Emerging dietary patterns: impact on child health

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A REPORT BY THE ALL-PARTY PARLIAMENTARY GROUP
ON A FIT AND HEALTHY CHILDHOOD

EMERGING DIETARY PATTERNS: IMPACT ON CHILD HEALTH

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THE ALL-PARTY PARLIAMENTARY GROUP
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The Working Group that produced this Report is a sub-group of the All-Party Parliamentary Group on A Fit and Healthy Childhood.

The purpose of the APPG is to promote evidence-based discussion and produce reports on all aspects of childhood health and wellbeing to include obesity; to inform policy decisions and public debate relating to childhood; and to enable communications between interested parties and relevant parliamentarians. Group details are recorded on the Parliamentary website at:

http://www.publications.parliament.uk/pa/cm/cmallparty/register/fit-and-healthy-childhood.htm

The Working Group is chaired by Helen Clark, a member of the APPG Secretariat. Working Group members are volunteers from the APPG membership with an interest in this subject area. Those that have contributed to the work of the Working Group are listed on the previous page.

The Report is divided into themed subject chapters with recommendations that we hope will influence active Government policy.

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A REPORT BY THE ALL-PARTY PARLIAMENTARY GROUP
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INTRODUCTION

What we eat today and how we decide to produce sufficient food to meet both demand and nutritional requirements will determine the availability, diversity and quality of diets for future generations.

Acceptability and normalisation of new dietary patterns must be prioritised to the same extent as education on environmental sustainability and health, because these are important social levers. They can help to reduce the psychosocial barriers and anxieties often connected to the behaviour changes that are needed to transition away from the traditional Western eating habits that are now increasingly subject to critical scrutiny.

Without understanding the motivations and facilitators to change eating habits (and then designing and amplifying solutions which make those changes attractive and compelling in the modern world) positive changes to young people's health and their environment through better food will not come quickly enough to halt potentially catastrophic consequences for people and planet.

Changing consumption is seen by experts as the most powerful lever compared to food waste reduction or more efficient food production methods and technological solutions. There is simply not enough on Earth to sustain the increase of intensification required to continue feeding a global population on its current trajectory with a diet so rich in animal produce.

However, radical behaviour modification is challenging and therefore cross-sector, bold and perhaps unorthodox leadership is necessary to inspire alteration in the food system, which will have a knock-on effect in terms of changing food environments and therefore food perceptions, narratives and behaviours.

There are no 'quick fix' solutions, but what is undeniable is that populations can only make effective shifts in dietary patterns if government and the food industry help them to make those changes. This requires budgetary investment in public health information and the implementation of policies that promote ways to eat healthily that are also affordable and environmentally sustainable. The aim is to offer food that tastes as good as it can be made to look so that uptake is maximised and the benefits are cumulative.

The inevitable upheaval incurred by making any alteration to entrenched patterns of consumption that have been centuries in the making should not be underestimated, but carrying on as before is no longer credible nor desirable. The aim is to offer 'nutritious' food.

'If we don't take action, the collapse of our civilisations and the extinction of much of the natural world is on the horizon' Sir David Attenborough.

This Report is our initial contribution to a conversation that has only just begun.

It is unlikely to be the last.

SUMMARY OF RECOMMENDATIONS

1. DIETARY PATTERNS: HISTORICAL BACKGROUND AND LEGACY:
No recommendations

2. THE SCALE OF THE CHALLENGE:
2.1   Food pedagogy and skills to be taught in schools as part of the National Curriculum
2.2   Government and the food industry to invest in public health information about healthy eating
2.3   Government to invest in, research and promote a Healthy Eating Policy with the aim of encouraging dietary habits that are palatable, affordable and contribute positively to the health of the planet and its inhabitants
2.4   Working towards mitigation of factors affecting climate change at the individual and community level should form part of the Government's stated long-term commitment to safeguard public health.

3. THE IMPACT OF ENVIRONMENTAL EDUCATION AND AWARENESS ON DIETARY BEHAVIOUR:
3.1   Environmental sustainability to be embedded into initial teacher training
3.2   UN Sustainable Development Goals (SDGs) to be benchmarks for comprehensive subject development throughout the National Curriculum and embedded within Ofsted Inspection systems
3.3   Government to build a public awareness and information campaign around dietary health supported by proven science and data findings in order to minimise unintended health and environmental consequence outcomes from pursuing diets popularised via social media trends
3.4   Development of funding options for tripartite diet/health environment studies in Further Education settings and continuing professional development in related areas (teaching/dietetics) in order to embed the topic in national learning and development pathways and maximise the social and economic opportunities for the talent pool in the field.

4. EMERGING PERSPECTIVES ON HEALTH AND CLIMATE IN DIETARY GUIDELINES:
4.1   The simultaneous incorporation of dietary and human health considerations into core climate and environmental policies at national and international levels
4.2   Sustainability to be embedded at the heart of all policies, especially (but not just) those concerning food

4.3   Diet and climate to be reflected within the core curriculum for young people and professionals training for roles which provide dietary advice based on FBDGs such as the British Dietetic Association's 'One Blue Dot Campaign':
https://www.bda.uk.com/resource/one-blue-dot.html

4.4   Public procurement strategies and planning incentives which are reflective of human and planetary health to recognise, connect better, support and leverage the crucial local activities which contribute to sustainable food systems and broader human wellbeing such as urban farming and community growing schemes.

5. AN INTERNATIONAL PERSPECTIVE WITH CASE STUDIES:

5.1   UK Government to follow the New Zealand lead by using a Wellbeing Budget to re-frame its approach to sustainability and the food system and place the environment at the heart of policy devised by all Government Departments.

5.2   For the UK government to proactively initiate an international dialogue to combat the syndemic of obesity, undernutrition and climate change.

5.3   An examination of the influence and activities of some members of the food industry in the political process hindering effective nutrition and climate change policy.

6. DIETARY POLICY AND PRACTICE IN THE DEVOLVED UK:

6.1   UK Government to invest in strategies to communicate the need for widespread food policy change

6.2   Introduction of the flexitarian diet via the school meals service and parallel initiatives designed for Early Years settings

6.3   Collaboration between devolved government in the UK to establish the principles of a UK food strategy based on the concept of food sovereignty that is capable of adaptation to suit the circumstances of the individual nations

6.4   The role in the UK Government of Secretary of State for Environment, Food and Rural Affairs to be supported by a Minister of State for Food and Sustainability.

7. THE SOCIAL AND ECONOMIC CONSEQUENCES OF DIETARY CHANGE:

7.1   Government to promote research into the health impacts of moving away from the consumption of animal products and towards the relative viability of alternative protein sources

7.2   Careful and wide-reaching public awareness campaigns to be initiated by the Government so that information and guidance about alternative protein sources is embedded into dietary advice and chef training in order to grow the knowledge base, confidence and social acceptability of new food sources

7.3   As more meat alternatives and novel food sources enter the market, it is essential that regulation is used to probe the validity of claims that are made about health and environmental impact to ensure that any 'benefits' that are offered are evidence-based.

8. A HOLISTIC APPROACH TO CHILD HEALTH:

8.1   Government strategy on children's health and wellbeing to adopt a 'whole child' ethos

8.2   The messages that healthy eating, hydration and frequent physical activity are essential to health, wellbeing and environmental sustainability should be explicitly taught within Early Years, Primary and Secondary school curricula and clearly communicated to parents and families.

9. THE WAY FORWARD: DAVOS AND AFTERWARDS:

9.1   Government to launch a '21st Century Food Challenge' in which cities and communities are encouraged to devise schemes in which they can participate and contribute to regenerative new food schemes. The Challenge to be extended to the devolved UK governments and to be monitored by a well-advertised system of targets and system of regular reporting.

1. DIETARY PATTERNS: HISTORICAL BACKGROUND AND LEGACY

Following the industrial revolution, cities and towns accessed food produce from the neighbouring countryside. The content of the average diet was largely unremarked, but this changed when academic departments were established in the early 20th century.

From then onwards the 'healthiness' (or otherwise) of consumption entered public debate; gathering momentum alongside the forward march of the 20th century. Now farming, nutritional and environmental sciences have acquired a collective resonance: what we eat is directly linked to how we preserve the environment:

Dietary Surveillance data
From 1940-2000 the National Food Survey spawned a plethora of in-depth food diaries. The Ministry of Food determined to ascertain the nature of a wartime family diet and the annual 'Family Food' publication contained statistical data about the quantity, cost and nutritional content of the food and drink purchased. In 2001 a merger with the Office of National Statistics' (ONS) 'Family Expenditure Survey' produced the 'Expenditure and Food Survey'; renamed in 2008 as the 'Living Costs and Food Survey'.

In the same year, Public Health England and the UK Food Standards Agency jointly funded the 'National Diet and Nutrition Survey Rolling Programme' (NDNS) a continuous cross-sectional survey designed to assess the diet, nutrient intake and nutritional status of the general population aged 1.5 years and over, residing in private households in the UK. This annual survey is both recognised and respected worldwide.

Wartime rationing
Food rationing ran from 1940–1954; reflecting the Government's desire to ensure that a limited food supply was apportioned fairly. Scientists and statisticians calculated quantities in accordance with the nutrients required for good health and a 'typical' 1940s meal consisting of small meat portions, abundant servings of vegetables, bread and a stodgy pudding (at first glance, unappealing, with decidedly 'unhealthy' connotations) had the high carbohydrate and low fat content to align it more nearly with contemporary expert recommendations than a typical diet today.

Its impact was to improve health and life expectancy outcomes together with a decline in infant mortality (Foster R & Lunn J, 2007), 40th Anniversary Briefing Paper: Food availability and our changing diet. Nutrition Bulletin, 32(3), 187-249).

From rationing to the present day

In the 1940s, rural households accessed a majority of fruit and vegetables from their own gardens and allotments (less marked for urban households) and approximately a third of household income went on food as opposed to 12% today.

Popular 1950s foods included salmon sandwiches, tinned fruit with evaporated milk, fish on Fridays and a Sunday 'high tea' of ham salad. Households ate four meals per day and grew more than double the amount of food in their gardens and allotments than they purchased from shops.

An end to rationing coincided with the dawn of new technology and an increase in women working outside the home. Frozen food, takeaways and ready meals became the norm and 'convenience foods' absorbed almost a fifth of a family's food spend. By 1979, nearly 95% of families owned a fridge (compared to 15% in 1974) and the appeal of canned food waned, (Public Health England, 2014 National Diet and Nutrition Survey: NDNS).

There is a correlation between what we eat and its cost. In the earlier part of the 20th century (relatively) higher food prices generated less waste and most animal and vegetable parts were consumed as part of a regular diet. For example, discarded pea pods might make a soup and data from 1974 shows a typical household purchasing 36g of liver per week. By 2014, this had declined to 3g; a 92% drop.

Nowadays, Italian-style food is popular but pasta did not make an appearance in the National Food Survey until 1998 and between then and 2014, weekly household purchases of it more than doubled. Pizza purchase rose from an average 2g per week in 1975 to 53g in 2014 with a 1,000% increase in takeaway pizzas bought per household during the same period.

Eating outside the home

In 1952, 50% of households ate all meals at home with a fifth eating one dinner a week out. By 1983, the average person ate three meals per week outside the home. Between 2005-15, the UK saw a 53% increase in the number of external eateries (The Food Foundation 2016 Force-fed. Does the food system constrict healthy choices for a typical British family?) and the NDNS suggests that between 2008/09 and 2012/13 a quarter of adults and a fifth of children ate at outlets away from home at least once a week (Public Health England, 2018 National Diet and Nutrition Survey: results from years 7and 8 combined rolling programme. London Crown Copyright).

Alongside increased availability of such food outlets, additional factors including time constraints, practical skill, resource and accessibility (ie JustEat and Deliveroo Apps) slick marketing and advertising contribute to the increase in out-of-home eating. The proliferation of fast food venues is disproportionate; higher in areas of deprivation than more affluent neighbourhoods (Public Health England, 2016 Obesity and the environment: density of fast food outlets): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/578041/Fast_food_map_2016.pdf

<u>Food and drink guidelines and public health messages</u>
In 1984 Atwater articulated the scientific basis for linking food composition, dietary intake and health.

'Unless care is exercised in selecting food a diet may result which is one-sided or badly balanced...one in which either protein or fuel ingredients (carbohydrate and fat) are provided in excess. The evils of overeating may not be felt at once, but sooner or later they are sure to appear – perhaps in an excessive amount of fatty tissue, perhaps in general debility, perhaps in actual disease,' (Hunt, Rayner M & Gatenby S, 1995, A national food guide for the UK? Background and development. Journal of human nutrition and dietetics, 8:5, 315-322).

In 1916, the US developed a five group food guide: milk and meat; cereals; vegetables and fruit; fats and fat foods; sugars and sugary foods (Hunt C, 1916, USDA's Food for Young Children Farmer's Bulletin No. 717 Washington DC; Government Printing Office). In the 1980s, UK public advice from the Health Education Authority on food selection was based on the dietary components of fat, fibre, sugar and salt. In 1990, 'The Eight Dietary Guidelines for Healthy Eating' was the first official government document to introduce the concept of food groups into food selection advice.

<u>The Eatwell Guide</u>
The 2007 'Eatwell Plate' launched by the Food Standards Agency was a visual representation based on five food groups depicting the proportion that each should contribute to a healthy diet. It was updated in 2015, reflecting new recommendations that free sugars contribute a maximum 5% of dietary energy with fibre increased to 39g per day for adults plus advice that the dietary reference value for carbohydrates be maintained at a population average of approximately 50% of total dietary intake. Protein guidelines were also updated to emphasise the importance of plant-based protein. In a 2019 report, the UK fell short on meeting the guidelines with Public Health England data showing too many calories, too much saturated fat, sugar and salt and too little fruit and vegetables, oily fish and cereal fibre (Winter M, 2018, Changing the Food Cultures: Challenges and

Opportunities for UK Agriculture, Exeter: University of Exeter and Nuffield Farming Scholarship Trust).

5-a-Day
The 5-a-day message about fruit and vegetable consumption originated in the US and was officially adopted by the UK in 2003. Its success has been partial; evidence shows that the middle classes and supermarkets have been receptive but disadvantaged communities (where fruit and vegetable presence/consumption were already low) have been less enthusiastic (BBC 2013 Five-a-day: a partial success):
https://www.bbc.co.uk/news/health-20858809

Fish and Omega-3 fatty acids
For the past three/four decades, the benefits of long-chain omega-3 polyunsaturated fatty acids for a number of disorders including cardiovascular, neurodegenerative, neuropsychiatric and inflammatory diseases and some cancers have been consistently reported (Weylandt KH, Serini S, Chen YQ, Su HM, Lim K, Cittadini A, & Calviello G, 2015. Omega-3 polyunsaturated fatty acids: the way forward in times of mixed evidence. BioMed research international).

The recommendation for two portions of fish per week (one of which should be oily) has contributed to a small increase in consumption over the past 40 years. However, 33% of adults in one UK survey said that high prices of fish have served to deter consumption (The Fish Site, 2012, UK Fish Consumption Patterns and Trends):
https://thefishsite.com/articles/uk-fish-consumption-trends-and-predictions

Salt
At the 2011 UN high-level meeting on non-communicable diseases, salt reduction was listed as one of three top priority actions to reduce premature mortality from non-communicable diseases by 25% at the target date of 2025 (The World Health Organisation, 2011, First ministerial conference in healthy lifestyles and non communicable disease control):
http://www.who.int/nmh/events/moscow_ncds_2011/en/

In 2013 The World Health Organisation recommended a 30% reduction by 2025 with an eventual goal of 5g per day worldwide (WHO, 2013, Guidance on dietary salt and potassium):
http://www.who.int/mediacentre/news/notes/2013/salt_potassium_20130131/en/
In 2003, the UK, through Consensus Action on Salt and Health and the Foods Standards Agency developed a programme of voluntary salt reduction in collaboration with the food industry. This has resulted in a fall in the UK salt intake; much of which is due to product reformulation.

Low fat
After 1980, the merit of a low-fat diet became orthodox ideology; building upon findings stemming from the 1940s of a correlation between high-fat consumption and high-cholesterol levels leading to heart disease. There was a major switch to skimmed milk in the 1990s and a reformulation of food and drink products to contain less fat – but more sugar (Nguyen PK, Lin S and Heidenreich P, 2016, A systematic comparison of sugar content in low-fat vs regular versions of food. Journal of Nutrition and Diabetes. 6:1, E193).

Sugar
Concerns about excess sugar in the diet were dismissed in the 1970s but in 2009, Professor Robert Lustwig re-published Professor John Yudkin's seminal text 'Pure, White and Deadly' (1972) and its concerns were adopted by a range of experts, celebrity chefs, academics and other groups. The World Health Organisation has recommended that governments introduce a range of fiscal measures and policies to help reduce consumption of free sugars at a population-based level with acknowledged benefits including a decrease in the risk of developing overweight and obesity, type 2 diabetes, tooth decay, cardiovascular diseases, diet-related cancers and more (The Lancet, 2016, Who's War on Sugar, The Lancet, 388:10055 P1956). Sugar has been a significant focus of the three publications of the UK Government's Childhood Obesity Plans over the past four years.

In 2018 a Soft Drinks Levy was introduced to prompt manufacturers to reduce the sugar content of sugar-sweetened drinks. A reduction in sugar of around 28% per 100ml has already been seen within the first year of implementation (Public Health England, 2019, Sugar reduction: report on progress between 2015 and 2018. Crown Copyright London). National public health guidance has been amended to encourage a population-wide sugar intake reduction.

Surveillance data from NDNS suggests that children's free sugar intake decreased significantly over a nine year period with adults; also showing a reduction in free sugar intake as a percentage of total energy over time; although smaller than for children. However, average intakes exceeded the current recommendations of no more than 5% of total energy from free sugars in all age/sex groups over the whole 9 years (Public Health England, 2019, National Diet and Nutrition Survey: Years 1 to 9 of the Rolling Programme 2008/2009 – 2016/2017): Time trend and income analyses).

The Government now proposes to re-assess the sugar content of commercially available baby food, milk-based drinks and the out of home sector in its latest chapter of the Childhood Obesity Plan (Department for Health and Social Care, 2019, Advancing all our health; prevention in the 2020s).

School meals

School meals were introduced in the 19th century and today, UK school meals are governed by some of the most comprehensive standards in the world.

Having school meal standards is thought to have a positive effect on children's food choices and their nutritional profiles and the UK's standards are both food and nutrition based.

Sweden, however (with a school meals system serving 1.3 million meals per day) has now made the connection between eating and planetary health and a Swedish dietary project focuses on four core elements:

1. The importance of school lunches to overall dietary intake of Swedish pupils
2. Optimising the food supply
3. Developing and evaluating a menu with reduced greenhouse gas emissions that is nutritionally viable and affordable
4. Exploration of views of pupils and kitchen staff about the new plan.

It is clear that some major aspects of our current dietary patterns are rooted in history and practice; but such patterns are rapidly changing in a world that is increasingly globalised; a society that is ever-more convenience–driven and a food industry both powerful and adaptable. The lines have become increasingly blurred as to whether the market supplies or shapes consumer demand.

One difference between the post-war era and modern times is the choice that is now available to the population. During the rationing era, this was not an issue – but now deciding precisely what to eat is complex, with multiple brands of the same products being available at numerous outlets and the potential consumer being assailed on a 24 hour daily basis by a veritable phalanx of media and marketing operations.

Greater choice is surely the harbinger of increased opportunity; but brings in its wake, a corresponding burden of responsibility.

This is a modern fact of life for individuals and families – but also for their governments.

2. THE SCALE OF THE CHALLENGE

The climate crisis

The UN climate summit of October 2019 (addressed by Greta Thunberg) focused upon what action worldwide is needed to impact the climate crisis and mitigate potential catastrophe.

The severity of the situation was presented in a 2018 Intergovernmental Panel on Climate Change report and included the claim that by 2020, there will be 10 years left to halt the current trajectory towards irreversible climate change by keeping global warming above pre-industrial levels to below 1.5 degrees centigrade (IPCC, 2018: Summary for Policymakers: Global Warming of 1.5_c. An IPCC Special Report on the impacts of global warming of 1.5_c above pre-industrial levels and related global greenhouse gas emission pathways, the context of strengthening the global. Geneva, Switzerland).

'Climate change denial' is shedding its remaining vestiges of credibility (Watts J, " 'No doubt left,' about scientific consensus on global warming say experts", The Guardian, 24th July 2019):
https://www.theguardian.com/science/2019/jul/24/scientific-consensus-on-humans-causing-global-warming-passes-99

It is now widely accepted that direct adverse consequences of the crisis are likely to include:

- Further extreme weather events
- Degraded air quality, food and water systems
- More physical illnesses
- Increased risk of hundreds of millions of people worldwide sinking below the poverty line.

Yet in 2020, the route from knowledge to action has not been traversed.

Few countries are on track to achieve their climate targets; the US has formally withdrawn from the 2017 Paris Agreement on carbon emissions and in 2019 the Lancet warned that today's children will perforce suffer lifelong climate change-induced challenges (Watts et al, 2019, The 2019 report of 'The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate', The Lancet, 394(10211), 1836-1878).

There is heighted and growing awareness of the damage that can be wreaked by modes of transport (eg a proliferation of news items concerning excessive celebrity plane use contrasting with Greta Thunberg's journey to address the UN

climate summit by means of an emissions-free yacht) and it is having some influence upon the public's travel choices eg 'flight shaming' in Sweden: https://www.bbc.co.uk/news/world-europe-51067440

However, excessive consumption retains the status of niche concern and governments worldwide are still averting their collective gaze as 'a slew of high-level reports...all argue that if the world is to make an impact on climate crisis, the food system needs to be radically reshaped', (What we eat matters: to change climate crisis, we need to reshape the food system): https://www.theguardian.com/commentisfree/2019/oct/08/climate-change-food-global-heating-livestock

Climate change and sustainable nutrition
The health and wellbeing of future generations and their access to sustainable nutrition will be irreparably jeopardised by the climate and ecological crisis unless radical changes in patterns of consumption are adopted.

Biodiversity experts contend that humanity has embarked upon a process of 'biological annihilation' that is directly linked to human overpopulation and excessive consumption (Ceballos G, Ehrlich PR & Dirzo R, 2017, 'Biological annihilation via the ongoing sixth mass extinction signalled by vertebrate population losses and declines ', Proceedings of the National Academy of Sciences, 114(30), E6080-E6096).

Urban populations grow apace and drive mass land use change and widespread pollution throughout fragile ecosystems globally (Grimm NB, Foster D, Groffman P, Grove JM, Hopkinson CS, Nadelhoffer KJ, & Peters DP, 2008, 'The changing landscape: ecosystem responses to urbanization and pollution across climatic and societal gradients'. Frontiers in Ecology and the Environment, 6(5), 264-272). Threats to biodiversity and soil quality impact food quality, and while species' diversity within, and available land for, human food production is limited and fast decreasing, the enlarging world population is predicted to reach 10bn by 2050.

Climate change and ecological breakdown will exacerbate existing food inequalities such as access to safe, nutritious and affordable food.

The poorest people in the UK are likely to suffer the most; adding to existing health inequalities affecting their families and communities (including recent immigrant populations and those of ethnic minority).

Trussell Trust and Independent Food Aid Network data shows that the number of food banks in the UK exceeds that of McDonald's restaurant outlets (Burke D, "UK

now has more food banks than McDonald's branches after almost 10 years of Tories", The Mirror, 3 December 2019):
https://www.mirror.co.uk/news/politics/uk-now-more-foodbanks-mcdonalds-21060125
Therefore, at a time when an average UK diet is plummeting below national guideline benchmarks and food bank demand has scaled an all time high, the accessibility and affordability of safe and nutritious food is sharply relevant to assessments made of the impact of climate change on children.

Local climate-related events such as flooding can impede access to food and damage to infrastructure and resultant barriers to transport owing to extreme weather events affects food markets by increasing food costs (Lal R, 2013, 'Food security in a changing climate', Ecohydrology & Hydrobiology, 13(1), 8-21). Direct experience of such events carries immediate physical health risks (injury and disease) plus enduring and hard to diagnose psychosocial effects including trauma which may impact self-care in later years inclusive of dietary intake and quality (Hall KS, Hoerster KD & Yancy Jr, WS, 2015, 'Post-traumatic stress disorder, physical activity, and eating behaviours', Epidemiologic reviews, 37(1), 103-115).

Children, young people and the unborn child have specific nutritional health requirements; those from disadvantaged families experience the greatest adversity from food insecurity and the growth in inequalities prompted by food scarcity could ultimately serve as a contributory trigger for social unrest and conflict (Paveliuc Olariu C, 2013, 'Food Scarcity as a trigger for civil unrest', Advances in Agriculture and Botanics, 5(3), 174-178).

Food quality and safety
Alterations to the planet's natural systems such as change in agricultural land use and rising levels of greenhouse gas concentration in the earth's atmosphere will disturb the ability to grow, produce and transport sufficient food supplies for a burgeoning global population and the maintenance of global supply chains.

Approximately 50% of food is consumed and produced in the UK with 50% imported; the top three imports (fruit, vegetables and meat) represent nearly £20bn in imported edibles which may be at risk or affected by clinical abnormalities (DEFRA, 2017, Food statistics in your pocket 2017 – Global and UK supply. National Statistics):
https://www.gov.uk/government/publications/food-statistics-pocketbook-2017/food-statistics-in-your-pocket-2017-global-and-uk-supply

The declining nutritional quality of mass commodity crops and protein sources (plus production challenges occasioned by extreme weather events) is likely to cause a global nutrition and market crisis as climate change accelerates,

contributing to more widespread micronutrient deficiencies, food poverty and hunger.

The safety of the future food supply is also a key consideration.

A recent report from The Pesticide Action Network cautioned that over-use of pesticides in industrialised farming systems degrades soil health, reduces the intrinsic nutritional quality crops and jeopardises human health via toxic 'cocktails' of multiple common pesticides aggregated in the food and drink consumed from around the world (Pesticide Action Network, The Soil Association, 2019, 'The Cocktail Effect'):
https://www.pan-uk.org/the-cocktail-effect

There have also been calls for stronger controls of antibiotic use in livestock farming (often to prevent the proliferation of disease in overcrowded conditions) in order to help combat human resistance to antibiotics (Harvey F, 'Brexit could weaken rules on antibiotics in farming activists warn', The Guardian, 18th November 2019):
https://www.theguardian.com/environment/2019/nov/18/brexit-rules-antibiotics-farming-activists-warn
A current lack of regulatory process to slow pesticide fertiliser antibiotic use from proliferating in response to climate-related challenges, poses further threats to general health, food safety and collective resistance to deadly infections.

The children's perspective
The climate crisis poses significant challenges to the resilience of future generations, one of which may be the perceived psychological burden of addressing the consequences of climate-related events for which their forbears have been in greater part responsible.

From a survey sample of 16-24 year olds, 40% reported feeling 'overwhelmed' by climate change (Beddington E, 'A-Z of climate anxiety: how to avoid meltdown', The Observer):
https://www.theguardian.com/environment/2019/dec/08/a-z-of-climate-anxiety-how-to-avoid-meltdown

The psychological toll on children of growing up in an unstable, uncertain world is not fully understood, but is nonetheless important to consider when investigating child health and development in the context of the climate crisis.

Direct experiences of climate change may cause trauma in aftermath, and a feeling of powerlessness over their future due to climate change can have a detrimental effect on children's mental health (Clayton S, Manning C, Krygsman K & Speiser M,

2017, 'Mental health and our changing climate: impacts, implications and guidance', Washington, DC; American Psychological Association and eco America).

Following a recent increase in the number of young people diagnosed with 'eco-anxiety', some researchers have suggested that hearing about the climate crisis may induce a type of 'pre-trauma' (Gifford E & Gifford R, 2016, 'The largely unacknowledged impact of climate change on mental health', Bulletin of the Atomic Scientists, 73(5), 292-297) characterised by moderate to extreme anxiety about a looming crisis.

Children's own views about dietary patterns and changes have not been extensively studied, although from birth, babies are active in their feeding relationship with their mothers (Keenan J & Stapleton H, 2009, 'It Depends What You Mean by Feeding On Demand: Mothers' Accounts of Babies', Agency in Infant-Feeding Relationships, in A James, AT Kjorholt, V Tingstad, (Eds) 'Children, Food and Identity in Everyday Life', Houndmills: Palgrave Macmillan).

They are pro-active in creating, reproducing and resisting ideas about food and food provisioning in their families (Grieshaber S, 2004, 'Rethinking Parent and Child Conflict', London: Routledge) and significant in influencing their families' food activity with some children making a definite choice to become vegetarian.

In the US, a study looked at 48 middle-class children aged 6-10 years, 16 of whom had decided to become vegetarian despite being part of non-vegetarian families. Of the others studied, 16 were raised in a family of vegetarians and 16 were non-vegetarians. Animal suffering was a key determinant in the responses of the vegetarian children although this was unrelated to wider ecological reasons and the younger children were less aware of links between climate change and food production.

A small study by Willeford et al (Willeford C, Reicks M, Schajev S and Mora MS, 2010, 'Go Veggie?: A Decision Case Experience for High School Students', Journal of Nutrition Education, 32(233B): 320-321) conducted in Midwest US provides evidence that as children get older, they develop a more nuanced understanding of animal welfare as part of broader concerns for the planet. A 'decision case' education tool was used to encourage children to reflect on the scenario of a hypothetical young person examining the pros and cons of 'going veggie.'

The study unit included examining the nutrient basis of a vegetarian diet as well as preparing/tasting vegetarian menus. The 'decision case' format enabled children to explore family and peer pressures on their diet; financial considerations, short and longer term health implications, food ethics and environmental concerns. Learning to evaluate food choices (moral, environmental and social) requires an

underpinning knowledge and could form part of the formal National Curriculum in school.

An Australian study of 225 primary carers of children conducted online (Bray HJ, Zambrana SC, Chur-Hansen A and Ankeny RA, 2016, 'Not Appropriate Dinner Table Conversation? Talking to Children about Meat Production', Appetite, 100:1-9) analysed what children learn about food at home.

Researchers observed that conversations about meat were generally stimulated by home meal preparation rather than visits to a farm or agricultural show. Many families initiated conversations about meat production before children reached age five and urban families were more sympathetic to children wishing to become vegetarian than rural families; the latter being more prosaic about meat production.

Wider dietary awareness and consumption in relation to environmental and planetary health are rarely discussed with children either at school or in the home. For example, some of the foods that contribute to greenhouse gas emissions and so add to global warming include fruit juices (8.9%) and sugars and confectionary (6.2%). The British Association of Dieticians recommends drinking tap water in preference to other beverages (particularly soft drinks). This small change in itself would not only decrease the risk of caries which affects 1 in 4 UK children, but also lead to a more environmentally sustainable diet.

More research is emerging
https://www.tandfonline.com/doi/abs/10.1080/09500690500069467

It can be argued that children and young people in the UK and worldwide are already facing novel and complex challenges created by an unstable climate.

How these risks and challenges will develop over time is uncertain, but what an increasing body of evidence suggests is that reducing the impacts of climate change and mitigating them where possible, including the deployment of dietary interventions with psychological support, must be prioritised if we are serious about protecting the food systems and thence the broader health and wellbeing of next and future generations.

Recommendations:

2.1   Food pedagogy and skills to be taught in schools as part of the National Curriculum
2.2   Government and the food industry to invest in public health information about healthy eating

2.3   Government to invest in, research and promote a Healthy Eating Policy with the aim of encouraging dietary habits that are palatable, affordable and contribute positively to the health of the planet and its inhabitants

2.4   Working towards mitigation of factors affecting climate change at the individual and community level should form part of the Government's stated long-term commitment to safeguard public health.

3. THE IMPACT OF ENVIRONMENTAL EDUCATION AND AWARENESS ON DIETARY BEHAVIOUR

Achieving any alteration in dietary behaviour is notoriously difficult and the changes of the past 50 years are diametrically opposed to the avowed aims of national and international public health policy.

The 'average' diet is more unhealthy and unsustainable; our vulnerability to life-threatening non-communicable disease has increased and the environment on which we rely for broader survival and quality of life has been damaged. Today's diet follows the 'Western' pattern; a paucity of plant-based foods, an excess of animal products and the adverse consequences to health and the environment exacerbated by the circumstances in which we eat.

Red and processed meat is of particular concern in the animal product category and predominant in the content of fast/junk food and out-of-home convenience meals.

Meat-based diets and environmental impact

Meat consumption in Western civilisation has risen significantly in recent decades and is the daily dietary staple for millions worldwide, owing to population increase and rapid changes in traditional diets. As a result, huge rainforests such as the Amazon have been despoiled to accommodate pasture for cattle-rearing or to produce animal feed substance to sustain the cattle. An estimated 70% of deforestation in the Amazon basin has been attributed to cattle ranching (One Green Planet, 2013):
https://www.onegreenplanet.org/animalsandnature/beef-production-is-killing-the-amazon-rainforest/

CO^2 is created by human burning of fossil fuels, coal, oil and natural gas and the absence of trees to remove it fuels global warming.

In 2019, a UN report on land use and climate change (IPCC, 2019, 'Climate Change and Land') castigated the West's high consumption of meat and dairy products. It emphasised that a daily reduction at population level would minimise the burden on the environment - but the pre-eminence of meat-based products in the diet of millions of UK people makes such wide scale dietary change difficult.

Recent data from 120 countries has suggested that a 'second nutrition transition' may be approaching for developed countries in which individuals from higher income brackets resile from excessive meat consumption (Vranken L, Avermaete T, Petalios D & Mathijs E, 2014,'Curbing global meat consumption: Emerging evidence of a second nutrition transition', Environmental Science & Policy, 39, 95-106).

Affluent families in general eat less red/processed meat and more plant-based foods than economically deprived groups who incur correspondingly high levels of childhood obesity.

The rise of veganism and considerations for the environment
Traditionally, veganism has been regarded as a movement dedicated to animal welfare, ethics and religious beliefs representing only a small proportion of the population with perhaps its earliest manifestation in the practice of Pythagoras who advocated benevolence amongst all species and followed what could be described as a vegetarian diet around 500 BCE (The Vegan Society, 2019): https://www.vegansociety.com/about-us/history

In recent years, veganism has appealed to those desirous of combating climate change, despite intermittent rumblings of resistance on health grounds: https://metro.co.uk/2019/11/26/nursery-goes-entirely-vegan-not-everyone-happy-11222690
https://www.ucl.ac.uk/news/headlines/2017/may/vegan-diet-could-be-damaging-childs-health-experts-warn

However, the British Dietetic Association has confirmed that when managed correctly, vegan diets are suitable for individuals of all ages in achieving a healthy and nutritious diet, supporting sufficient growth, development and bodily functions (British Dietetic Association, 2017).

Income level is not the sole determinant of dietary awareness and there is evidence to suggest that higher levels of educational attainment can shift dietary patterns towards healthier and more sustainable practice in a similar manner to higher earning potential (UKCR Centre for Diet and Activity Research (CEDAR) 'Food, income and education; who eats more of what?', February 2014): http://www.cedar.iph.cam.ac.uk/resources/evidence/food-income-education-graphic/

The findings are well-replicated and demonstrate the potential untapped impact of investing in educational schemes focused on dietary outcomes, to safeguard future generations by equipping them with the knowledge, skills and motivation to follow eating patterns which are better for health prospects and planetary stability.

The effect of new foods and technologies
The dietary awareness of the general population is driven in part by market availability.

The conversation about the consumption of animal produce (particularly amongst young people) has been stimulated by the explosion in availability of meat and dairy alternatives in supermarkets and on the high street; all advertising themselves as 'healthier' and 'more environmentally friendly'.

The business community has been swift to commandeer a burgeoning market for plant-based products and meat alternatives and the most recent Forum for the Future Protein Challenge 2040 Report has scanned 132 of the most influential global food businesses in the supply chain which provide protein to our food system, finding that 55% of total businesses, 61% of food services and restaurants, and 79% of food brands are investing in, acquiring, or launching new meat-free products (Forum for the Future, 'The Future of Food; Are businesses on track to deliver a sustainable protein system by 2040?', Report, November 2019): https://www.forumforthefuture.org/handlers/Download.ashx?IDmf=f2a9339c-8a62-4462-a886-f7de0e3fd729

The UK has embraced the trend; topping the list of countries for the number of new vegan product launches in 2018 (mintel. '#VEGANUARY: UK overtakes Germany as world's leader for vegan food launches'): https://www.mintel.com/press-centre/food-and-drink/veganuary-uk-overtakes-germany-as-worlds-leader-for-vegan-food-launches
The popularity of the Greggs vegan sausage roll (launched in January 2019) has helped to increase access to vegan and vegetarian diets and to normalise meat-free eating occasions.

Awareness-raising has escalated via documentaries, events and information-sharing on social media platforms; notably the vegan documentary 'Cowspiracy', local vegan markets and events such as Vegan Nights in London (Hancox D, for The Guardian, 'The Unstoppable Rise of Veganism; how a fringe movement went mainstream', 1 April 2018): https://www.theguardian.com/lifeandstyle/2018/apr/01/vegans-are-coming-millennials-health-climate-change-animal-welfare

Other influential factors include celebrity endorsement of plant-based diets and Extinction Rebellion-linked protests staged by Animal Rebellion in 2019.

It can be argued that the social communication of ethically-motivated lifestyle choices linked to environmental concerns is having the greatest effect on young people's eating patterns; presenting as a key component of an attractive vocal and technology-savvy community with plant-based values that has propelled itself into the mainstream.

The changing vegan market and its impact on health

The notion that a plant-based diet is bound of its essence to be 'virtuous' however requires pause.

Recent research from Action on Salt and Sugar has introduced an element of doubt into the equation of meat and dairy free food with a sine qua non 'health halo.' In 2018, the campaign group revealed that some meat-free burgers, sausages and mince products were concealing high levels of salt. The salt content surveyed of meat content beef burgers from retailers including Tesco, Sainsbury's and Asda was on average 0.75g per serving lower than that of meat-free burgers at 0.89 per serving (Action on Salt, 2018, Meat-free alternatives):
http://www.actiononsalt.org.uk/media/action-on-salt/Meat-Alternatives-Oct-18-Report.pdf

In 2019, the group surveyed sugar content of festive hot drinks sold across a range of coffee outlets and the latte with the highest sugar content was Starbucks Gingerbread Latte with Oat Milk (Venti) containing over 14 teaspoons of sugar and 523 calories per portion (Action on Sugar, 2019):
http://www.actiononsugar.org/news-centre/press-releases/2019/festive-hot-drinks-loaded-with-sugar--calories-reveals-lack-of-progress-inachieving-sugar-reduction-targets-.html

The sustainability of vegan diets at population level

The assumption that a 'vegan shopping basket' is invariably cheaper than one containing meat-based products requires qualification.

Vegan products such as beans, pulses and lentils represent good value for money but today's society is heavily reliant upon food that is processed and pre-packaged. More of it is bought and consumed outside the home and meal preparation using raw ingredients has decreased for vegans and meat-eaters alike. However, vegan speciality foods can be costlier than their meat/dairy alternative and a vegan diet in this processed form may not be affordable for all.

There are also some environmental questions. Avocados are popular, vegan-friendly and a source of nutrient-dense calories, mainly deriving from monounsaturated fats. From 2012-2016, global imports of them grew by 21%, largely exported from Mexico, Africa and Australia to the extent that these countries' own supplies of avocados are at risk. Mexico now earns more from exporting avocados than it does from petroleum:
https://www.independent.co.uk/life-style/food-and-drink/veganism-environment-veganuary-friendly-food-diet-damage-hodmedods-protein-crops-jack-monroe-a8177541.html
This has become a driving force in illegal deforestation to make way for planting more avocado trees (Global Forest Watch, 2019):

https://blog.globalforestwatch.org/commodities/forests-falling-fast-to-make-way-for-mexican-avocado

Similarly, almond milk, is less efficacious in terms of human health than might be supposed and the environmental costs are considerable: https://www.theguardian.com/lifeandstyle/shortcuts/2015/oct/21/almond-milk-quite-good-for-you-very-bad-for-the-planet

<u>Issues of plastic pollution</u>
One of the key food and drink purchasing behaviour shifts is the movement away from single-use plastics following widespread publicity about their devastating effect on global marine wildlife. The ubiquity of single-use bottled drinks has resulted in the UK using 13bn plastic bottles per annum with only 7bn being recycled and the remaining 5.5bn despatched to landfill, littered or incinerated (House of Commons Environmental Audit Committee, 2017, Turning back the plastic tide).This offers an opportunity to make a positive change by substiting tap water (in reusable water bottles).

National Rail has acted as pioneer, and over the past 13 months, the most popular place for passengers to refill their flasks on the London North Western route was London Euston (219,487 bottles) followed by Manchester Piccadilly (141,532 bottles), Birmingham New Street (138,972 bottles) and Liverpool Lime Street (42,395 bottles) (National Rail, 2019). 'Refill' have launched an app that helps consumers to locate their nearest water top-up point; encouraging businesses to sign up and supply access to free drinking water for people who are out and about.

Water as a main drink of choice helps to ensure healthy hydration with no additional sugar or calories; a win-win for the health of the consumer and the environment.

<u>Microplastics in food</u>
Microplastics are minute plastic pieces (ranging from 5mm to 100 nanometres in diameter) that are crowding the seas and working their way into the oceans' inhabitants. The great mass of data about this involves fish, shellfish and bottled water, but researchers consider it likely that micro plastics have seeped into a wide range of everyday foods and thus into our bodies.

The precise impact for human health is as yet unclear, but one study has hypothesised that the cumulative effect of ingesting plastic could be toxic to the human immune systems and gut (Wright Sl & Kelly FJ, 2017, 'Plastic and human health: a micro issue?', Journal of Environmental Health and Science. 51; 12, pp.6634-6647). Much more research is needed but in the coming years we may see

a dietary shift away from foods about which sufficient evidence suggests contain high levels of micro plastics towards alternative sources of food and drink with lesser amounts.

<u>The environmental challenge for young people</u>
Against the background of dietary issues described above, young people are increasingly exposed to the influence of ever-pervasive social networks, social marketing campaigns and trending issues rather than evidence–based pedagogy from which to make choices.

The lack of 'joined-up' strategy from government leaves current educational entities lacking in structure and accessibility, particularly in the area of food skills. Young people are thus exposed to potential disinformation from social media-triggered echo chambers and lack the wherewithal to build food-related skills, knowledge and experiences from a young age to support decision making and better health outcomes in later life.

The Cambridge Primary Review Trust on Global Learning for Sustainability (Bourn D, Hunt F, Blum N & Lawson H, 2016, 'Primary Education for Global Learning and Sustainability', York: Cambridge Primary Review Trust) has recommend that the UN Sustainable Development Goals (SDGs) should be utilised to implement more holistic environmental education efforts within the curriculum and to enable important consensus on exactly what, why and how sustainability should be taught and presented in early years settings and beyond.

Children engaged in sustainability education have been found to increase the value they place upon diversity, fairness and empathy overall, plus having more self esteem and confidence (Hunt F, 2012, 'Global Learning in Primary Schools in England: Practices and Impacts', DERC Research Paper no.9. London UCL Institute of Education). These traits may also be useful for transitioning towards a more environmentally friendly diet in a healthy way, as dietary change requires the psychological capability and stability to maintain new behaviours over an extensive period.

In the absence of a co-ordinated national programme, Rethink Food:
https://www.rethinkfood.co.uk
is now delivering its own programme to over a hundred schools as a not for profit company with a stated mission 'to improve health and wellbeing outcomes for children, young people and communities by changing the way we think about food while working to the UN's Sustainable Development Goals.'

Also, activists and celebrities are driving action and awareness on the Global Goals and demanding responsibility from the Governments who signed up to them initially:
https://www.independent.co.uk/life-style/letter-world-leaders-global-goals-emma-watson-malala-yousafzai-climate-crisis-poverty-inequality-a9309496.html
Emma Watson, Idris Elba, Malala Yousafzai and Dr Jane Goodall were amongst other famous names who signed a text stating:

'This is an emergency. We are activists for different causes from across the world, writing as one for the first time to demand your immediate action in this critical year...Five years ago, at the United Nations, 193 countries committed to the Global Goals for Sustainable Development. A historic plan to end extreme poverty, conquer inequality and fix climate crisis. Look at our world now. ....Our climate is heating up. Natural disasters are increasing. Millions flee their homes. Children suffer without vital food and healthcare. Activists are murdered for their views...... Girls and women are refused an education and subjected to discrimination and violence. But still dare hope that in 2020 you will act decisively and courageously and kickstart a decade of action.'

Recommendations:

3.1   Environmental sustainability to be embedded into initial teacher training
3.2   UN Sustainable Development Goals (SDGs) to be benchmarks for comprehensive subject development throughout the National Curriculum and embedded within Ofsted Inspection systems
3.3   Government to build a public awareness and information campaign around dietary health supported by proven science and data findings in order to minimise unintended health and environmental consequence outcomes from pursuing diets popularised via social media trends
3.4   Development of funding options for tripartite diet/health environment studies in Further Education settings and continuing professional development in related areas (teaching/dietetics) in order to embed the topic in national learning and development pathways and maximise the social and economic opportunities for the talent pool in the field.

4. EMERGING PERSPECTIVES ON HEALTH AND CLIMATE IN DIETARY GUIDELINES

Until recently, most food-based dietary guidelines (FBDGs) focused solely upon health outcomes to the exclusion of food production methods and impacts on the natural environment.

They were originally developed by the World Health Organisation and the Food and Agriculture Organisation (WHO & FAO, 1996, 'Preparation and use of food based dietary guidelines'):
http://www.fao.org/3/x0243e/x0243e00.htm
The guidance states that FBDGs should be 'agriculturally and environmentally sustainable' but includes no practical definition.

The Millennium Development Goals prioritised finding solutions to hunger and malnutrition, but few resultant national FBDGs contained elements of environmental sustainability explicitly within their remit. In 2015, the launch of revised Sustainable Development Goals (SDGs) ignited fresh interest in the ways in which food and public health policy tools might better reflect targeted and deliverable action against the wider impacts of food consumption and production.

Scientific consensus is now coalescing around the connection between the health and environmental outcomes of our diets, but not about the optimum ways in which to embed climate change mitigation and broader sustainability issues within existing FBDGs; especially in view of the realisation that efforts to do so should also encompass economic and social considerations (FAO & WHO, 2019, 'Sustainable healthy diets - Guiding principles', Rome, Policy Guideline Document):
http://www.fao.org/documents/card/en/c/ca6640en/

Despite widespread general agreement about the content of a 'healthy and environmentally sustainable diet', individual eating habits are contextualised.

It is therefore difficult for policy-makers to promote such a diet as capable of long term adoption whilst also reflecting a necessarily diverse cultural range.

In 2010, attendees at a symposium organised by FAO and Biodiversity International agreed that:

'Sustainable Diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy, while optimising natural and human resources.'

(International Scientific Symposium, Biodiversity and Sustainable Diets United Against Hunger, FAO Headquarters, Rome, Italy, 3-5 November 2010).

The symposium also showcased analyses from the Barilla Centre for Food and Nutrition revealing that in most cases, foods which are recommended in FBDGs to be eaten in higher quantities (such as fruit and vegetables) had the smallest environmental impact, whilst those recommended for limited consumption (meat and dairy) had the highest impact.

This 'double food pyramid' is an early example of how recommending environmentally sustainable eating patterns would contribute significantly towards meeting healthy eating guidelines.

The Food and Climate Research Network investigated the integration of sustainability into FBDGs at national level; finding that by 2016, only Brazil, Sweden, Qatar and Germany had embedded environmental sustainability into their guidelines. Of these, only Brazil explicitly included elements of social and economic sustainability in terms of referencing traditional food cultures and awareness of marketing and advertising effects (Fischer CG & Garnett T for FCRN 2016, 'Plates, pyramids and planets; developments in national healthy and sustainable dietary guidelines; a state of play assessment', Food and Agriculture Organization of United Nations):
http://www.fao.org/3/a-i5640e.pdf

The report also highlighted countries with 'quasi-official' guidelines, including the Netherlands and the UK. In 2016, the UK's dietary guidelines made some progress towards incorporating sustainability, though much of the messaging was inexplicit. For example, the overarching advice to 'eat less meat' was not accompanied by benchmarks.

As knowledge in this field accumulates, further modifications to the Eatwell guide are likely; including a larger fruit and vegetable sector and a more varied protein sector containing a range of alternative proteins such as mycoprotein (Quorn) soy, tofu and others:
https://www.gov.uk/government/publications/the-eatwell-guide
https://www.mycoprotein.org/files/Protein_White_Paper_140619.pdf

The UK trajectory towards including more sustainable elements within FBDGs has been replicated by other countries such as Belgium (removal of all processed meat from the Belgian pyramid) and Canada with a focus on social eating.

However, the most promising (but difficult) route to achieving holistically–based FBDGs is likely to be the integration of sustainability into all policies; not just those

concerning food. (Tuomisto HL, 2018, 'Importance of considering environmental sustainability in dietary guidelines', The Lancet Planetary Health, 2(80, e331-e332).

The 'Planetary Health Diet' (PHD) report by the EAT Lancet Commission was launched in January 2019 and produced by 19 Commissioners and 18 co-authors from 16 countries in the fields of agriculture, human health, political and environmental sciences. Combined with a renewed focus on climate awareness (largely stimulated by Greta Thunberg) it contains a powerful incentive to achieve change in the way that food is produced and eaten globally. The report contends that current food systems pose a threat to both human health and environmental sustainability.

Whilst global food production has remained in alignment with calorie demands, more than 820 million people have insufficient food and the quality of what is being produced is generally poor; adding to the resultant micronutrient shortfalls.

Humanity has never before attempted to change the global food system on the scale advocated in the Planetary Health Diet. The report and subsequent 'planetary plate' require dramatic shifts in policy in order to achieve a 50% decrease in red meat and sugar consumption alongside a doubling in the consumption of fruits, nuts, vegetable and legumes. Radical reductions in food waste and major improvements in food production practices are also essential (Willett W et al, 2019, 'Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems', Lancet 393(10170):447-492).

Without an urgent human-centred integration of environmental sustainability targets into FBDGs and other core policy tools for dietary improvement, it is probable that clear and consistent climate-health co-benefits will be missed.

Diet-based greenhouse gases (GHGs) are predicted to rise by 50-80% from food production by 2050 if current trajectories are allowed to continue.

In summary, the embedding of climate and planetary health into FBDGs is critical if we wish to transition to diets that can sustain the human population to at least the year 2050 without causing radical alteration in the environment.

To date, most national and international climate policies and educational frameworks omit dietary choices and/or agricultural activities as high-potential mitigation areas in comparison to the promotion of initiatives such as recycling, which is four times less effective at reducing carbon emissions at the individual level than following a plant-based diet (Wyens S & Nicholas KA, 2017, 'The climate mitigation gap: educational and government recommendations miss the most effective individual actions', Environmental Research Letters, 12(7), 074024).

New Zealand is one of the first countries to promote plant-based diets. Currently, agriculture makes up 49% of New Zealand's greenhouse gas emissions; heavily influenced by dietary preferences. New Zealand has adopted the 2030 Agenda for Sustainable Development which includes a set of Sustainable Development goals. The SDGs consist of 17 goals and 169 targets that outline a universal plan to action to support people, the planet, prosperity, peace and partnership (Ministry of Health, 2019, 'Sustainability and the Health Sector'): https://www.health.govt.nz/publication/sustainability-and-health-sector

In the Netherlands, the 'Wheel of Fire' is a new validated food counselling model that serves as a simple and effective means of helping Dutch residents to make their diets healthier and environmentally sustainable.

The model encourages the consumption of:

- Large amounts of fruit and vegetables
- Wholegrain products such as bread, pasta, couscous and brown rice
- Less meat and more plant-based food
- Sufficient dairy products such as milk, dairy and cheese
- A daily handful of unsalted nuts
- Soft or liquid spreadable fats and cooking fats
- Sufficient amount of fluids such as tap water, tea and coffee.

(Brink E et al, 2019, 'Development of healthy and sustainable food-based dietary guidelines for the Netherlands', Public Health Nutr 22(13):2419-2435): https://mobiel.voedingscentrum.nl/Assets/Uploads/voedingscentrum/Documents/Professionals/Pers/Factsheets/English/Fact%20sheet%20The%20Wheel%20of%20Five.pdf

Since the 1990s, individual knowledge and development in the areas of farming, nutritional and environmental science have grown apace, but there has been insufficient effort directed towards bringing them together. In the 21st century, the value of looking at health and sustainability collectively is gaining momentum both as a means of improving nutrition and preserving the environment.

Recommendations:

4.1   The simultaneous incorporation of dietary and human health considerations into core climate and environmental policies at national and international levels

4.2   Sustainability to be embedded at the heart of all policies, especially (but not just) those concerning food

4.3　Diet and climate to be reflected within the core curriculum for young people and professionals training for roles which provide dietary advice based on FBDGs such as the British Dietetic Association's 'One Blue Dot Campaign':

https://www.bda.uk.com/resource/one-blue-dot.html

4.4　Public procurement strategies and planning incentives which are reflective of human and planetary health to recognise, connect better, support and leverage the crucial local activities which contribute to sustainable food systems and broader human wellbeing such as urban farming and community growing schemes.

5. AN INTERNATIONAL PERSPECTIVE WITH CASE STUDIES

The promotion of a healthy diet reduces the environmental footprint of food consumption in Europe and globally. Professor Walter Willet from Harvard TH Chan School of Public Health states:

'Transformation to healthy diets by 2050 will require substantial dietary shifts. Global consumption of fruits, vegetables, nuts and legumes will have to double, and consumption of foods such as red meat and sugar will have to be reduced by more than 50%. A diet rich in plant-based foods and with fewer animal source foods confers both improved health and environmental benefits.'
(Willett W, 2019, 'Food Planet Health: Healthy Diets from Sustainable Food Systems', Summary Report of the EAT-Lancet Commission).

Our current planetary diet is grounded in ultra-processed food; itself a key component in the Global Obesity pandemic. The food system is driving unprecedented environmental damage, adding up to 29% of anthropogenic greenhouse gas emissions, rapid deforestation, soil degradation and huge biodiversity loss (Vermeulen SJ, Campbell BM et al, 2012, 'Climate Change and Food Systems', Annual Review Environmental Resources 37: 195-222).

However, following the WHO/FAO Guiding Principles for Sustainable Healthy Diets, the WHO 2030 Agenda for Sustainable Development has been published, focusing on the urban environment.

Examples of action around the globe on improving food systems and related climate concerns
Mexico uses investment to improve nutrition and tackle the climate change fall-out of their current food system. Bloomberg Philanthropies invested in civil society actions and research to boost public awareness of the need for policy action to reduce diabetes and its complications, taxes on sugary drinks/junk food and for social change to support action on food and obesity. The approach is capable of wider replication. An investment of $1 billion from philanthropic and other sources could support 100 countries to apply Mexico's approach to hasten the implementation of food policy.

The power of vested interests can obstruct the efforts of policy makers to combat the detrimental effects of obesity and climate change. When the USA and Australia attempted to add sustainability to their national dietary guidelines, the move was impeded by pressure from the food industry. In contrast, Brazil surmounted negative influences to produce the first dietary guidelines with explicit sustainability recommendations (Monteiro CA, Cannon G et al, 2015, 'Dietary

guidelines to nourish humanity and the planet in the 21st century. A blueprint from Brazil', Public Health Nutrition 12: 2311-22).

Chile's robust stance has prompted change towards a combined portfolio of food labelling, taxation and marketing regulation. Bucking pressure from the food industry, protestors brandished posters emblazoned with the message 'Our President, selling out the health of our children' at the Presidential Palace gates (Senator Guido Giradi, 2019, 'People's experience – the Chilean Senator's battle for food policies', Contribution by Senator Dr Guido Giradi, Chile to the Lancet Commission, vol 393, February 23, 2019).

The Chilean government has also banned junk food advertising to children as well as Peru, Mexico, Ecuador, South Korea, Taiwan, Turkey and Denmark attempting to restrict/ban unhealthy foods (Bettina Elias Segal, 2019, 'Kid Food; The Challenge of Feeding Children in a Highly Processed World', Oxford University Press).

Yet unhealthy food marketing marches on apace in Nepal, Ghana, South Africa and Mongolia. Brazilian cities Bogata, Columbia and Curitiba have invested in public transport; improving the living environment of low-income residential areas and healthy food availability (Gilbert A, 2006, 'Good Urban Governance; Evidence from a model city?', Bull Lat Am Res 25:392-419).

The scarcity of infrastructure and oversight for markets and food vendors in low income countries has spawned food deserts and swamps, characterised by a multitude of fast food chains and outlets specialising in processed foods. The multiplying of supermarkets in low income countries may have exacerbated the problem as in Kusuma, Kenya but the Kusuma stakeholders are collaborating to upgrade marketplaces and urban food security (FAO, 2017, 'Indigenous peoples', United Nations Food and Agricultural Organisation):
http://www.fao.org/indigenous-peoples/en

Indigenous and traditional peoples constitute 5% of the world's population but 15% of the global poor, making them disproportionate victims of the Global Syndemic of obesity, malnutrition and climate change. For example, the Arctic Inuit are experiencing diminishing levels of sea ice, whilst Pacific Island Nations have become accustomed to flooding on traditional farm areas. Both situations reduce the acquisition of traditional foods.

The size and predominant role of China in the global economy provides a unique opportunity to unleash a major food transformation.

Ground-breaking Initiatives such as Belt and Road as well the open economy are increasingly shaping global food supply and demand. EAT's Chief Strategy

Officer has observed that the most recent Chinese guidelines (2016) represent a unique opportunity to review and revisit policies, but significant challenges remain in pockets of under nutrition amongst the poor and rising levels of diabetes and obesity. However the younger generation is expressing an increasingly vocal interest in pursuing healthier and more sustainable food practices (Olav Kjorven, 2019, More Than Just Food for Thought, EAT Forum).

New Zealand is the first country to have undertaken a survey of national food environments; constructing a dashboard of indicators to measure government and food industry progress and changes in the relative health of food environments. Food is the biggest export earner but also the largest source of illness, premature death, major causes of inequalities and amounts to half of all greenhouse gas emissions. In the words of Professor Boyd Swinburn:

'New Zealand could make strides by thinking about obesity and climate change together, so the underlying causes were obvious; develop sustainable dietary guidelines and invest in educating consumers about healthy sustainable diets; lead the world on policy approaches to include agriculture in emissions reduction efforts; and appoint a minister overseeing food in all its dimensions.'
(Morton J, 2019, 'Time to Keep 'Big Food' Out of Government Policy'. NZ Herald, 28th January).

According to the C40 Good Food Cities Declaration (C40 Good Food Cities Declaration, 2019. 14 cities commit to sustainable food policies):
https://eatforum.org/learn-and-discover/c40-good-food-cities-declaration/
eating sustainably and eschewing food waste could cut greenhouse gas emissions from food consumed by more than 60%. By 2050, over two thirds of the global population will reside in cities, and 11 million lives could be saved via the adoption of the Planetary Health Diet. Declaration City Mayors aim to work with their citizens to achieve planetary health for all by 2030.

The cities involved are Barcelona, Copenhagen, Guadalajara, Lima, London, Los Angeles, Milan, Oslo, Paris, Quezon City, Seoul, Stockholm, Tokyo and Toronto.

Under the Declaration by 2030, these cities commit to:

1. Align food procurement policies to the Planetary Health Diet ideally sourced from organic agriculture
2. Support an overall increase of healthy plant-based food consumption in the cities by moving away from unsustainable, unhealthy diets
3. Reduce food waste by 50% from 2015 figures

4. Work with citizens, businesses, public institutions and other organisations to develop a joint strategy for implementing these measures and incorporating it into the City's Climate Action Plan.

Other examples of sustainable food initiatives based on C40 Good Food Cities Declaration include the following:

Oslo, Norway introduced a 'climate budget'. The Mayor, Raymond Johnson, has committed to a 95% emissions reduction by 2030 but much less emphasis has been placed upon how individuals shop and what they eat.

Milan, Italy is cutting food waste via tax breaks for stores that donate left-overs to charity rather than discarding them.

Durban, South Africa is training farmers to grow crops sustainably in the city without the use of pesticides and fertilisers.

New York, USA introduced school 'Meatless Monday', committing to reduce city meat purchasing by 50%.

City authority choices on procurement, managing systems for food loss and waste and designing and regulating the food environment represent great opportunities for system change and massive investment. Their power can shape markets and influence private sector responses to a growing demand for sustainable and healthy food.

The Rudd Centre for Food Policy and Obesity highlights grassroots and community-based initiatives in the USA. Los Angeles wants to engage youth in policy change; banning teachers from working behind the counters at local McDonalds as part of McTeachers Night fundraisers.

The California Bay Area 'Bigger Picture' empowers young people to contribute their voices to change social norms around food marketing via writing workshops and film making in order to prevent Type 2 diabetes in young people.

This is also the case in North Carolina and in New York City, the Youth Food Educators Programme (YOFE) engages young people in developing counter marketing campaigns, advocacy and public speaking skills as well as designing artwork for campaigns to reduce demand for unhealthy food and linking it to environmental concerns (Mancini S and Harris J, 2018, 'Policy changes to reduce unhealthy food and beverage marketing to children in 2016 and 2017', RUDD Centre Brief, April 2018).

In 2013, a public consultation across Europe identified the following areas for action:
1. Better technical knowledge on the environmental impacts of food
2. Stimulating sustainable food production
3. Promoting sustainable food consumption
4. Reducing food waste and losses
5. Improving food policy coherence

(European Commission, 2019, 'Sustainable Food Briefing Document updated 07/08/2019. Highlighting a Public Consultation with EU Member States':
https://ec.europa.eu/environment/eussd/food.htm

UNICEF and EAT have launched the CHEW initiative (Children Eating Well) a collaboration aiming to transform global food systems; protecting and promoting the right of children and adolescents to nutritious, safe and affordable diets within planetary boundaries (EAT/UNICEF 2019 CHEW (Children Eating Well) initiative, London):
http://eatforum.org/learn-and-discover/unicef-and-eat-announce-collaboration/

The Eat Lancet Commission advocates a fundamental reorientation of food systems, proposing five strategies for a Great Food Transformation:

1. Seek international and national commitment to shift towards healthy diets
2. Re-orientate agricultural priorities from producing high quantities of food to producing healthy food
3. Intensify food production sustainably to increase high quality output
4. Strong and coordinated governance of land and oceans
5. At least halve food losses and waste, inline with UN Sustainable Development Goals.

Coca Cola: Perplexing the consumer and the planet
The actions and stance of Coca Cola represent a misleading picture for those who care about consumption and sustainability worldwide.

On 24th October 2019, The New York Times carried an advertisement extolling the merit of the product stating:

'We're all in....But we need your help to change how America recycles.'

The grounds to qualify such optimism include:

Resisting Bottle Bill legislation:

On a political front, Coca Cola advocacy against bottle bill legislation (which transfers some of the cost and responsibility back to the relevant companies) has been a persuasive and influential voice in the anti-recycling camp.

Coca Cola: Drinking the World Dry:
Coca Cola has been accused of dehydrating communities in its pursuit of water resources to resource its own plants, drying up farmers' wells and destroying agriculture. It has been reported that the company has also violated workers' right in countries such as Columbia, Turkey, Guatemala and Russia. Coca Cola accepts that without water it would have no business at all and its operations have been blamed for exacerbating water shortages in regions already affected by lack of water resources and rainfall:
https://waronwant.org/media/coca-cola-drinking-world-dry
This is a major problem in the Indian states of Rajasthan and Utter Pradesh.

The UK Coca Cola Christmas Truck Tour 2019:
The bright red bus (depicting the full sugar version of the product) visited 19 locations nationwide. The Christmas tour is now partnered with Crisis, the national homelessness charity and pledges to donate 10p in exchange for every can placed in recycling bins. The company reminds everyone that Coca Cola also have a global pledge 'World Without Waste' – to collect and recycle a bottle/can for every item that they sell by the year 2030. There is no indication of who is monitoring this or to what extent it is just virtue-signalling.

The promotion of Coca Cola in all its varieties to the child and the family continues in an upfront and aggressive way. The YouTube clip 'Change the Tune' (a remix of the Coca Cola theme jingle) has been viewed by nearly 500,000 people, sharing a very powerful message:

'Please drink soda less. It isn't happiness.'

The above scenario is both confusing and perplexing for the consumer – not just nutritionally but also with regard to planetary health.

The overall outlook on food and sustainability matters is encapsulated by Katie Dain, CEO of the Non-Communicable Disease Alliance (Dain K, 2019, 'Report: 'Radical Rethink' Needed to Tackle Obesity, Hunger, Climate', Agency France-Presse. Science and Health, January 2019):

'For too long we have been day-dreaming our way to a diseased future. A food system that secures us a better diet for this and the immediate next generations, will save millions of lives and, at the same time, help save the planet.'

Young people across the globe who are starting to find a collective voice about these issues are demonstrating their own passionate determination to achieve change.

In her book, 'No One Is Too Small to Make a Difference,' Greta Thunberg, addressing the Houses of Parliament, London 23rd April 2019 captured the mood:

'.....Did you hear what I just said? Is my English okay? Is the microphone on? Because I'm beginning to wonder.'

Recommendations:

5.1   UK Government to follow the New Zealand lead by using a Wellbeing Budget to re-frame its approach to sustainability and the food system and place the environment at the heart of policy devised by all Government Departments.

5.2   For the UK government to proactively initiate an international dialogue to combat the syndemic of obesity, undernutrition and climate change.

5.3   An examination of the influence and activities of some members of the food industry in the political process hindering effective nutrition and climate change policy.

6. DIETARY POLICY AND PRACTICE IN THE DEVOLVED UK

There are two main ways in which to achieve a diet that will benefit the health and wellbeing of the UK population whilst reducing the greenhouse gases (GHGs) that are contributing to the destruction of the habitat and the health of our global neighbours. The first is to impose policies on the population in order to secure the required outcome and the second is for people to work together to create policies that they then own.

The first approach would probably be the most efficient; the second, the most effective.

For a policy to be accepted (and therefore effective) it is necessary to change preconceptions. The introduction of any 'food policy' will by nature be contentious; therefore the rationale must be clear and the benefit manifest.

On January 16th 2019, the EAT-Lancet Commission on Food, Plant and Health:
https://eatforum.org/eat-lancet-commission/
recommended a 'flexitarian' diet; largely plant-based and focusing on a high consumption of carbohydrate-based grains, vegetables, fruit and legumes whilst significantly curtailing that of meat and dairy products.

The diet addresses global issues of food scarcity, obesity and planet sustainability and supplies a clear evidence-base to illustrate the health benefits that its adoption will bring to a UK population and worldwide. Health data and rising levels of childhood obesity necessitate action being taken across the whole of the UK and this would require substantial policy co-ordination and alignment between the devolved governments.

In 2014, The Food Ethics Council collaborated with The New Citizenship project to assess the future of food in England. The result was the development of A People's Food Policy by a coalition of representatives from organisations including the Land Workers' Alliance, Global Justice Now, the Ecological Land Co-op, The Centre for Agroecology, the Permaculture Association, trade unions, small businesses and individuals.

The policy was published in 2017, quickly adopted by over 80 organisations and Heidi Chow representing Global Justice Now said:

'From the increasing corporate control of agriculture in the UK, to the price of basic foodstuffs outstripping the rises in rural wages, through to small farmers being aggressively squeezed out of the market, with over 33,000 small to medium farms

closing down in the past decade – the UK is witnessing a series of crises in how we produce, distribute and sell food.'

Dee Butterly from the Landworkers' Alliance added:

'The lack of a coherent joined-up food policy framework in England is becoming increasingly problematic. In this country, we have shameful levels of food insecurity, with food bank usage rising year on year, and an estimated over eight million people now in a state of such financial precarity they can't afford to eat. Just last week, Unicef released a report 'Building the Future' with evidence that the UK has some of the highest levels of child hunger and deprivation among the world's richest nations, with one in five children under 15 years old currently food insecure…… We need to develop a national food policy in the coming years that transforms our food systems and that puts equality, resilience and justice at the forefront':
www.peoplesfoodpolicy.org

Backing the strategy, The Food Ethics Council said that the goal was to achieve:

'A food system where everybody, regardless of income, status or background, has secure access to enough good food at all times, without compromising on the wellbeing of people, the health of the environment and the ability of future generations to provide for themselves. In this vision, food is nutritious, healthy, good quality, local, culturally appropriate, fresh and sustainably produced':
https://www.foodethicscouncil.org/programme/food-citizenship/

The strength of A People's Food Policy is that it advocates an alteration in mindset whereby people see themselves as food 'citizens' rather than food 'consumers'. With the development of this way of thinking, countries are encouraged to devise food policies based upon the principles of food sovereignty.

Many countries have already referenced food sovereignty in their national legislation including Bolivia, Nepal, Nicaragua, Senegal, Uruguay, Venezuela and Mali.

Canada and Australia have already completed their own People's Food Policy processes, Scotland is compiling a Good Food Nation Bill and IPES-Food is currently working on a Common Food Plan for Europe.

The Common Food plan has five main objectives which aim to surmount existing barriers.
- Ensuring access to land, water and healthy soils; combating the failure to put sustainable farming first

- Rebuilding climate-resilient, healthy agro-ecosystems; combating techno-fixes that sideline the real solutions
- Promoting sufficient healthy and sustainable diets for all; combating the hidden costs of cheap food
- Building fairer, shorter and cleaner supply chains; combating the untapped potential of alternative food system initiatives
- Putting trade in the service of sustainable development export orientation; combating a race to the bottom.

'Towards A Common Food Policy For The European Union' by the International Panel Experts on Sustainable Food Systems (IPES) was adopted by the IPES Food Panel in 2019.

The document maps the current policy gaps and disconnects in each area and outlines short-term policy proposals and medium to long-term strategy.

One of the major dietary recommendations is that:

'Over time, a single body should be created for monitoring and overseeing the design, implementation and evaluation of National Healthy Diet Plans and anti-obesity and food scarcity strategies. While food banks and food assistance schemes are likely to remain an important part of the social safety net for some time to come, the longer term vision should be based on delivering social policies that address inequality, and working towards a food system where access to healthy and sustainable diets is a human right':
www.ARC2020.eu

Scotland already has a well-developed policy framework with the Good Food Nation programme. The national food and drink policy 'Becoming a Good Food Nation' was published in 2014 and set a new vision: that by 2025 Scotland will be 'a Good Food Nation, where people from every walk of life take pride and pleasure in, and benefit from, the food they produce, buy, cook, serve and eat each day.'

The plan recognises Scotland's strengths in the five key areas of Health, Social Justice, Knowledge, Environmental Sustainability and Prosperity and also the ambitious target to be recognised as a Good Food Nation by 2025. The initial programme was put out to public consultation in 2018 and the latest update published on 21st November 2019. It is a policy development model that is capable of transference to the wider UK, where specific measures can be adapted to suit local and national priorities.

In June 2016, the Welsh Government Published its Food Strategy. The Strategy set a vision for the Welsh food sector which aimed to reflect interconnections

between food and wider policy objectives. The subsequent Action Plan narrowed the food focus in Wales and at the same time, the actual macro-food policy agenda and its relevance to the wellbeing of Welsh business communities and people has become significantly wider and deeper.

Recommendations include:
- Placing sustainable diets at the heart of food and nutritional policy through adopting successful public health interventions such as Food for Life and bolstering the public sector food procurement and catering provision
- Providing support for farmers to produce less intensive, more sustainable and higher quality food products through more diversified sets of supply chains
- Increasing investment in the 'missing middle' infrastructure of the food supply chains
- Progressing research, development and extension in sustainable production and consumption systems
- Expanding horticulture
- Effective monitoring in line with the Wellbeing of Future Generations Act goals
- Creating a full Welsh Government Cabinet Minister for Food
- Creating an active network of food sector Partnership Boards.

The Common Food Policy for the European Union, the Good Food Nation for Scotland and the Welsh Food Strategy provide clear, detailed and well thought-out models that could be adapted to create a collaborative and holistic UK Food Policy. However, in the short term, investment is needed by the UK Government in the development and communication of a widespread information strategy to educate the population about the subject; outlining and explaining the range of positive outcomes that a change in food policy imperatives will bring to everyone.

The starting point may be within the school; where school lunches can be redesigned around a flexitarian diet as part of an already existing Healthy Schools Campaign. In this way a foundation for future development could be established and built upon as acceptance is gradually achieved at population level.

Recommendations:

6.1   UK Government to invest in strategies to communicate the need for widespread food policy change
6.2   Introduction of the flexitarian diet via the school meals service and parallel initiatives designed for Early Years settings

6.3 Collaboration between devolved government in the UK to establish the principles of a UK food strategy based on the concept of food sovereignty that is capable of adaptation to suit the circumstances of the individual nations

6.4 The role in the UK Government of Secretary of State for Environment, Food and Rural Affairs to be supported by a Minister of State for Food and Sustainability.

7. THE SOCIAL AND ECONOMIC CONSEQUENCES OF DIETARY CHANGE

In 1987, Gro Harlem Brundtland gave what is now the classic definition of 'sustainable development' by describing it as a system essentially requiring human societies to live and meet their needs 'without compromising the ability of future generations to meet their own needs' (Brundtland GH, Khalid M, Agnelli S, Al-Athel S, & Chidzero B, 'Our common future', New York). It necessitates preserving human rights to social mobility, wellness and economic prosperity in addition to the inheritance of functioning and protected eco-systems.

However, the dietary shifts which are most advantageous to the planet may not be of equivalent benefit to human health and economic growth (and vice versa).

It is therefore imperative to undertake robust and multidisciplinary scientific analysis of the health economic outcomes of emerging dietary patterns that are applied more consistently, together with detailed consideration of their implications for national and international public health and the environmental policies of the future.

Advances in nutrition science have demonstrated the importance of diet for good health.

A diet both balanced and varied can help in the maintenance of a healthy body weight, enhance general wellbeing and reduce the risk of diseases including heart disease, stroke, cancer, diabetes and osteoporosis. In 21st century Britain, food is plentiful and choice is determined by a wide range of social, economic and environmental factors.

Three broad classes of social and economic effects have been identified in relation to the characteristics of the United States' food system and present summary information about its overall performance. These are:

- Levels of income wealth and distributional equity
- Broader indicators of quality of life such as working conditions, job satisfaction and freedom of choice to pursue taste/lifestyle preferences
- Associated impacts on worker health and wellbeing.

Affected individuals fall into three groups:

1. People involved directly in agricultural food production (eg farmers)
2. People involved in the rest of the food system (eg processing, manufacture, food service, retailing)

3. Consumers. Food production, processing and availability can also affect community-level measures, such as economic growth and social infrastructure.

Economic Factors
The World Health Organisation (WHO) asserts that the global food price crisis is a threat to public health and jeopardises the health of the most disadvantaged groups including women, children, elderly people and low-income families. Economic factors are definitive and could impact personal nutrition status and health. It is understood that economic decision factors such as food price and income influence people's food behaviours and that prohibitive costs can deter low-income families from making healthier food choices.

Some studies link diet costs with food quality and safety.

The recent surge in food prices has precipitated serious reservations about food security worldwide. Rising food prices are having a severe impact on population health and nutritional status; therefore, people who alter their diet pattern on economic grounds may develop a range of nutritionally-related disorders and diseases, from so-called 'over-nutrition' to (or with) 'under-nutrition) even in a single household. This is likely to be exacerbated by growing food insecurity.

Currently, economics is not integrated with mainstream nutrition science or practice (other than in 'home economics) but it can enable greater understanding of how socioeconomic status may interweave with human nutritional status and health and how a resolution might be achieved. Collaborative, cross-disciplinary nutritional economic research should be given greater importance in the prevention and management of food crises (Lo YT et al, 2009, 'Health and Nutrition economics: diet costs are associated with diet quality', Asia Pacific Journal of Clinical Nutrition 2009).

Emerging dietary patterns such as plant-based, flexitarian, 'reducetarian', vegetarian and vegan; as well as traditional Mediterranean and the Planetary Health Diet (EAT-Lancet, 2019, as above) offer an opportunity to reverse some key threats to sustainable development posed by the popularised Western diet. However, these require public-facing support from world leaders, governments and large organisations to develop trust and action rather than yet further debate.

The latter is typified by an over-consumption of animal-derived foods, convenience foods/fast foods, larger portions/food waste and out of season/non-regional foods (Laestadius LI & Wolfson JA, 2019, 'Unsustainable societal demands on the food system', In Sabate J, 2019, eds. 'Environmental Nutrition: Connecting health and nutrition with environmentally sustainable diets', Elsevier, London).

Reducing over-consumption of animal products; in particular processed meat and red meat would have the greatest impact on social and economic outcomes; partly because they are eaten in such large quantities and, unlike dairy, eggs and white meat, are classified as carcinogenic by the World Health Organisation (International Agency for Research on Cancer for WHO. 'IARC monographs evaluate consumption of red and processed meat', 26th October 2015): https://www.iarc.fr/wp-content/uploads/2018/07/pr240_E.pdf and also because animal agriculture represents such a large global industry. If healthier diets were adopted (in line with current FBDG recommendations) diet-related emissions would drop by about 27%.

If more vegetarian, vegan and plant-based diets were pursued, the potential reduction in emissions could reach 70% according to University of Oxford modelling; saving between 79-129 million years of life relative to expected dietary trajectories, largely attributable to a reduction in red/processed meat and an increase in fruit and vegetables (Springmann M, Godfrey HC.J, Rayner M & Scarborough P, 2016, 'Analysis and valuation of the health and climate change co benefits of dietary change', Proceedings of the National Academy of Sciences, 113(15) 4146-4151). The research demonstrates that in order just to achieve equilibrium of emissions intensity from within the food system, a mass shift toward more heavily plant-based diets is essential.

Such shifts could have massive co-benefits both for the state of global health and also by reducing the burden of ill health on services and society for future generations through increasing dietary diversity and fibre consumption.

The Planetary Health Diet has encountered predictably robust opposition from the meat industry and associated lobbyists and some analyses suggest that the transition may be neither affordable nor accessible to the poorest groups without additional nutritional and financial assistance (Hirvonen K, Bai Y, Headey D & Masters WA, 2020, 'Affordability of the EAT-Lancet reference diet: a global analysis', The Lancet Global Health, 8(1), e59-e66).

A study from the Oxford Martin Programme on the Future of Food, published in 2016, has calculated the benefits of dietary change at $700bn -$1trn per year in savings on healthcare costs and lost working days consequent to illness, but in the interests of equity, such savings should be redirected into community-based schemes and educational and social resources to ensure that nobody is 'left behind'.

Current data indicates that flexitarian diets are more likely to be chosen by females than males, suggesting that unless eating patterns are carefully designed

to be 'gender neutral,' the social benefits may be unevenly skewed towards those identifying as women (Derbyshire E J, 2017, 'Flexitarian diets and health: A review of the evidence-based literature', Frontiers in nutrition, 3, 55). Additional research is also required in order to understand how a motivation to follow alternative dietary patterns may change over time due to ethical, personal and environmental influence.

Some evidence suggests that social pressures to adopt restrictive diets can lead vulnerable individuals into maladaptive eating patterns and potentially be used to mask an existing propensity to eating disorders (Forestell CA, 2018, 'Flexitarian Diet and Weight Control: Healthy or Risky Eating Behaviour?', Frontiers in Nutrition, 5, 59). However, a flexitarian diet may protect against some of the more serious nutritional deficiencies which may be occasioned by a poorly planned vegan diet (such as a paucity of iron, zinc, omega-3 and B12).

It should also be noted that in addition to expected and predictable concerns about the nutritional efficacy of plant-based diets, traditional dietary patterns are also failing to provide the nutrient profiles necessary for full health. In the UK, 90% of people do not eat sufficient fibre (Gallagher J, for The BBC, 'The lifesaving food 90% aren't eating enough of', Article, published 11 January 2019, available at): https://www.bbc.co.uk/news/health-46827426
a nutrient which would be more plentiful in a sustainable plant-based diet as well as a wide array of micronutrients from increased fruit and vegetable intake.

Debate now surrounds the future potential of food technologies and 'farm free' food including lab-grown meat (does not eliminate the risk of disease from consuming animal-derived red meat) and fermented protein sources from micro-organisms (Monbiot G, for The Guardian, 'Lab-grown food will soon destroy farming – and save the planet', 8 January 2020): https://www.theguardian.com/commentisfree/2020/jan/08/lab-grown-food-destroy-farming-save-planet

It has been suggested that this line of enquiry may sound the death knell for farming; a major part of the UK's culture, heritage and economy as well as providing substantial employment paths and shaping the physical landscape of the places we inhabit.

A move towards a purely plant-based diet could cause nutritional deficits and inadequate protein intake for those in the population who require protein sources in higher volume such as children, those recovering from adverse health conditions such as pulmonary rehabilitation, elite athletes and elderly people who are at risk of sarcopenia (muscle mass loss).

Little research has been conducted on the viability of alternative proteins to replace animal sources for these individuals, although an emerging body of research suggests that complete protein sources such as the fungi-derived mycoprotein (found in 'Quorn' products) may be able to supplement diets in a way that is beneficial to human health and wellbeing.

What is abundantly clear now, is that the pressure to adopt alternative diets is 'going mainstream.'

In 2016, a group called Fairr (Farm Animal Investment Risk and Return) co-ordinated 40 large institutional investment funds worth £900bn publicly to urge major food producers and retailers such as Kraft, Heinz, Nestle, Unilever, Tesco and Walmart to develop plant-based alternatives.

There is widespread acceptance of the fact that the current traditional food system is degrading the environment on which its future depends – and that at the same time, political and economic inequities in the system mean that people are not being fed effectively, with around half the global population underfed, overfed or suffering from micronutrient deficiencies.

If we are to address our environmental problems, adapt to climate change, reduce the economic costs of being unsustainable and create a more food-secure, fairer and nutritionally adequate future, then the current system must adapt and change.

First, a more equitable balance of power in the food system, at both national and international levels must be established. Second, the amount of food that is lost or wasted along the whole supply chain must be reduced. Finally, eating patterns will need to change. What and how much is eaten is directly related to what, how much and in what ways it is produced.

This means in essence; consuming more sustainably by adopting eating patterns with lower environmental impacts delivering broader societal benefits and supporting good health.

Recommendations:
7.1   Government to promote research into the health impacts of moving away from the consumption of animal products and towards the relative viability of alternative protein sources
7.2   Careful and wide-reaching public awareness campaigns to be initiated by the Government so that information and guidance about alternative protein sources is embedded into dietary advice and chef training in order to grow the knowledge base, confidence and social acceptability of new food sources

7.3   As more meat alternatives and novel food sources enter the market, it is essential that regulation is used to probe the validity of claims that are made about health and environmental impact to ensure that any 'benefits' that are offered are evidence-based.

8. A HOLISTIC APPROACH TO CHILD HEALTH

The main focus of 'dietary change' as it impacts child health and wellbeing is food, but the importance of fluid intake is becoming increasingly recognised.

Children's thirst response is underdeveloped and although sufficient hydration is essential to maintain their health, it is overlooked as a dietary essential. In 2019, the Department of Education recommended that school governors should include advice on water consumption within the context of a healthy eating ethos and Howells and Williamson have developed Community Hydration Packs (2020 in press Community Hydration Packs and the development of young children's understanding of fluid intake) but there has been no official guidance from Government.

Adequate hydration is essential for life and children are more vulnerable to the effects of fluid loss and hydration (Derbyshire E, 2017, 'Hydration for Children', London: Natural Hydration Council):
https://www.naturalhydrationcouncil.org.uk/wp-content/uploads/2017/05/NHC-Children-Hydration-Factsheet-FINAL.pdf

Derbyshire recommended that all children between 4-13 years of age should drink between 5 and 8 200ml of water per day on top of their intake from food. She has suggested that this might best be represented via the number of glasses; emphasising a need to focus on fluid intake as well as food to ensure children's future health and wellbeing.

Benefits of good hydration have been variously listed as:

- Improvement in cognitive awareness
- Increased feelings of wellbeing and happiness
- Improved concentration levels
- Greater willingness and readiness to learn.

It is therefore paramount to increase the understanding of parents and teachers about the role of fluid intake and the impact it can have on children's personal and well as community wellbeing so that beneficial lifelong habits can be developed.

A holistic and forward-facing approach to children's health and wellbeing should also include the importance of frequent physical activity alongside good hydration and healthy eating.

The Association for Physical Education (afPE) has argued that all children should understand the need to incorporate physical activity into daily life to reap a broad

range of physical, mental and social health benefits, assist with a healthy weight management and enhance quality of life. The message should be introduced in Early Years settings and Primary schools, developed in Secondary schools in PSHE and reinforced in PE and food technology.

Whilst the Healthy Schools initiative includes separate ratings for food education, school food standards, time spent on physical education and active travel, there is no mention of teaching how to assist pupils in making connections between food and drink consumption and energy used on physical activity to achieve the best individual outcomes for health and wellbeing. Also, a big opportunity to link active transport with environmental benefits in a joined-up strategy has been by-passed.

Emerging and future dietary patterns as they relate to food must therefore be considered alongside hydration and physical activity when seeking to achieve the best outcomes for the heath and wellbeing of children.

Advice from Government should contain and instil this necessary tripartite message at all levels so that parents, carers, health and education professionals are best placed to equip children with the knowledge that they need to safeguard and foster their own health and wellbeing.

Recommendations:

8.1   Government strategy on children's health and wellbeing to adopt a 'whole child' ethos
8.2   The messages that healthy eating, hydration and frequent physical activity are essential to health, wellbeing and environmental sustainability should be explicitly taught within Early Years, Primary and Secondary school curricula and clearly communicated to parents and families.

9. THE WAY FORWARD: DAVOS AND AFTERWARDS

Events at the 2020 World Economic Forum (WEF) in Davos have exemplified the urgent need to address an overburdened food system.

Addressing the Forum, the lead of the Planetary Boundaries Framework, Director of the Potsdam Institute for Climate Impact Research and Professor of Earth System Science, Johan Rockstrom, warned that the quality of food will decline due to the stressors placed on the climate (Belger T, for Yahoo Finance, 'Professor warns climate change will make food less nutritious', 22 January 2020): https://uk.finance.yahoo.com.news/davos-2020-food-quality-world-economic-forum-171620350.html

The session highlighted the huge, untapped opportunity to shift towards sustainable plates as described in the landmark 2019 Report – where half the diet is comprised of fruit and vegetables, and whole grains, plant-based oils and alternative proteins are prioritised over animal products.

The Planetary Health Diet has been proposed as a solution to feed a projected global population of 10 billion people, whilst remaining within the limits of the Paris Agreement. Without limiting climate change to this extent, the nutritional quality of crops would decline under global warming scenarios that exceed the 1.5$_c$ degree pathway.

The Forum also heard evidence from University of Oxford academics, on the health, economic and environmental impacts of potential fiscal policy levers, such as taxation and food emissions pricing, which would inevitably hit red meat and other animal products hardest whilst keeping prices lower for climate-friendly foods. The coupled health and environmental modelling work found that taxing food commodities according to their greenhouse gas (GHG) intensity could save approximately 1GtCO^2 (which when set in context is greater than the current GHG contribution of aviation) and may also lead to half a million avoided deaths.

However, the researchers noted that whilst not negligible, these numbers pale in comparison to the estimated 5.8 million deaths which may be avoided by shifting towards plant-based diets (Springmann M, Godfray HCJ, Rayner M & Scarborough P, 2016, 'Analysis and valuation of the health and climate change co benefits of dietary change', Proceedings of the Nutritional Academy of Sciences, 113(15), 4146-4151) and concluded that in order to maximise health benefits, additional policy measures to taxation would be a necessity.

Some of these policy measures may be best channelled to target education and younger generations to support plant-based diets into older age which have been

consistently associated with reduction in disease incidence and all-cause mortality in the general population (Kim H, Caulfield L, Garcia-Larsen V, Steffen LM, Coresh J & Rebholz CM, 2019).

The Oxford academics estimated that in 2020, at current levels, circa 4.4% of global deaths will be attributable to red and processed meat consumption, and will demand 2.2% of global health expenditure for the year.

Proposed 'optimal' taxes on red and processed meat in high income countries like the UK were 21% and 111% respectively, calculated by incorporating regionally sensitive health costs of consuming one extra serving of each food into the final figures, to achieve the largest and most equitable health and climate co-benefits (Springmann et al, 2017, 'Mitigation potential and global health impacts from emissions pricing of food commodities', Nature Climate Change, 7(1), 69-74 and Springmann et al, 'Emissions pricing of food commodities: climate change mitigation potential and global health impacts'):
https://www.tappcoalitie.nl/images/COP25-presentation-Marco-Springmann-1578609186.pdf

The Forum also took unprecedented steps to ensure that the food served at the event reflected the need to find solutions for sustainable diets and showcase plant-based diets and alternative protein sources as critical to the challenges.

Over the course of the summit (where almost 3,000 world leaders gathered to discuss how to achieve a 'cohesive and sustainable world') a menu of fresh, regional and plant-rich dishes was served throughout, and one day was dedicated to 'Future Foods' highlighting alternative protein sources and meat alternatives.

Another key issue was the need to end food waste, and the potential for artificial intelligence to support waste minimisations at scale and to design smarter menus at future events.

The WEF described the landmark initiative as a part of their ambition to be a leader in sustainable practices, and to 'provide participants with healthy and sustainable options, highlighting the impact of individual consumer choices on their personal wellbeing as well as the health of our planet' (WEF, Durand-Gasselin C & Sweet L, 'What's for lunch? Sustainability on the Davos menu', 17th January 2020):
https://www.weforum.org/agenda/2020/01/sustainability-davos-menu-food/

Increasing numbers of prominent organisations and events are also promoting environmentally responsible dining and food procurement, including within the Arts.

The 77th Golden Globes ceremony this year served a 100% plant-based, vegan menu to film elites, with the Hollywood Foreign Press Association President Lorenzo Soria citing as the reason that 'the climate crisis is impossible to ignore... we're hoping to raise awareness around small changes that can have a greater impact' (Barr S, for The Independent 'GOLDEN GLOBES 2020: CELEBRITIES TO BE SERVED ONLY VEGAN FOOD AT THIS YEAR'S CEREMONY', 3 January):
https://www.independent.co.uk/life-style/food-and-drink/golden-globes-2020-vegan-plant-based-meal-menu-celebrities-a9268561.html0

The move has spurred other high-profile events to follow suit with regard to the type of food served to guests including the celebrated 2020 Critics' Choice Awards which referenced the need to be 'mindful of the impact our event has on the environment' as their main motivation to do so (Gallagher S, 'CRITICS CHOICE AWARDS SERVING ONLY PLANT-BASED MEALS, FOLLOWING GOLDEN GLOBES', 10th January 2020):
https://www.independent.co.uk/life-style/food-and-drink/critics-choice-awards-ceremony-meal-vegan-a9277856.html
The commitments made at such events have been praised by influential celebrities and film icons who have used their professional standing to support dietary climate action.

Young, prominent climate and animal welfare activists such as Greta Thunberg and Genesis Butler have been enthusiastically met and praised by such celebrities whilst simultaneously being invited to global political summits (like Davos) to represent and elevate the youth voice. Through representation at such events, increasing numbers of young people are becoming aware of, engaging with and influencing the shifting global political and corporate responses to issues of climate change and dietary choice.

However, in order to achieve a truly sustainable food system, large-scale initiatives and provisions must be made accessible not only at the gatherings of the global elites, but to the general population and designed to be sensitive to the most vulnerable communities and individuals in society.

Leeds City Council is a recent public body to announce a scheme to provide vegan food to its 182 schools twice a week, in an effort to address the climate emergency, promote healthier and more environmentally friendly choices from a young age and embed learning about the importance of food and how it is produced into the area's educational culture, as part of the Leeds Climate Commission's ambitious plans to halve the city's emissions by 2025, and reach net zero by the end of the decade.

Public procurement and city-wide strategies such as these have the targeted power to change perceptions of non-traditional, emerging dietary patterns, and create sustainable habits from a young age, whilst also influencing wider family environments and regional food culture.

Cities and communities can (and should) look further into considering the next steps they might take to participate in and contribute to, regenerative food upon which feeding 10 billion depends (Graziano da Silva J & Semedo MH, for WEF 'To feed 10 billion people, we must preserve biodiversity. Here's how', 29th July 2019): https://www.weforum.org/agenda/2019/07/biodiversity-food

Projects might include investing in greening city environments, establishing community food growing programmes and prioritising increasing biodiversity in urban settings.

All of these schemes offer substantial return on investment to collective societal outcomes and strengthen the resilience of the food system in a circular way (Weber V, for WEF 'Greener, healthier, more sustainable: why cities of the future need more biodiversity', 6thJanuary 2020): *https://www.weforum.org/agenda/2020/01/future-cities-smart-sustainable-biodiverse-health/*

The interconnected nature of food, climate and health is the biggest challenge we face, but therein also lies its strength and boundless potential should we act with the necessary urgency, creativity and commitment. It is at the local level – supported by national policy – that the largest returns from such pro activity will accrue.

The food that we eat here and now can change the world.

If we are serious about protecting and restoring natural environments, safeguarding the health and wellbeing of our children today and restoring and protecting that of future generations, then there is only one solution.

We must change it.

Recommendations:

9.1   Government to launch a '21st Century Food Challenge' in which cities and communities are encouraged to devise schemes in which they can participate and contribute to regenerative new food schemes. The Challenge to be extended to the devolved UK governments and to be monitored by a well-advertised system of targets and system of regular reporting.