio-cultural issues as they constitute social determinants of obesity in the UK.

Methods: Based on the modified PRISMA protocol, a literature search was conducted for the social determinants of obesity in the UK across four generalisable themes or search areas: living environment, behaviour/psychology, biology/physiology and economic drivers of food production and consumption. The systematic review identified published works done in the UK from 2000 to 2018 using ten databases. Only studies characterised by empirical evaluations of causality of obesity predicated on four generalisable themes and which, met the inclusion criteria were considered in this review.

Results: A total of 14 articles met the inclusion criteria and were reviewed in this study. The majority of the determinants related to living environment and economic drivers for food production and consumption, rather than behaviour/psychology or biology/physiology. This review found living environment and economic drivers for food production and consumption to be demonstrably having the most influence on obesity as a public health problem in the UK.

Conclusion: The living environment and economic drivers for food production and consumption were the two key determinants of obesity in the UK as shown in this review. Many limitations are noteworthy and should be considered when interpreting the findings highlighted here. Future studies on causalities of obesity would benefit from pursuing two vital paths of inquiry recommended in this review.

Key words: *obesity, social determinants, epidemiology*

Introduction

Obesity is most commonly determined with body mass index, a simple index of weight-for-height commonly used to categorise whether an individual is underweight, healthy, overweight or obese, and is defined as the weight in kilograms divided by the square of height in metres (kg/m^2). The World Health Organisation (WHO) describe these categories using cut-off points that indicate an individual with a basal metabolic index (BMI) between 25 and 30 is considered to be 'overweight' whilst a BMI >30 is defined as 'obese'.¹⁻³

A startling development about prevalence of obesity in the UK is the variations in the regional distribution. The trends over time in England indicated that adult obesity increased from 15% in 1993 to 28% in 2019 while the proportion of adults who were either overweight or obese increased from 53% to 64% for the same period.^{4,5} Obesity rose from 10% in children aged 4–5 years, and rising to 23% by age 10–11 for the period between 2006 and 2022. Childhood obesity is more likely due to widening gap in poverty and deprivation.⁴ A study by National Child Measurement Programme 2021/2022 showed that 12.1% and 10.1% of children aged 4–5 years were overweight and obese

respectively. These percentages were higher among children aged 10–11 years, with 23.4% being obese and 14.3% overweight.⁶ The likelihood of overweight or obese based on BMI above normal is higher in men (69%) than in women (59%), and higher ($>70\%$) in adults aged 45–75 years relative to other age groups, with adults aged 16–24 years least likely to be overweight or obese to underscore dissimilarities in age and sex considerations.⁵

Demographic characteristics of overweight and obesity prevalence is important. Data on inequalities showed marked variations in percentage of either overweight or obesity between social groups.⁷ Overweight or obesity is 14% higher in most deprived areas compared to least deprived areas. Similarly, overweight and obesity is 12% higher among people with disability than those without.⁴ Excessive weight gain is highest in the black (72%) and lowest in the Chinese (37%) ethnic population, and rates of excessive weight gain in people without qualifications are 12% higher than those with at least level 4 qualifications or higher.⁴

Prevalence of overweight or obesity also differ among local authorities in England.⁷ Data from Public Health England Active Life Survey in 2021/2022 showed that

Sandwell Local Authority at 14.9% and Richmond–Upon–Thames Local Authority at 5.4% recorded the highest and lowest percentages of overweight or obese children aged 4–5 years respectively. Similarly, Sandwell Local Authority at 34% and Surrey Local Authority at 12.4% recorded the highest and lowest percentages of overweight or obese children aged 10–11 years respectively.⁶ Among adults, Thurrock Local Authority recorded the highest percentage (76.3%) of overweight or obesity while Islington Local Authority recorded the lowest percentage (44%) of overweight or obesity.⁷

Data from Scottish Health Survey in 2021 showed that 36% of adults were overweight, 31% were obese while 33% were neither overweight nor obese. Of these, more men (69%) than women (31%) were overweight, but more women (65%) than men (35%) were obese.⁸ More than 70% of adults aged >55 years were overweight or obese to further underscore the importance of apparent differences in age and sex distribution.⁸ Obesity prevalence in Scottish children varies with age and household socioeconomic status (SES) with obesity commonest in children living in households with lower incomes. Obesity in children aged 2–6, 7–11 and 12–15 were 20%, 22% and 12% respectively. The likelihood of obesity however, was higher in boys than in girls (20% versus 16%).⁸

The National Survey for Wales in 2021/2022 reported higher prevalence of obesity in women (26%) than in men (23%), and a higher proportion of overweight in men (67%) compared to women (58%). Obesity was highest in people aged 45–64 years (29%) and lowest

in those aged 16–24 and >75 years (16%). Overweight and obesity in Wales is influenced by inequalities in health and geographical location.⁹ Data from Child Measurement Programme for Wales for 2018/2019 showed higher prevalence of overweight (14.4%) than obesity (12.6%) in children aged 4–5 years. There were only small dissimilarities between obesity rates for boys and girls. Childhood obesity rate was almost twice as high (15.3%) in most deprived areas of Merthyr Tydfil as those in least deprived areas of Monmouthshire and Vale of Glamorgan (8.3%).⁹ There were only small dissimilarities between obesity rates for boys and girls.

Data from Heath Survey Northern Ireland in 2019/2020 showed highest obesity rates among ages 65–74, with a rising trend from 23% in 2010/2011 to 27% in 2019/2020.¹⁰ More adults were overweight (38%) than obese (27%), and of these, more men (71%) than women (60%) were overweight or obese. However, twice more women (48%) than men (24%) said they were trying to lose weight through healthy diet, exercise or bariatric surgery for those with a BMI above 40 and 35–40 if health problems such as diabetes or heart diseases exist.¹¹ Obesity rates were 7% and 4% in children aged 2–10 and 11–15 respectively in Northern Ireland in 2019/2020. However, the survey's small sample size made it difficult to subject the data to meaningful and robust comparisons over time between different age groups in the children population.¹⁰

The foregoing data therefore indicate that obesity rate in the UK is subject to regional variations in age, gender, trends over time and other inequalities related to deprivation, disability, ethnicity and

education.⁴ A comprehensive understanding of these factors is vitally important to help guide assessment of obesity risks and rising prevalence in the UK. This systematic review (SR) is therefore aimed at summarizing the rising impact of lifestyle factors, economic conditions, environmental and socio-cultural issues as they constitute social determinants of obesity in the UK.

Methods

Search strategy

The purpose of search strategy was to find published works in healthcare and management journals based on the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework¹² incorporating summarised revisions formulated according to Quality of Reporting of Meta-Analyses (QUORUM) guidelines.¹³ The rationale of PRISMA framework was predicated on the need to ensure comprehensive database search for social determinants of obesity within the targeted UK population.

Three search steps were involved in the search strategy.

1. Identification: Wide search groups were used to include analysis of text words in journal titles and abstracts of index terms in published works. Ten bibliographic databases were searched, namely:

- PubMed,
- Education Resources Information Center (ERIC),
- Excerpta Medica Database (EMBASE),
- Medical Literature Analysis and Retrieval System Online (MEDLINE),

- National Institute for Health and Care Excellence (NICE),
- Cumulative Index to Nursing and Allied Health Literature (CINAHL),
- Health Management Information Consortium (HMIC),
- Database of Abstracts of Literature in the field of Psychology (PsychINFO), and
- ProQuest Theses and Dissertations.

Thereafter COCHRANE Central Trials Register was searched to identify qualitative reports of SR on obesity. This completed the search at this stage.

2. Screening: Identified keywords and index terms such as overweight, obesity, lifestyle, determinants, economic, environment, social, cultural, behavioural, psychological, biology and physiology were used to search the databases in step 1. To ensure a comprehensive report, keywords were searched to identify SR (e.g., "systematic" or "review") that specifically discussed the social determinants of obesity among UK population. Therefore, search was refined to combine keywords like "obesity", "social determinants" and "United Kingdom".

3. Eligibility: Reference lists from both selected citations and bibliographies of major reports and relevant guidelines were identified and checked for inclusion or exclusion according to review criteria discussed in the next section. Details of PRISMA flow chart protocol¹² of search strategy, study selection and review criteria are contained in figure 1.

Review criteria

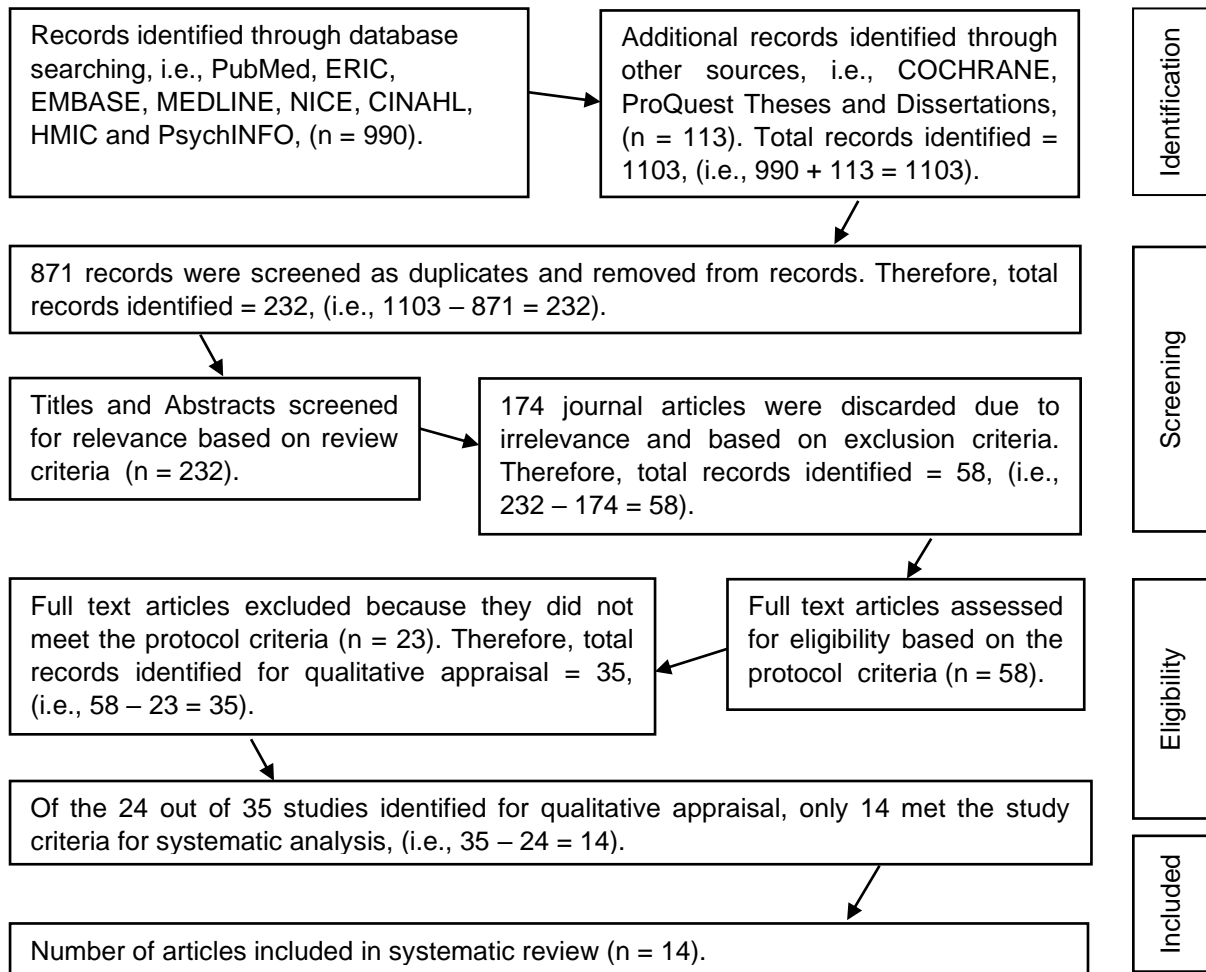
Increasing obesity prevalence among UK population presents a key challenge to

public health. The Foresight Study¹⁴ projects more than half of UK population could become obese by 2050. This has significant economic implication on the National Health Service (NHS), wider cost to business and society.¹⁵

It is not that the present UK population are more gluttonous, have reduced willpower and dissimilar genetic constitution compared to previous generations¹⁴. Societal transformations since the last 50 years have brought changes to work patterns, access to recreational facilities, food production and sales. The tendency for the UK population to be obese has

increased with devastating consequences on quality of life, leading to upsurge in prevalence of cancer, diabetes and cardiovascular diseases.¹⁵

Furthermore, the pace of technological advancement has outstripped human evolution to ensure that contemporary lifestyle favour obese predisposition inevitably. These considerations and other issues bordering on socioeconomic disadvantages loaded against some vulnerable ethnic minorities have conspired to push obesity as a 'normal condition' among UK population.¹⁵



Based on the importance of the Foresight Study,¹⁴ it is justifiable that a review which will elicit government intervention strategies to address the need to halt the rising prevalence of obesity in relation to economic costs¹⁵ and associated health risks¹⁶ must be anchored on review criteria, search strategy, selection process, quality assessment and data extraction that not only targets the UK population but most importantly, defines the inclusion criteria to incorporate studies done in the English language, among UK population, from 2000 to 2018, in local health authority (LHA) and primary care or community healthcare setting. Studies not undertaken in the English language, outside the UK population, before 2000 and after 2018, and in other settings outside the LHA and primary healthcare environments were excluded from the study.

Selection of studies

Following completion of searches, the results were then assembled in the citation manager for sifting. Duplicate results were removed. Selected abstracts were re-screened for compliance with inclusion criteria. Those marked for exclusion were carefully re-screened according to exclusion criteria. Full text versions of all selected articles were then put together for the next stage of data extraction.

The fact that abstracts were not selected in a stratified random manner meant that critical studies were not missed as this would have knocked the credibility of the selection process. Also, the non-randomised selection process widened the scope of the themes that emerged. Therefore, it was justifiable that data collected in this way would address the

objectives of this study and any focused question arising therefrom.

Data extraction

Data were extracted using standardised qualitative data extraction technique¹⁷. Thereafter, the data extraction table were reviewed. Data were extracted from the published works in the 10 databases that were relevant to the objectives of the systematic review using a data extraction form in Microsoft Excel. Information extracted from each journal article include details of the authors, sample size, study design and environment, originating country, objectives of study, age, gender and ethnic background of the study population, data collection method and findings. These are set out as the data extraction tables 1 and 2.

Assessment of quality

The quality of papers included in the review was assessed for procedural validity according to standardised guidelines contained in the Joanna Briggs Institute (JBI) critical appraisal checklist for qualitative research based on the JBI System for Unified Management, Assessment and Review of Information (SUMARI).^{18,19}

Majority of the journal articles identified related to the diagnosis, prognosis and management of obesity in the country of origin and setting where the studies were undertaken, and were therefore excluded. Further screening to remove duplicates and review the articles and abstracts for relevance sieved the list down to 14 articles that met the inclusion criteria (figure 1). The articles were procedurally varied to capture the 4 search areas of Behaviour/Psychology, Biology/Physiology, Living Environment, and Economic drivers for food production

and consumption. Due to predicted variety of the types of articles and small sample size, formal grading of studies was not undertaken. Rather, efforts were made to identify major themes and outcomes of the studies. Common themes were identified and collated, and any inconsistencies were discussed and reconciled²⁰. A library staff played the role of an independent reviewer in this study.

Data analysis methods

Thematic analysis (TA) is the method of data analysis chosen for this study. TA was chosen because it affords the researcher the opportunity to be engrossed in the dataset in a manner that facilitates recognition and correct interpretation of themes generated from the dataset.²¹ Further justification derives from the TA being able to foster order, structure and meaning to the dataset irrespective of the size or diversity. Conducting a TA involves a six-phase framework that include familiarisation with the dataset, generation of initial codes, searching for themes, reviewing themes, defining themes and writing-up the exercise.²⁰

Essentially, relevant information about individual theme of interest was abstracted from each paper included in the review. This information were summarised in a tabular form to reflect the scope of literature review. Thereafter, the findings were imported into the tables to represent information regarding each study paper.

However, the TA as applied in this study is limited by the extent to which an individual's perspectives could favourably compare with those of others, coupled with the intrinsic doubt and bias about justifying 'common themes' as belonging to a specific category of dataset.²¹ To overcome this limitation, an attempt was

made to avoid formulating themes around questions thrown up by the dataset which, have the potential to overlap. Rather, themes were allowed to emerge naturally from the dataset.

Results

Search results

Steps were taken to identify articles for inclusion based on the modified PRISMA flow chart protocol shown in figure 1. In step 1, a total of 1103 papers were identified through the bibliographic database search and other sources.

In step 2, 871 of these papers were excluded because they were duplicates, with 232 papers qualifying for hand review screening of the titles and abstracts for relevance based on review criteria explained under the method section. This led to 164 journal articles being discarded based on the exclusion criteria.

After steps 1 and 2, 58 full text articles were considered for eligibility based on the protocol criteria. Following eligibility assessment, 23 full text articles were excluded because they did not meet the protocol criteria, leaving 35 full text articles to be considered for inclusion.

Next, 21 full text articles were excluded because they were not empirically based, did not use primary care settings as the units of analysis and did not examine the social determinants of obesity as the primary aim/objective of the study. A total of 14 remaining studies were included in this review.

Study findings

Of the 14 studies reviewed as shown in table 1, findings from four (28.6%) studies demonstrated that eating

behaviour/psychology (i.e., people's motivation for decisions and choices, food intake, energy expenditure and activity behaviours) contributes to the rising prevalence of obesity in the UK.

One (7.1%) study that focused on biology/physiology and the impact of early life and growth patterns (i.e., genetic constitution, homeostatic mechanism of energy balance, basal metabolic rate (BMR), adiposity rebound and critical role of the leptin hormone)) showed that obesity can be transmitted over generations via both genetic and non-genetic pathways.

Five (35.7%) studies that focused on the living environment (i.e., access to technology, opportunities for recreational activity, and access to, and availability of food and drinks) demonstrated that limited access to outdoor space for physical activities are associated with high risks of obesity to health and wellbeing and its prevalence.

Four (28.6%) studies that focused on the economic drivers of food production and consumption (i.e., cost of food and drinks, food marketing, feeding patterns and purchasing capacity, and effects of working practices) showed a strong association between low socioeconomic position (SEP) measured by income gradient and the associated health risks to obesity across all age groups in the UK.

Furthermore, a majority of the studies (n = 12, 85.7%) were found in the EMBASE and HMIC databases, while 2 (14.3%) were found in the CINAHL database. It, therefore, follows that the studies contained in the other 7 bibliographic databases were excluded from the study based on the established criteria.

The information presented in table 2 summarizes the study characteristics (i.e., aim/objective, study design, setting, study population and demographics, data collection and findings) of the 14 studies included in the review. In all, 11 (78.6%) studies did not state the ethnic background of their subjects, while 3 (21.4%) indicated theirs as Black, Chinese, South Asian, non-South Asian and White British. Ethnic background is important since the prevalence of obesity varies across different ethnicities among the UK population. Across 13 (92.9%) studies, variations in the study population ranged from 35 to 1,001,096 subjects with an average of 89,944 subjects. Only in 1 (7.1%) study that used the UK Observational Data Model was the size of the study participant not stated.

Of the 13 studies that stated their method of data collection, 6 (46.1%) used questionnaire, 2 (15.4%) used data from The UK Millennium Cohort Study, 2 (15.4%) used Geographic Information System (GIS), 1 (7.7%) used Accelerometry, 1 (7.7%) used Peer-reviewed Literature and 1 (7.7%) used the BMI scale. Age is a key demographic index of obesity study and in 6 (42.9%) studies, this was shown to vary from 4 to 73 years while 8 (57.1%) studies did not state the age of their subjects. However, these subjects were reported as adults in 6 (75%) studies, adolescents in 1 (12.5%) and children in 1 (12.5%) study each.

Table 1- Studies of behaviour/psychology, biology/physiology, living environment and economic drivers for food production and consumption including grey literature searches in the bibliographic databases and article selection

Search Area	Title of Journal Article	Author (s)	Journal/ Volume/ Page(s)/ [Year Published]	Database
Behaviour/ Psychology	Maternal eating behaviour differs between ethnic groups: considerations for research and practice.	Ref. 22	<i>Maternal and Child Nutrition</i> , 14 (4): e12630, [2018].	EMBASE
	Sociodemographic, lifestyle and behavioural factors associated with consumption of sweetened beverages among adults in Cambridgeshire, UK: The Fenland Study	Ref. 23	<i>Public Health Nutrition</i> , 4 (15): 2766 – 2777, [2017].	EMBASE
	Food outlet availability, deprivation and obesity in a multi-ethnic sample of pregnant women in Bradford, UK.	Ref. 24	<i>Social Science and Medicine</i> , 75 (6): 1048 – 1056, [2012].	HMIC
	A health assessment tool for multiple risk factors for obesity: results from a pilot study with UK adults.	Ref. 25	<i>Patient Education & Counselling</i> , 62 (1): 79 - 88, [2006].	CINAHL
Biology/ Physiology	A Mathematical Model for Predicting Obesity Transmission with Both Genetic and Nongenetic Heredity.	Ref. 26	<i>Obesity</i> , 26 (5): 927 – 933; [2018].	EMBASE
Living Environment	The impact of greenspace and condition of the neighbourhood on child overweight.	Ref. 27	<i>European Journal of Public Health</i> ; 28 (1): 88 – 94, [2018]	EMBASE
	Physical activity in older age: perspectives for healthy ageing and frailty.	Ref. 28	<i>Biogerontology</i> , 17 (3): 567 – 580; [2016]	EMBASE
	Understanding the relationship between food environments, deprivation and childhood overweight and obesity: evidence from a cross sectional England-wide study.	Ref. 29	<i>Health Place</i> , 27: 68 – 76, [2014].	HMIC
	Perceptions of the environment, physical activity, and obesity.	Ref. 30	<i>Social Science and Medicine</i> ; 63 (11): 2835 – 2846 [2006].	HMIC
	Effect of socioeconomic status on objectively measured physical activity.	Ref. 31	<i>Archives of Disease in Childhood</i> , 91 (1): 35 – 38, [2006].	CINAHL
Economic drivers for	Poverty, weight status, and dietary intake among UK adolescents.	Ref. 32	<i>International Journal of Environmental Research and Public Health</i> , 15 (6): pii: E1224 [2018].	EMBASE
	Unevenly distributed: a systematic review of the health	Ref. 33	<i>BMC Public Health</i> , 12(18):doi: 10.1186/ 1471	HMIC

food production and consumption	literature about socioeconomic inequalities in adult obesity in the United Kingdom.		- 2458-12-18 [2012].	
	Childhood obesity and overweight prevalence trends in England: evidence for growing socioeconomic disparities.	Ref. 34	<i>International Journal of Obesity (London)</i> , 34 (1): 41 – 47,[2010].	HMIC
	Adult socioeconomic, educational, social, and psychological outcomes of childhood obesity : a national birth cohort study.	Ref. 35	<i>British Medical Journal</i> , 330 (7504): 1354 – 1357, [2005].	HMIC

Table 2- A summary of the characteristics of selected studies on social determinants of obesity in the UK population. The common demographics (i.e., age, gender, ethnic background and location) are representative of the diverse study population that reflect dissimilar aims/objectives, study design and setting, data collection and findings

Journal Article	Study Aim / Objective	Study Population	Ethnic Background	Gender/Age of Study Participants	Data Collection Method	Finding (s)
Maternal eating behaviour differs between ethnic groups: considerations for research and practice.	Explore how maternal eating behaviour may differ between UK ethnic groups.	660	Chinese, Black, South Asian and White British.	Female / Not Stated	Survey Questionnaire	Maternal eating behaviour may therefore be a contributor to higher levels of overweight among South Asian and Black children living in the UK.
Poverty, weight status, and dietary intake among UK adolescents	(1) Determine if income gradient to obesity exists in UK adolescents, (2) Examine associations between poverty, weight status, and dietary intake among adolescents.	10,736	Not Stated	Male and Female / Not Stated	Wave Six of The UK Millennium Cohort Study	There is a strong income gradient to overweight and obesity among UK adolescents
The impact of green space and condition of the neighbourhood on child overweight.	Assess the influence of the green space, access to garden and neighbourhood condition on being obese.	6,467	Not Stated	Male and Female / Not Stated	The UK Millennium Cohort Study	This study suggests that limits on access to outdoor space are associated with future childhood overweight/obesity.
A mathematical model for predicting obesity transmission with both genetic and	Examine the contribution of genetic and nongenetic effects to	Not Stated	Not Stated	Not Stated	UK Observational Data Model	The proposed "first approximation" model

nongenetic heredity.	assess their influence on obesity prevalence.					captured the complex interactions between the genetic and nongenetic effects on obesity.
Sociodemographic, lifestyle and behavioural factors associated with consumption of sugar-sweetened beverages (SSB) among adults in Cambridgeshire, UK	Identify socio-demographic, lifestyle and behavioural determinants of SSB and artificially sweetened beverages (ASB) among adults in Cambridgeshire, UK.	9,991	Not Stated	Male and Female / 30 – 64 years	Food Frequency Questionnaire.	Frequent consumers of SSB and ASB differ by several socio-demographic characteristics. But increased BMI, younger age & unhealthy eating behaviours are common to both groups.
Physical activity in older age: perspectives for healthy ageing and frailty.	Examine how regular physical activity helps in reducing obesity risks in older people.	92,000	Not Stated	Male and Female / Not Stated	Survey Questionnaire	Obesity risk is reduced by regular low intensity walking and more vigorous sports and resistance exercises.
Understanding the relationship between food environments, deprivation and childhood overweight and obesity.	Assess the positive association between density of unhealthy food outlets and the prevalence of obesity in children.	1,001,096	Not Stated	Male and Female / 4 – 5 and 10 – 11 years.	Geographic Information Systems (GIS)	Associations between obesity and deprivation do not appear strongly due to local food environments.

Journal Article	Study Aim / Objective	Study Population	Ethnic Background	Gender/Age of Study Participants	Data Collection Method	Finding (s)
Food outlet availability, deprivation and obesity in a multi-ethnic sample of pregnant women in Bradford, UK.	Explore the association between food outlet location, deprivation, ethnicity and weight status.	1,198	South Asian, non-South Asian.	Female / Not Stated	Geographic Information Systems (GIS)	Stronger association exist between area level deprivation and fast-food density than with area level deprivation and obesity.
Unevenly distributed: a systematic review of the health literature about socioeconomic inequalities in adult obesity in the UK.	To summarise important differences in the prevalence and determinants of obesity by different indicators of SEP in the UK.	35	Not Stated	Male and Female / Not Stated.	Peer-reviewed literature	Socioeconomic indicators of low SEP were generally inversely associated with adult obesity risk in the UK
Childhood obesity and overweight prevalence trends in England: evidence for growing socioeconomic disparities.	To update the prevalence trends among school-age children and assess the changing socioeconomic gradient.	15, 271	White British	Male and Female / 5 – 10 years	BMI and SEP score as a composite score based on income and social class.	There is an urgent need to reduce socioeconomic disparities in childhood overweight and obesity.
Perceptions of the environment, physical activity, and obesity.	Examine (1) the association of environment with obesity (2) whether physical activity mediates association between	14,836	Not Stated.	Male and Female/ Not Stated.	Survey Questionnaire	The results show that certain aspects of the environment may contribute to the risk of obesity and poor health.

	environmen t and obesity.					
Adult socioeconomic, educational, social, and psychological outcomes of childhood obesity.	To assess adult socioeconomic, educational, social, and psychological outcomes of childhood obesity.	16,567	Not Stated.	Male and Female / 10 – 30 years	Self-Report Questionnaire	Obesity limited to childhood has little impact on adult outcomes.
A health assessment tool for multiple risk factors for obesity: results from a pilot study with UK adults.	Pilot a measure of multiple risk factors for obesity, designed to assess their relative importance at individual and population levels.	80	Not Stated.	Male and Female / 19 – 73 years.	Self-Report Questionnaire	Strong associations exist between BMI and attitudes, emotions and social influences on eating and activity behaviours.
Effect of SES on objectively measured physical activity.	Examine if habitual physical activity and/or sedentary behaviour are associated with SES in young Scottish children.	339	Not Stated.	Male and Female / 4 – 6 years.	Accelerometric measurement of physical activity and sedentary behaviour.	Low SES in young Scottish children is not associated with lower habitual physical activity or higher engagement in sedentary behaviour.

Discussion

The implications of appraising the social determinants of obesity as a function of the disparities in the socioeconomic indicators pertaining to low SEP or SES, and as a growing problem of public health among the UK population is considerable. Indices of SEP predict obesity in women more than in men.³³ Furthermore, socioeconomic indices of SEP such as 'occupational social class of the head-of-household at birth and during childhood, earlier adulthood occupational social class, contemporaneous occupational social class, educational attainment, and area-level deprivation' bear inverse relationship to adult obesity risk.

Health risk factors in childhood that may predict obesity in adulthood have been evaluated to include birth weight, parental fatness and dietary habit alongside other behavioural factors.³⁶ There is increased risk of childhood obesity progressing into adulthood among offspring of obese parent(s). But what remains unknown is the relative contribution of genes and hereditary lifestyle factors from obese parent(s) to a child. Whilst no clear association appear to exist between childhood SES and obesity, however, a strong relationship between low childhood SES and obesity in adulthood exist³⁶. What this portends is an enormous cost implication to public health finance regardless of the intervention measures being applied.¹⁵

Main finding of this study

This review underscores the influence of lifestyle choices, economic conditions, environmental factors and social issues in relation to obesity risks and prevalence in the UK population. The study analysis further demonstrated the degree of

dissimilarities in respect of the intervention strategies suggested in the works of different researchers examined in this review.

The results, together with verifiable trends and socio-demographic elements that are fundamental to misunderstanding body weight considerations in obese adults, demonstrate evidence that the rising trend in under-estimation of obesity status among the UK population is probably the result of normalizing obesity.¹⁵ This observation draws from the stereotypic narrative that is predicated on generalised depiction of a critical public health issue as a 'new normal' within the UK population.¹⁶ What this portends is the necessity for obesity intervention strategies to incorporate the diverse socio-demographic attributes that are connected to under-estimation of body weight status.

Majority of the social determinants of obesity among the UK population are related to the living environment and economic drivers for food production and consumption.³⁷ These assessments found that limited access to outdoor space for physical activity and the unequal distribution of opportunities resulting in growing socioeconomic disparities largely constitute the vital causal factors of obesity.²⁷⁻³¹ Some of these limitations exacerbate the risk of developing obesity alongside cardiovascular diseases.²⁶ Lack of greenspace and access to recreational facilities restrict the opportunity to engage in regular physical exercises ranging from low intensity walking to more vigorous sports and resistance activities.²⁷⁻³¹

Cost-effectiveness of inadequate recreational facilities, poor work environment and poor housing facilities are diverse elements of environmental

factors that predispose to physical inactivity. While frequent physical exercise helps to improve mental and physical health and wellbeing including reversing some effects of obesity particularly in adults, there is evidence that predominantly sedentary lifestyle accounts for increasing prevalence of adult obesity.²³ Notwithstanding the widely acknowledged benefits of access to outdoor space for physical activity, the overwhelming majority of adult UK population still fall short of the minimum level of physical activities needed to maintain healthy living and reduce the incidence of obesity.

The fact that local authorities are statutorily responsible for providing green space, access to garden and neighbourhood conditions, meant that their involvement in mitigating the disease burden of obesity is vital.³⁸ The challenge of stimulating frequent physical activity across all population groups is enormous and noteworthy. However, the benefits that accrue from intensified awareness of engaging in physical exercise to reduce the health risks associated with adverse events of obesity is worthwhile. Local authorities could undertake as part of informed public health initiatives, to encourage the elderly particularly the relatively healthy elderly and those with physical frailty to increase their participation in physical activities.

Evaluation of the economic drivers for food production and consumption in relation to poverty, deprivation, inequality, inequity, unemployment and low income, was an objective of this review. Socioeconomic disparities in obesity and related health risks factors are increasing among UK population. There is increased likelihood of obesity for adolescents living

in poverty and multiple deprivation.³²⁻³⁵ Meagre household income and poverty accounted for the strong income gradient to obesity that exist among the adolescent UK population. This is further accentuated by concomitant consumption of cheap and nutritionally deficient diets of fast foods and sweetened drinks with less recurrent consumption of fruits and vegetables.²²⁻²⁵ Urgent intervention strategies needed to reduce adolescent obesity must target the reduction of indices of deprivations and inequalities in household SES via more employment opportunities and higher wage structure to alleviate poverty.

The adult population has not fared better either. Available evidence showed that adult obesity is largely a function of poverty and deprivation, and an outcome of poor household income and unemployment in childhood.³⁵ Initiatives to reduce the socioeconomic burden of obesity within adult population have always focused on measures aimed at preventing the incidence of childhood obesity. However, the impact of childhood obesity on adult outcomes has not been fully elucidated given the paucity of UK-wide representative data.³⁵

Overall, it can be speculated that through a combination of poverty, deprivation, inequalities, inequities and differential health behaviours, increased prevalence of adult obesity may probably be explained by multifaceted and hard-to-measure interaction of health determinants operating at disparate levels throughout the life course.³³ But whether poverty, deprivation and low income constitute the determinants of adult obesity beyond the UK setting, to inform public health initiatives for reducing obesity is still debatable.

This review demonstrates that the number of UK-based, primary care studies on the social determinants of obesity around generalisable themes of living environment, behaviour/psychology, biology/physiology and economic drivers of food production and consumption within a timeframe of 2000 to 2018 is incredibly small. Further studies specific to the themes evaluated in this review that will target the health risks of obesity and increasing prevalence are needed.^{36,38}

Whilst this review supports the opinion that evaluation studies on causality of obesity is better undertaken within LHA for reasons of cost-effectiveness and availability of primary care data, there is however, as much dissimilarities in outcomes as there are studies. More studies may not necessarily improve statistical reinforcement for reliability of study outcomes in an ethnically diverse population like the UK. There is, however, the need for studies undertaken in hospitals/acute care settings, screening programmes and tertiary environments to provide outcomes for robust comparative analysis with those of LHA, primary care and community healthcare centres.

Extensive studies that would emphasise ethnic diversities, gender disparities and regional variations in the prevalence of obesity across the UK population may help to situate the public health burden of obesity in its proper perspective. When there are adequate studies available to conduct SR on the assortment of settings, widespread recommendations for prompt interventions can be made with greater confidence. However, the contradictory views of different studies on the social determinants of obesity is underscored by overlapping outcomes of generalisable

themes in this study. This observation was lacking in previous studies.

Although White and colleagues³⁸ argued that preventative public health intervention strategies for obesity are generally cost-effective notwithstanding the further studies that could justify the continuing increase in public health funding, El-Sayed and colleagues³³ advocated a strong reliance on the measures of SEP as being more predictive of obesity on gender basis. The fact that this review evaluated the social determinants of obesity in the UK on broad generalisable themes to support broad harmonisation of outcomes should count as a strength, and an addition to existing knowledge on the topic.

Limitations of this study

Some limitations of this review need to be considered when interpreting the findings. Firstly, the inclusion criteria limited the studies reviewed to those undertaken in LHA, primary care settings and community healthcare practices. It is possible that this scope of the review could introduce bias in the conclusions reached. Though the inclusion criteria is comparatively permissive and comprised many studies that involved largest obesity surveys in the UK,³⁶ the findings reported here may not precisely reflect contemporary knowledge of social determinants of obesity in the UK.

Secondly, there was uncertainty about COCHRANE database as a search strategy. It is probable that some studies on causality of obesity in the UK population may have been missed in the findings. However, the identification of records during step 1 of the search strategy was meticulously done to reduce this probability. Much interest was therefore

focused on finding published works in both healthcare and management journals. A broader search on Google Scholar may have provided scholarly articles on recent reviews on the health risks of obesity and its prevalence.³⁹

Thirdly, the breadth of the findings may be limited by the considerable overlap of the surveys conducted in the studies reviewed. This, nonetheless, is an inevitable constraint forced on this review by the studies themselves.

Fourthly, the fact that the findings reflected TA of this review meant that the conclusions may have been influenced by the generalisable themes.

Fifthly, this review was limited to studies on the social determinants of obesity in the UK population. This would therefore render it inapt to generalise the findings outside the UK context.

Conclusion

This SR of literature from 2000 to 2018 showed substantial disparities in the social determinants of obesity among the UK population. Most of the determinants focused on the four generalisable themes of economic drivers for food production and consumption, living environment, behaviour/psychology and biology/physiology, with economic drivers for food production and consumption, and living environment demonstrably having the most influence on obesity as a public health problem in the UK.

Conversely, several factors limit an understanding of causality of obesity risks and rising prevalence in the UK. A careful consideration of these limitations relative to an understanding of the causality factors will necessitate an inquiry along two pathways: One, the theory and

investigation of future studies on causality factors would benefit from composite and multisystem methods that encompass the significant influence of SEP at different levels of personal, family and community, on the health risks of obesity and its prevalence. Two, future reviews would be enriched by assessing the social determinants of obesity based on disparate ethnic milieu of the UK population. As this review suggests, the interplay of SEP and ethnic background may have significant influence on obesity.

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