



SUSTAINABLE HEALTHY BEHAVIORS: ERGOT AND NUTRITION

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ABSTRACT

Purpose: The dual purpose of this paper is first, a polemic argument that, with the exception of Genetically Modified (GM) foods, our reliance on nutritional value is naturally present in whole foods, especially grain, for health and sustainability. Secondly, this paper will argue that outbreaks and food scares are often associated with food safety, and therefore are a threat to sustainability and public health behavioural change.

Design/Methodology/Approach: Empirical results found in literature reviews, research in food scares, and behaviour in consumerism, with a specific focus between 1998 and 2008, were used in examining and analysing sustainability in global food safety.

Findings: This paper submits that grains, and foodstuffs made from grains, are necessary nutrition for complete health, based upon ethics in religion, tradition and culture. For example, a condition known as ergotism linked to bacteria found in grains, causes damage to fingers, toes and extremities, and is known to incubate during winter months through vasodilation.

Originality and Value: Arguing that green behaviour as practiced in solar farming and consuming locally grown food, use of solar energy, and cloud technology are indeed sustainable collective actions fit for green behaviour, policy making and global strategies. This paper also offers considerable opportunities for extended research and improvement in examining psychology in green behaviour and global food safety.

Keywords: diseases; ethics; food scares; food contamination; green behaviour; North Carolina food safety

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INTRODUCTION

With the exception of Genetically Modified (GM) foods, this paper will examine our reliance on the nutritional quality naturally present in whole foods for health, sustainability and nutrition. Public health officials are concerned with outbreaks of a condition referred to as 'Holy Fire' and 'Saint Anthony's Fire', ergotism, which causes terrible damage to fingers, toes and extremities, and incubates during winter months. Since we now live in an age of low carbs and gluten free diets, reliance on the nutritional substances found in our grains, for example baked flour and grain based foods, are being challenged with illnesses and loss of valuable dietary value.

Ergotism, associated with transmittal between mother and infant through lactation and some pharmaceuticals, for example methylergometrine, ergotamine and calcium blockers, can result as an interaction with other dermatological drugs. Delivery of ergotism uses vasodilation, especially during cold temperatures when our body temperatures struggle with indoor and outdoor comfortability with the constriction of arteries and capillaries necessary for regulating our blood and body temperatures. Since, historically, ergotism has been present in our society for more than 8000 years, allowing insects to populate asexual spores in grains and causing delirium and damage in extremities, this paper submits that grains and foods made from grains are necessary for nutrition and complete health.

The Holy Qur'an (2:168) advises us, "Ye People, eat of what is on earth, lawful and wholesome". During the time of the prophet Mohamed, peace upon him, the choices in our food supply focus was whether food was halal or haram, and supposedly not whether food was safe for consumption. Nutritionists agree that eating grains and foods made from grain is recommended because these foods contain all the necessary nutrients for sustaining life (Lepore, 1985). Bernard Jensen argues that whole foods contain all of the vitamins known to us, and changing their composition destroys vital nutrients in our food chain (1983). The Prophet Mohamed himself was always known to eat fruit and vegetables grown locally and in season (Al-Akili and Ibn Qayyim Al-Jawziyah, 1993). Furthermore, barley naturally warms the blood

in winter: it is not preferred in summer, unless an individual is suffering from chills and colds from an illness (Jensen, 1983).

While ergotism is no longer considered a serious threat in food safety, this paper makes a polemic argument that implicates ergotism in most known and prevalent diseases, for example heart disease, diabetes, Parkinson's disease, low infant birth weight, food borne illnesses and side effects from some prescribed medicines. The World Health Organization (WHO, 1992), describes food borne illnesses as lacking appropriate public health attention, and that new and emerging pathogens are associated with food borne illnesses (Borgdorff and Motarjemi, 1997; Kaferstein and Abdussalam, 1999). Sustainability in green behaviour is adequate when addressing the environment, human migration and population growth, class and social structuring, aging and food production when included in global green strategies. Sustainable green behaviour requires perhaps a collective psychology grounded in theory and practice, while adhering to actions in self-efficacy and citizenry models.

FOOD SAFETY, THEORIES AND GLOBAL STRATEGIES

When examining food safety, gender and sustainable quality involvement, rural women in Sudan use active participation, systemic processes, and indigenous knowledge to actively contribute to food safety via household food processing (Ibnouf, 2012). During June and October, rural women, who now make up over 70% of the population, preserve foodstuffs for future use, and ensure household food security with nutritious food throughout the year (Ibnouf, 2012). In North Carolina, and most states in our nation, household food safety and security when using traceable measures from the farm to the table often ensures sustainable health and nutritional food. However, even with governmental agencies monitoring food production and food borne illnesses, regulations and oversight are dependent upon local standards.

Researchers in North Carolina targeted migrant workers and sanitation in living environments during harvest seasons, and found numerous concerns for public health. An estimated 48 million Americans suffer from food borne illnesses every year, and with US\$7.7 billion lost

due to work day illnesses, the North Carolina Department of Labour (NCDOL) reports that they currently do not have guidance laws and regulations judging food safety in facilities (Quandt et al., 2013). Quandt et al.'s findings report that, when workers experience unhealthy work environments, poor quality of input and output is often the end result (2013).

As seen in practices and theories, organisational behaviour measures in performance and safety often require education and learning, active participation, partnerships and collaborations. The purpose of the Food Safety Modernization Act (FSMA), is to safeguard the food supply chain, and monitor the professional management in logistics and administration of food safety (Kheradia and Warriner, 2013). Farm-to-fork approaches in food safety are embraced in most cultures, for example USA and UK, and provide a basic framework in safe food production, manufacturing, and legislation enforcing value, ethics and compliance (Kheradia and Warriner, 2013). Likewise, mapping consumer attitudes, behaviour, and tracing food production and consumption prompted evidence-based narratives in linking locally grown food with collaborative partnerships between vendors and farmers in North Carolina (Colloredo-Mansfeld et al., 2014). Hazard Analysis and Critical Control Point (HACCP), represents standards recognised globally in controlling, evaluating, and identifying hazards in food safety (Anica-Popa, 2011).

Mapping, as found in the Geographic Information Service (GIS), allows decision-makers opportunities for viewing through the lens of spatial data, geographical boundaries, aggregates using algorithmic measures in allocations and resources. Public health and public administration using GIS and technological innovations can bridge dichotomies in gender, race, socio-economic and global challenges in our environment. Current decision-making in resources and land use, are without concrete rules in data collection, and differ between agencies and countries, except in population census (Briassoulis, 2001). While theorists and practitioners argue that current land use strategies involve knowing local trends in culture and tradition, and its links with economics, political, social and the environment, partnerships in gender and traditional roles are challenged in green behaviour and marketing (Briassoulis, 2001).

Peattie and Crane (2005), critiquing theories and practices in green marketing, cite numerous challenges in economics, and the philosophy in marketing, hindering sustainability. While Peattie and Crane focus on packaging and marketing in green behaviour, it is true that public trust must be gained in order to attract sustainable and healthy choices in our environment (2005). Since green behaviour marketing began in the early 1990s, scepticism in changing habits in consumerism has become the norm. The concept of green marketing and green behaviour attempts to merge corporate behaviour with the wants and needs of consumers, while adhering to innovative ideas in marketing and technology. Marketing communications in environmental concerns are difficult, and choosing methods designed for each specific market should be carefully pursued in sustainability. Davies (2014) argues and draws parallelism between government policies and our food supply, 'food for thought' changing consumer behaviours to green and sustainable eating habits in the 21st century (Davies, 2014).

Again, local communities at national and global levels adopting sustainable measures in producing, processing, marketing, eating behaviour and lifestyles, require active participation. Scarcity in data and a consensus in defining household sustainability present public administration with daunting tasks in future green behaviour and quantitative studies (Davies, 2014). However, qualitative data in our ecological footprints are evident in indicators including, but not limited to, environment, socio-economic boundaries and technological innovations.

Revisiting theories in sustainable behaviour and attitudes in improving farming methods, incentives seem to translate into tangible rewards across all boundaries and around the globe. Recently, local newspapers in our South Eastern North Carolina counties reported interest in solar farming. South Eastern North Carolina already has diverse farming resources, for example blueberries, strawberries, beans, peas, tomatoes, corn, grapes, cucumbers, peanuts, pecans, grapes, yams and most recently soybeans; adding solar farming is forecast to increase yield and save on production costs. 'New solar farms provide solar surge, 2014' reports, solar farms will impact solar energy.

The National Rural Electric Cooperative Association (NRECA), and the United States Agency for International Development (USAID), have formed a partnership with North Carolina for improving and ensuring sustainability in American investments in Sub Sahara Africa. Although implemented nearly 70 years ago, farmers in Sudan are now similarly embracing sustainable technologies in the Gezira Scheme in irrigation and land acquisition; diffusion and return on investments have attracted global attention (Ahmed, 2003). Economic, social, political and environmental indicators are still key motivators in green behaviour and sustainability, bridging gaps between stakeholders and consumers across cultural and global boundaries.

DESIGN/METHODOLOGY/APPROACH

Using literature reviews and disease registries, the Environmental Protection Agency (EPA) and the Center for Disease Control (CDC), an overview and generalisation of the prevalence of foodborne illnesses during 1998 and 2008 were reviewed for findings in the USA. Food borne illnesses are normally referred to as botulism, cholera, Hemolytic Uremic Syndrome (HUS), listeriosis (*Listeria*), salmonellosis (*Salmonella*), Shiga Toxin-producing *Escherichia coli* (STEC) infections, shigellosis (*Shigella*) and vibriosis (Painter et al., 2013). Although, missing data exist in the authors' findings, thus affecting outcomes, foodborne illnesses from beans and grains are still a major concern. In addition, hypothesising and focusing on oils and sugars, when combined in incidences of grains, oils, and sugars mostly used in baked goods, different parameters and results may emerge. These results can be seen in Table 1,

which reports ergotism and Americans suffering from ergotism between 1998 and 2008 (Painter et al., 2013).

Results from CDC suggest that, virally, our foodborne illnesses are most infectious, and occur through 'all agents', plants, grains, oils, sugars, and produce in the spread of ergotism (Painter et al., 2013). Assumptions that ergot is being spread through bacteria, chemical and parasites are now challenged in these findings. National Corn Growers versus EPA, a case defining guidelines and boundaries in food safety in pesticides, domestically and for exporting purposes, found a lack of public voice and participation in policies and decision-making (Shapiro and McCarthy, 2011). Judicial courts ruled in favour of the EPA (without a public hearing as requested by the National Corn Growers), suggesting a need for green behaviour from farmers and administration, and the adoption of sustainable partnership measures between growers, administration and policy makers. Scientific findings were ruled as being insufficient in pesticide harm to corn, however pesticides in this case are not the only example of the EPA and its agency discretions. The EPA has discretion authority in product regulations at the Food and Drug Administration, and the Cosmetic Act, prescription drugs, food additives, consumer products and agriculture (Shapiro and McCarthy, 2011).

ERGOTISM AND POSSIBLE LINKS IN CHRONIC DISEASES

Postpartum psychoses, delirium, etiologically have been associated with ergotism and vasoactive drugs (Iffy et al., 1989). Ergot poisoning is also linked to alkaloids found in fungi, Claviceps purpurea, affecting the vascular system and

Table 1 Annual estimates foodborne illnesses by etiology and pathogen type, USA, 1998–2008*

Commodities	All Agents	Bacterial	Chemical	Parasitic	Viral
Plants	51.1	32.1	25.2	29.5	65.8
Grains/Beans	4.5	5.0	5.2	–	4.3
Oils/Sugars	0.7	0.9	1.1	–	–
Produce	45.9	27.0	19.0	29.5	60.3

*Emerging Infectious Diseases, www.cdc.gov/eid, March 2013.

individuals suffering from Parkinson's disease (Bennett and Klich, 2003). Other claims associated in ergot poisoning with direct vasodilation are heart disease and hypertension, which are chronic and leading causes of death in both developed and developing nations (Ward et al., 2014). This paper claims that grains are nutritionally necessary in sustainable health, and foodborne illnesses affect economic stability, defined by the WHO as being the most globally widespread health problem (Kaferstein and Abdussalam, 1999). Ergot is also described as being a plant disease; this increases the number of pathogens possibly responsible, as shown in Table 1, and etiologically increases intrinsic probabilities in contracting foodborne illness.

Since our claim that foods containing grains are derived from many sources including barley, oats, wheat, corn and various flour products, oils are essential in manufacturing and production of grain and cereal foodstuffs. Extracts and essential oils normally used in food production constitute a separate commodity in Table 1, and present an independent set of indicators in foodborne illnesses. Essential oils are oxygenated, anti-fungal, and are used in foods, sanitation and cosmetic products, and are herbal extracts and spices naturally occurring in foods (Dobre et al., 2011). Essential oils are of particular interest in this paper because of possible cofounders in ergotism and foodborne illnesses, Table 1, with respect to commodities and being pathogens in ergotism. Thus, missing data and cofounders obscure hypotheses and conclusions in the prevalence of ergotism, and links in major, chronic and often deadly illnesses.

However, mycotoxins are significant in mycotoxicoses and moulds in cheeses, also found in bread, and when exposed to aflatoxins and ergot contaminated flour (Peraica et al., 1999). Moulds used in pharmaceuticals, for example antibiotics, are beneficial in treating certain diseases. Ergot alkaloids, *inter alia*, are effective in treating Parkinson's disease, prolactic inhibiting, cerebrovascular difficulties, migraines, venous thrombosis, stimulation in cerebral, peripheral, and urine stimulation and as a dopamine (Peraica et al., 1999). Other agents necessary in ergot submission involve environmental, meteorological, social, and economic conditions favourable in growing moulds (Peraica et al., 1999). Ergot strains are found in some penicillins, and this paper indeed posits

the importance of continued monitoring in ergot poisoning and possible links between ergotism and chronic illnesses. The Holy Qu'ran 55:10–13, again reminds us the importance of healthy choices in our diets, and defines our boundless resources in the earth's supply of fruit, vegetables and whole foods. And the earth hath he appointed for his creatures. Wherein are fruit and sheathed palm trees, Husked grain and scented herb. Which is it of these favours of your Lord that ye deny?

GREEN BEHAVIOUR AND LESSONS IN HEALTH

Green behaviour and consuming locally grown crops are now being targeted with a focus on sustainability. Previous behaviour, perhaps, in consumers and produce choices and selections, were centred on diverse market providers, adding nutrients and value to their diets. Immune systems are at their best when fighting off microbes that are most harmful to us. Consuming local microbes and pathogens, some of which may be disease producing in different scenarios, are now believed to be useful allies in fighting off illnesses. Dr El-Samahy argues that longitudinal cells living in flies as parasites are antibiotics when dispersed outside their cell walls, offering healing and regenerative results (2012). As narrated via Hadith, traditions of Prophet Muhammad, peace upon him, a fly when discovered in drinking liquids should be resubmerged, before removing it, getting the benefits of osmosis in health (El-Samahy, 2012).

GREEN BEHAVIOUR AND LESSONS IN SUSTAINABILITY

Green behaviour and sustainable policies are also concerned with economics, and in local markets sketch mapping offers researchers a glimpse into culture, land use and governance (Ingalls, 1999). Local stakeholders and having a voice in decision-making are an integral part in green behaviour (Pineno, 2011). Social and economic assets and resources influence green behaviour, and motivate a culture of sustainable innovations. Establishing guidelines and standards in reporting sustainability include the Global Reporting Initiative (GRI), and the United Nations Environment Programme (UNEP): these are formulated for organisations, but are also suitable for local communities (Pineno, 2011). At the University of North Carolina

and Princeton University, spatial and economic were integrated with land use and sustainable attributes found in depletion and land erosion (Pineno, 2011). Preferred methods in collecting data use GIS, for clarity and accountability, and adhere to rigorous standards and requirements in decision making.

Sustainable Development (SD), and legitimacy theories argue in favour of transparent management tools in green behaviour, addressing economic and technological growth (Eugénio et al., 2013). While SD is mainly concerned with reporting social, economic, and environmental factors in corporate environments, it is also an important and useful tool in sustainability in local communities. Communicating SD and its potential when reporting outcomes transparently, presents public administrators with legitimate claims and adds value identity.

RECOMMENDATIONS: SOLAR ENERGY AND CLOUD COMPUTING

Carbon footprint, greenhouse gases, climate change, global warming and conflicts continue to confront sustainability and green behaviour. Bridging the gap in scarcity in sustainability data, and motivating psychological and proactive collective participation in green behaviour, requires ongoing research and innovations. Poverty is considered as our deadliest disease, and complicates efforts in sustainable and green behaviour. Food safety and foodborne illnesses affect both the privileged and the less privileged. Kaferstein and Abdussalam, posit that the rich suffer from mild forms of food poisoning based on their lifestyles, and the poor suffer more deadly diseases from lack of adequate food and proper facilities in its preparation (1999). Poverty conditions affect infants, the claim in low infant birth rates, and thus affect sustainability and health.

In science and technology, sustainable and green behaviour simplifying methods in detecting foodborne illnesses, and methods in surveillance require further development in technology, learning and training (Kaferstein and Abdussalam, 1999). More global cooperation is needed in identifying, reporting, communicating green behaviour and sustainability, including international agencies and regulations codified in human accountability and transparency.

Embracing solar and cloud technologies, relying upon green behaviour and sustainability naturally existing in agriculture and food production, require partnerships and cooperation, balancing scorecards and distributive resources.

SOLAR ENERGY

Recommendations in solar energy are emerging as alternatives in energy that offer low cost benefits. Solar energy is less polluting, reducing environmental concerns, and adds value in the developing world in food safety with lower refrigeration costs (Kaferstein and Abdussalam, 1999). Energy use and development in Sudan, like most countries, developed and undeveloped, look to harvest human and social capital within constraints and contexts (Abdeen, 2002). With abundant solar radiation and resources in wind velocity, are defined as diverse and renewable energy (Omer, 2011). Solar and thermal technologies are currently in use in Sudanese food industries, cold storage, water pumps, bakeries, communication systems and lighting (Omer, 2011). Solar energy has been linked with lowering costs in food production, farming, is less threatening to environment sustainability, and supports green behaviour.

Trends in solar panels have seen millions of dollars invested in mirrors installed outside reflecting the sun powering turbines, and producing energy (Sills, 2011). Despite investments, resources lag behind demand in solar supply. Gridlock can be avoided in solar energy using green and sustainable consumerism and use that shows ethical social responsibility, and ownership in the environment and society.

CLOUD COMPUTING

Cloud computing has been around since early times as astrology, however with interests in detecting environmental concerns in the climate, agriculture, economics and health, meteorology has recently emerged as green management technology. During the 1930s, the Irish Meteorological Service of the Department of Industry and Commerce was delegated to educate and train forecasters in weather predictions and conditions (Dixon, 1957). Historically important in the environment, and in this paper, cloud computing is associated with predicting weather patterns, and taking the

appropriate actions ensuring sustainability and continued socio-economic progress. Similar to well-known green behaviour, as published in the Farmer's Almanac, an American handbook for the lay community, it uses climate and environment predictions for planting and harvesting, and best ways for household to sustain health. Cloud computing and meteorology, assisted nations for future defence against potato blight ('Phytophthora infestans'), eliminating mycelium and damage to crops and plants (Dixon, 1957).

Mobile applications now available in most technological environments recently marketed community action in improved green behaviour in consumerism and dieting. In 'Sign in the Sky', North Carolina State found links to abnormalities in behaviour and tracking computer congestion and traffic overloads (Thilmany, 2010). Predicting overloads and bottlenecks, cloud technology allows and prepares business environments economically, and is cost saving while advancing technological development and green sustainability.

Cloud computing in Turkey focusses on energy consumption in businesses and households. Households being Turkey's largest consumers of energy, alternatives are being explored using Tradable White Certificates (WhC), an impressive system that targets

1. the Kyoto protocol
2. new environmental energy markets and CO₂ trading, most important in green behaviour and this paper and
3. public awareness and participation (Duzgun and Komurgoz, 2014).

RECOMMENDATIONS: CONTROL STRATEGIES AND ACTION PARTICIPATION

Control strategies are recommended to be administered through local government and health agencies, with international and global involvement. Health agencies are suggested with the notion that they are ethically focused on social justice and sustainable health for all people at local, national and global levels. Other recommendations are grounded in organisational developmental theories and practices in governance and public administration. Early learning and development across boundaries in culture, gender, religion, and

socio-economic taxonomies require consensus in accomplishing sustainable green behaviour.

Action participation, as a framework model and used in most organisations, agencies and non-profits attempt involving all levels in communications and bottom-to-top matrix decision-making. Therefore, this paper recommends and advocates theory-based practices and action participation. SMART models used at the Center for Disease Control (CDC), offer communities objectives and goals in participation, and motivation adaptable for local and global communities (cdc.gov, 2013). Sustainability and green behaviour should be specific, measurable, achievable, relevant and time bound. Theories in SMART sustainability and green behaviour are action and participation based, and should include motivational leadership and social responsibility.

RECOMMENDED THEORIES FOR GREEN BEHAVIOUR

- Theory of Reasoned Action/Planned Behaviour (Ajzen and Fishbein, 1980) – beliefs, culture, influences marketing and advertising.
- Social Learning/Cognitive Behavioural Theory – observation models, social interactions influences behaviour (Bandura, 1986).
- Rogers' Diffusion of Innovations – ideas, innovations, spread through culture and communications (1983).

RECOMMENDED THEORIES FOR SUSTAINABILITY AND HEALTH

- Communication-Persuasion Model – concepts communicated through persuasion, human nature, behavioural change (McGuire, 1981a, b).
- Ecological systems theory – human biology influences societal microsystems.
- System theory – abstract, spatial, phenomena and transdisciplinary, mathematical models.
- Unified theory of acceptance and use of technology model – moderates behaviour in gender, age, experiences in information technology, seeks common ground.

Theories, grounded in philosophy, sociology and psychology, target adult behaviour in this paper (changingminds.org, 2004). However learning and development starting at an early age may assist decision and policy makers in accomplishing goals and objectives in sustainable health. Green behaviour, sustainable actions in food consumption, require changing minds.

DISCUSSION

Marketing green behaviour and sustainability targets local communities, global communities, government and non-governmental agencies, non-profits, households and educational institutions, and changes and challenges in the 21st century. Despite realisations of emerging pathogens and microbes in our environment attributing to complex scenarios in food safety and foodborne illnesses, green and sustainable behaviour are intuitive values in society. Efforts in green behaviour require participation at all levels, communicating goals and objectives that are specific, measurable, achievable, relevant and time-bound. More research and scientific findings are needed in food borne illnesses; however, hypotheses in linking foodborne illnesses to chronic illnesses have strong implications in ergotism and food contamination and poisonings. Ergotism now attracts less attention in public health research, therefore there should be a call for further research in linking this to Parkinson's disease, asymptomatic, cardiac and vascular illnesses based on scientific and mixed methods in qualitative and quantitative data. Claims in the paucity of literature in food safety research studies, and indeed implicating ergotism in many existing and newly emerging illnesses, are ongoing tasks in future public administration.

With the global food trade and consumption in foodstuffs, this paper calls for collaborative efforts in regulating guidelines, and compliance in food safety and sustainable green behaviour. Efforts that are specific, measurable, achievable, relevant and time bound transcend socio-economic, gender, environment, age, political, religion and cultural boundaries in our society. Solar energy and cloud technologies being cost effective, and requiring the same

communication and partnership strategies in our local and global communities and social learning in green behaviour. Leadership across all sectors, and modelling in citizenry, are necessary in successfully leading future goals, objectives and visionary green sustainable behaviour.

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BIOGRAPHICAL NOTES

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