THE GREEN REVOLUTION AND ORGANIC FARMING CONTEXT: EFFECTS AND PUBLIC HEALTH DISPARITIES IN AFRICA

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Abstract

Introduction*: The paper provides the discourse of public health in consideration of illnesses, high mortality rate and deterioration of life expectancy in Africa. Thus, the paper is driven by the pre and current food production systems as well as the status of food and public health; looking at the juxtaposition on the effects of the green revolution and organic food production systems.*

Aim*: The aim of this paper is to conceptualise the effects of the green revolution and organic farming respectively looking at the issues of public health disparities in Africa. Notwithstanding other challenges, the paper focuses on one of the challenges that developing countries are fronted with which is public health.*

Methodology: *This paper assembled data in respect of the green revolution and organic farming on the basis of their impact on public health in Africa. Thus, the opinions of scholars are included to substantiate the argument and premise of the paper. The paper framework and methods solely depended on literature based analysis approach (reviewed of secondary sources).*

Results: *The study revealed there is public health issues due to the kind of food consumption in developing countries. The paper upholds the notion that too much consumption of non-nutrients food produced cause illnesses on the human body, predominantly in developing countries. Literature revealed relevant data that aid in drawing the analyses; that is the genetically modified seeds that degrade arable land, health issues and deterioration of life expectancy.*

Conclusion*: The system of public health in the developing countries is affected due to the kind of food consumed. As a result, the public health issues continue to be unabated. There is a need of resources for health purposes, including not only medical care but also health-promoting living on consumption of food.*

Keywords*: Organic Farming; Green Revolution; Production; Public Health; Africa.*

JEL Classification: I1 Health; **JEL Codes**: I18 Public Health.

1. INTRODUCTION

The premise of the paper is driven by the pre and current food production systems as well as the status of food and public health in developing countries. This is in consideration of the juxtaposition on the effects of the green revolution and organic food production system on public health disparities. Looking at the current food production system, a relative majority of people in the developing are faced with socio-economic issues such as starvation, malnourishment and environmental degradation (Gollin, Hasen & Wingender, 2016; Sskyewa, George & Muller, 2013; Matt, Rembialkowska, Luik, Peetsmann & Pehme, 2011; Mosley, 2003). It is evident that through the green revolution, production can be better than in organic farming; contrarily, there are increasing concerns about the health of the public in the developing countries (Matt et al., 2011). Since the introduction of green revolution in the developing countries there has been a plethora of health challenges that emanated. The challenges encapsulate a high child mortality rate and reduction of life expectancy among others (Gollin et al., 2016; World Health Organization (WHO), 2005). Thus, the problem of health became a major focus to be dealt with in developing countries, particularly in African countries (Crinnion, 2010). Subsequently, pursuing health equity means striving for the highest possible standard of health for all people and giving a special attention to the needs of those at the greatest risk of poor health (Dimitri, 2012; Crinnion, 2010).

According to Cantrell & Hettel (2004), the green revolution proved that poverty and hunger could be alleviated through the application of modern science and technology; without it, the number of poor and hungry people today would be far greater. However, not disputing the contributions of the green revolution in alleviating poverty and hunger, one could argue that poverty and hunger remain

unabated. As result, the possibility of a high rate of poverty remain while having amid the green revolution. Accordingly, the importance of organic farming is highlighted as a crop biodiversity which is a key role player in helping farmers to improve their livelihoods while protecting the environment and families' health (Bouagnimbeck, 2013; Ton, 2013; Crinnion, 2010). Interestingly, it is recorded that planting organic traditional seeds alongside the green revolution seeds is for the purpose of controlling pests than using pesticides (de Ponti, Rijk & van Ittersum, 2012; Cantrell & Hettel, 2004). It is therefore evident that the statement highlights the key aspects and role of organic seeds in terms of pests control and diseases that can emanate through the green revolution form of farming. It can therefore be argued that organic farming has the capacity of reducing negative effects on health towards the human body.

Most notably, a relative majority of African countries rely on agriculture for various productions and these include Kenya and Uganda (cash crop farming for coffee), Zimbabwe, South Africa, Zambia and Malawi (most predominantly maize production, and Ivory Coast and Ghana (cocoa) (Bouagnimbeck, 2013; Ssekyewa *et al.*, 2013). Through the ages, African countries relied on traditional agriculture (organic farming) that has usually followed ecological wisdom unlike the green revolution that relies on technologies for production (Bouagnimbeck, 2013). Thus, in contrast, the green revolution produces products that lead to a change in dietary habits; and, many people are affected by malnutrition in that regard, considering iron or vitamin-A deficiencies among others (Frankema, 2014; Matt *et al.*, 2011; WHO, 2005). Organic farming is perceived as a way of yielding food products that can offer people benefits of direct access to nutritional foods. As a result of the green revolution produce, the combination of pesticides and fertilizers to increase food production has adverse effects on human health and the environment (Mulvaney, Khan & Ellsworth, 2009; WHO, 2005; Cantrell & Hettel, 2004). As a result, this can possibly affect the health of a wide number of people mostly in the developing countries of Africa. Within this context, the issue of health, production and consumption calls for a symbiotic engagement with the ecology, cultural and social systems.

2. GREEN REVOLUTION IN AFRICAN AND WESTERN COUNTRIES

The green revolution was initiated in the United State of America and led by Norman Borlaug, "Father of the Green Revolution" who received the Nobel Peace

Prize in 1970 (Chowdhury, 2016; International Food Policy Research Institute (IFPRI), 2002). The term "Green Revolution" was first used in 1968 by the former United States Agency for International Development (USAID) director William Gaud, who noted the spread of the new technologies (Chowdhury, 2016; IFPRI, 2002). The new technologies were funded by the Food and Agriculture Organization (FAO), the Rockefeller, Ford Foundation and other organisations, for the purpose of proliferation in agriculture (Chowdhury, 2016; IFPRI, 2002). Thus, the green revolution in the field of agriculture contains the consideration of new revolution which focuses on intensifying food production. It is believed that the motive behind the agricultural farming system revolution was to eradicate hunger and poverty as well as increasing agricultural production. Ironically, ther green revolution was abandoned due to its negative impacts on the environment and human health among others (Misner & Florina, 2013; IFPRI, 2002). Later on, it was offered to the developing countries, specifically Africa in order to resolve issues such as food insecurity, yet western countries prioritised organic farming.

Accordingly, the reason why western countries deemed the strategy suitable for 3rd World countries was due to their dire socio-economic problems and high per capita population growth (Ssekyewa *et al.,* 2013; Mosley, 2003; IFPRI, 2002). Conversely, Frankema (2014) articulated that the green revolution in developing countries was never a direct strategy for managing population growth and addressing food insecurity. Instead, it has proven to be a hazardous food production system to human health in the developing countries. For case in point, African and other Asian developing countries have already experienced the tragedy of the system (Chowdhury, 2016; Gollin *et al.,* 2016; Ssekyewa *et al.,* 2013; Dimitri, 2012; Mosley, 2003). The poorest areas in Africa that relied on rain-fed agriculture are the slowest to benefit from the green revolution, contributing to widening interregional disparities and an incidence of poverty that still remains high (Chongtham, de Neergaard & Pillot, 2010; Bouagnimbeck, 2013). Therefore, it cannot be agreed that the system played a vital role in the food production in the developing countries if produced food products result in malnourishment of vitamins such as iron and vitamin A deficiency.

Notably, the green revolution's negative impact gave rise to the prioritisation of organic farming in the United States of America in agriculture for food production (Misner & Florina, 2013; Mulvaney *et al.,* 2009). That was after realising the

negative repercussions of the green revolution as a system of farming irrespective of its benefits for high yielding varieties. Moreover, most of the western countries prioritise organic farming than the use of the green revolution as a system of farming; and, that serves as a motive behind the reason why the western countries have a high life expectancy when compared to 3rd World countries (Chowdhury, 2016; Bouagnimbeck, 2013; IFPRI, 2002). In developing countries, it is rare for an individual to live up to 55-60 years in this modern generation; and as compared with the developed countries an individual can live up to 75+ years (Chowdhury, 2016; Frankema, 2014; Mosley, 2003; IFPRI, 2002). An assumption can be made that there are good health systems in the western countries and perhaps even the food they consume is of good nutritional value as compared to what people in the 3rd World countries are bound to consume. Thus, western countries prioritised organic farming regardless of initiating and introducing the green revolution, due to an awareness of vast negative impacts of the system on both the environment and society (Dimitri, 2012). It can be reasonable to argue that western countries became aware of the fact that food produced through organic farming is nutritious as compared to the one produced through the green revolution. It is therefore not a coincidence that the green revolution was abandoned and organic farming being prioritised in that regard. Moreover, the failure of green revolution was perceived through the pesticides that failed to kill insects such as fall armyworm, locust infestation and the highly pathogenic Asian avian influenza that threaten and destroy livestock and crops in the agricultural sector of most part of African Countries in 2017.

2.1. The emanation of diseases and mortality rate

According to Shiva (2016), African countries are perceived to be the most users of the green revolution system for dealing with food insecurity issues. The green revolution has been seen as a development approach to reduce poverty in many countries, particularly in the developing countries (IFPRI, 2002). Conversely, the green revolution has been a tragedy in the developing countries by perpetuating the rapid increase of health problems and mortality rates (Frankema, 2014; WHO, 2005; Mosley, 2003). Furthermore, chemically based conventional farming methods such as pesticides that are used have led to human health risks (de Ponti *et al.*, 2012; Gollin *et al.*, 2016). Pesticides have damaged wildlife, poisoned farm workers and created long-term health problems such as cancers and birth defects (Matt *et al.*, 2011; Crinnion, 2010). Additionally, in areas where the population

drinks water from the wells and rivers that contain detectable amounts of nitrate, this has amounted to diseases and high mortality rate due to the green revolution (Matt *et al*., 2011; WHO, 2005).

Due to consumption of the produced food through green revolution, people had to change dietary habits (Mulvaney *et al*., 2009; Mosley, 2003). Almost 60% of yearly deaths of children under the age of five in developing countries are affected by malnutrition as a result of deficiency of iron or vitamin-A (Lu, Toepel, Irish, Fenske & Barr, 2006; WHO, 2005; Curl, Fenske & Elgethun, 2003). As a result, there is a growth of human morbidity and mortality due to pesticide residue and malnutrition. It has been viewed that during the initial phase of green revolution, this practice induced high mortality rates among the poor (Frankema, 2014). It has been discovered that exposure to pesticide poisoning in mothers in the month of and/or after conception increases the chances of infant death within a month of birth, and also has long-lasting negative effects on child health (Ibrahim, 2016; Lu *et al.,* 2006). When mothers are directly exposed to chemical applications on the soil to improve productivity, children are exposed to those contaminants too; either before and after birth (Ibrahim, 2016; Lu *et al*., 2006; Curl *et al.,* 2003). This exposure may contribute to the relatively poor indicators of child health if applied in the presence of pregnant women or those who gave birth (Lu *et al*., 2006; Curl *et al.,* 2003). For example, illnesses such as coronary heart disease have been shown to be more common in adults who have babies; that resulted to low-birth weight and can be inheritable to subsequent generations (Lu *et al*., 2006; Curl *et al.,* 2003).

3. THE EFFECTS OF GREEN REVOLUTION

The nutritional gains of the green revolution have been uneven; although the overall calorie consumption increased, dietary diversity decreased for many poor people and micronutrient malnutrition persisted (Shiva, 2016; Morris, Kelly, Kopicki & Byerlee, 2007; Evenson & Gollin, 2003). In some cases, traditional crops that were important sources of critical micronutrients such as iron, vitamin A and zinc were displaced in favour of the higher-value staple crops (Shiva, 2016; Evenson & Gollin, 2003). Intensive monoculture systems can lead to the loss of wild leafy vegetables and fish that the poor had previously harvested in the developing countries (Shiva, 2016; Conway & Barbier, 2013). Farm workers are estimated to suffer pesticide poisoning every year, and at least 20,000 die annually

from this exposure, particularly in the developing countries (Quinn, de Vos, Fernandes-Whaley, Roos, Bouwman, Kylin, Pieters & van den Berg, 2011; Rother, Hall & London, 2008). These effects can possible affect relative majority of African countries because of the reliance on monoculture seeds for production than poly-culture seeds.

3.1. Poly-culture and monoculture seeds

The type of seeds considered for food production through the green revolution are called monoculture seeds while organic farming uses polyculture seeds for food production (Suthar, 2008; Lutz, 2003). Organic farming is a method of crop production, through poly-cultural, that does not use pesticides, fertilizers, genetically modified organisms, antibiotics and growth hormones (Crinnion, 2010). Accordingly, poly-cultural is the use of multiple crops in the same space that provides crop diversity that result in the diversity of natural ecosystems that avoid using a large stand for a single crop (monoculture) (de Ponti *et al.*, 2012; Suthar, 2008). In contrast, monoculture seeds produce products that can lead to a change in dietary habits and result in malnutrition due to deficiencies in iron or vitamin-A among others (Suthar, 2008). Monoculture seeds were used to feed animals and can be turned into biofuel in order to fasten food production for human consumption (Frankema, 2014; Suthar, 2008; Lutz, 2003). According to Frankema (2014), biofuel is produced through contemporary agricultural processes such as agriculture and anaerobic digestion. Thus, too much consumption of biofuel and food produced through monoculture seeds can cause emerging illnesses on the human body (Frankema, 2014; Matt *et al.*, 2011). To this end, African countries can be affected and become vulnerable to such effects due to reliance on monoculture for food production in an attempt to address socio-economic issues that are prevalent. According to Frankema (2014), monoculture productivity is not necessarily good for human consumption because it results in malnutrition and is killing children under the age of 5 years so rapidly. However, monoculture productivity possibly causes new diseases on human bodies and therefore impairs the public health system to a relative majority of the developing countries.

3.2. Pesticides and herbicides

The use of chemical fertilisers, synthetic herbicides and pesticides dramatically influenced the environment by increasing pollution and erosion (Ibrahim, 2016). All too often, the combination of pesticides and fertilisers turn out to have adverse

environmental effects (Shiva, 2016; Quinn *et al*., 2011). For example, the heavy use of pesticides has caused severe problems; new organic farmers cite the rising costs of seed, fertilizer and pesticides including concerns that decades of chemical use are ruining the soil (Rother *et al*., 2008). The overuse and misuse of pesticides and herbicides result in malarial mosquitoes breeding in stagnant pools of water that contribute to rural poverty abounds (Ibrahim, 2016; WHO, 2010; Morris *et al.,* 2007). Excessive tillage and the use of synthetic materials including fertilizers, pesticides and fumigants, destroy the soil structure and interfere with microbial and root exudates that help hold soil particles together (Ibrahim, 2016; Morris *et al.,* 2007). Additionally, use of synthetic nitrogen fertilizers has been implicated in reducing the amount of organic carbon and nitrogen that is sequestered by the soil (Ibrahim, 2016). This increases the chances of affecting human health by certain diseases, because farmers who spend most of their times on the field are exposed to toxic chemicals. But many scholars are also revolting against what they see as the environmental degradation that has come with the new farming techniques, particularly the serious pollution of drinking water that village residents blame for causing cancer and other diseases (WHO, 2010). Some farmers are turning their backs on modern agricultural methods (the use of modified seeds, fertilizer, and pesticides) in favor of organic farming (Conway & Barbier, 2013).

The chemicals that are added to the soil and plants could possibly pollute the soil, water and plants around the fields. Therefore, the pollution of the water can be exposed to people and the environment considering the chemicals that are used in the farm fields. The pollution of the soil will result into lower soil quality, which increases the risk of erosion of the topsoil (Ibrahim, 2016; Morris *et al.,* 2007). Evidently, the decline in soil quality can be reversed through the practice that is used by organic farmers. With a few exceptions, the impact of water pollution on all of these dimensions of health in the developing countries has largely been neglected (WHO, 2010). As a result, a relative majority - if not all - of African countries are vulnerable to such effects due to the problem of water scarcity and drought in the continent. There is a significant health risk from pesticide residue on the foods that people eat. People eating a conventional food diet had eight times the organophosphorus pesticide exposure compared to those who eat organic diets (Lu *et al*., 2005; Curl *et al*., 2003). The situation of people eating contaminated food with pesticide residue can be worse if people do not eat organic food. Predictably, one can argue that grown food through conventional

farming is heavily pesticide redden than organically grown food. The point of reference is the soils of organic farming systems that continually rid themselves of pesticides; thus, the pesticide residue gap between conventional and organic farming will grow even larger (Misner & Florian, 2013; de Ponti *et al.*, 2012).

3.3. Farmworkers health

The population groups affected by pesticides use are mostly farmworkers and their families. These people live in communities near the application of toxic pesticides, where pesticides drift and water contamination is common (Evenson & Gollin, 2003). Severe pesticide poisonings for farmworkers are only the aspect of health consequences of pesticide exposure (Rother *et al.*, 2008). Many farmworkers spend years in the field exposed to toxic chemicals; and some studies have reported increased risks of certain types of cancers among farmworkers (Quinn *et al.*, 2011; Rother *et al.*, 2008). Thus, some emerging science on endocrine disrupting pesticides reveals that pesticide exposure result in chronic health effects (Shiva, 2016). Pesticide residues in food as a measure of pesticide exposure involve the toxic chemicals in production that put workers' health at risk (Rother *et al.*, 2008). Pesticide use in production and farmworker exposure is a necessary consideration in looking at the whole pesticide problem. Evidently, it could be reasonable to say both pesticide applicators and fieldworkers, who tend to and harvest the crops, come into frequent contact with pesticides. Their families and children are then exposed to these pesticides through contact with them and their clothing. Furthermore, pregnant women working in the fields unwittingly expose their unborn babies to toxic pesticides as well (Lu *et al.*, 2006).

3.4. Consumer Health

Over consumption of saturated fats is recognised as a contributory factor in cardiovascular disease (WHO, 2005). Other studies have indicated that partaking in a lot of conventional food and exposures to pesticides may have an influence on sperm quality (Ibrahim, 2016; Evenson & Gollin, 2003). This is of particular interest given the average sperm concentrations around the world, where in the last 50 years until 1990, fell by half from around 113 million/ml to around 66 million/ml16 and are still falling by around 2 per cent a year (WHO, 2005). According to WHO (2005), it has been estimated that the minimum level needed

for men to reproduce is around 20 million/ml. Recent studies found that groups of men who consumed organically grown food had average concentrations of 99 and 127 million sperm/ml respectively, considering the higher food intake of organic food: >25 versus >50 per cent of their diet (Ibrahim, 2016; WHO, 2005; Evenson & Gollin, 2003; Mosley, 2003). The control groups who did not eat organically grown food had average concentrations of 69 and 55 million sperm/ml (Ibrahim, 2016; WHO, 2005; Evenson & Gollin, 2003; Mosley, 2003). In essence these differences demonstrate coherently the quality of both organic and genetically modified foods impact on the human body. Taking into consideration the genetically modified food, the average person in the developing world consumes roughly 25% more calories per day now than before (WHO, 2005). As a result, too much calories can result in overweight or obesity although calories are for providing energy. Interestingly, conjugated linoleic acid (CLA), a natural fat found in beef, poultry and eggs can help prevent cancer, reduce heart disease and help weight control (Matt *et al.*, 2011; Crinnion, 2010). CLA levels increase in meat and milk if there is a higher content of grass, hay or silage of organic fodder for cattle's diet (Matt *et al.*, 2011; Crinnion, 2010). As a result, partaking in such food content can eliminate diseases that are caused by conventional farming.

4. ORGANIC FARMING IN RESPECT OF PUBLIC HEALTH

Organic agriculture does not utilise the toxic chemicals and thus eliminates enormous health hazard to workers, families and communities (Chongtham *et al*., 2010; Crinnion, 2010). Food produced from organic farming is assumed to contribute to better health. Hence, Crinnion (2010) accords that food produced through organic farming reduce the pesticide exposure for all and increases nutritional quality. Crinnion (2010) further suggests that a shift to organic agriculture is the only way to eliminate toxic pesticide exposure for everyone. Organic foods can help protect what is most valuable to people including health. The benefits of organic farming are widespread and important to multiple sectors of society. Eating a healthy diet rich in antioxidants, vitamins and minerals is a solid investment in preventative care (Dimitri, 2012). More recent clinical evidence comes from doctors and nutritionists who administered alternative cancer treatments where they have observed that a completely organic diet is essential for a successful outcome (Ton, 2013; Dimitri, 2012; Crinnion, 2010). Nutritional cancer therapies have revealed that the avoidance of pollutants and toxins food as much as possible, the exclusive consumption of organically grown

foods and increases in nutrient intakes have yielded good results (Dimitri, 2012; Crinnion, 2010). There are reports of positive health effects in humans resulting from the consumption of organically grown foods. Some reports highlighted that improved health of the African people began with serving almost exclusively organically grown produce (Ton, 2013). The following observations were made: lower incidences of catarrhal conditions, decline in colds and influenza, more rapid convalescence, excellent health generally, clear and healthy skin and improved dental health among others (Crinnion, 2010). Furthermore, studies have also shown that dairy products from organically raised animals are healthier than conventionally produced dairy products for human consumption (Bouagnimbeck, 2013).

According to Bouagnimbeck (2013), the organically grown food averaged 63% higher in Calcium, 78% higher in Chromium, 73% higher in Iron, 118% higher in Magnesium, 178% higher in Molybdenum, 91% higher in Phosphorus, 125 % higher in Potassium and 60% higher in Zinc. These highlight the reflection of outputs that would be beneficial for developing countries in the context of public health. As a result, preventing disease is much more cost efficient than treating them. Organic foods can play an important role in keeping people healthy. It has also been proven that organic farming is important for families in protecting and enhancing the health of their children (Misner & Florian, 2013; Curl et al., 2003). Young bodies in particular are more susceptible to the impacts of pesticides, fungicides and other synthetic chemicals used in non-organically grown fruits and vegetables (Lu *et al.*, 2006; Culr *et al*., 2003). In essence, dietary contamination of food is a source from pesticide exposure and organic farming is critical to reducing such pesticide exposure. However, not only does organic food promotes the lack of toxic residues in production, it also ensures better human health and the environment than conventional production (Ton, 2013; Crowder *et al.*, 2010). Research has shown that organic farming contributes to clean water by using biological fertilizers that release nutrients slowly, build soil organic matter, increase soil water-holding capacity and reduce leaching of nitrates into groundwater (Ton, 2013; Dimitri, 2012; Crinnion, 2010). This means that organic farming can also reduce the vulnerability and accumulating illnesses for people in rural Africa who still depend on groundwater, rivers and dams as a source of water.

5. CONCLUSION

It is worth noting that dire socio-economic issues in most developing countries become the push-factors for adopting the green revolution. Furthermore, literature reveals that most developing countries have no option but to use green revolution as a source of food production. However, green revolution strategy is perceived to be based on intensification of favourable areas; hence its contribution to poverty reduction was relatively lower in the marginal production environments. As revealed by various scholars, consumption of too much food produced through green revolution causes different kinds of diseases such as obesity, heart failure/attack among others. Moreover, there is persisting and unabated poverty as well as food insecurity in most parts of African countries, despite an adoption of the green revolution. As a point of reference, the World Bank conducted a study in 1986 that concluded that rapid increase in food production did not necessarily result in lessening hunger.

On one hand, green revolution is a strategy that is considered for fastening the increase of crop production through artificial fertilizers, pesticides and high yield crop varieties (HYV). Within this context, it is perceived that green revolution produces products that are assumed to be the leading factors to a change in dietary habits. As a result, people are affected by malnutrition in that regard, looking at the iron or vitamin-A deficiencies due to food consumption. On the other hand, organic farming is perceived as a method of crop production that relies much on choosing not to use pesticides, fertilizers, genetically modified organisms, antibiotics and growth hormones among others. Therefore, the study revealed that organic farming is a way of yielding food products that can offer people benefits for a direct access to nutritional food. Then the paper upholds the notion that too much consumption of food produced through green revolution can cause illnesses on the human body, predominantly in developing countries because they are vulnerable and tend to experience health disparities.

Even though organic farming is perceived to be slow or gradual in the production of food products, there are disparities in terms of the impacts on public health with green revolution, predominantly in the developing countries. This shows that it is not a matter of producing pleasurable loving food consumers and also adhering to environmental attuned. Accordingly, there is a need to consider domestic issues such as malnourishment, poverty and hunger that prevail and

continue to widen the gap between the rich and poor. Health is needed for optimal functioning in every sphere of life. Therefore, there are resources needed to be healthy, including not only medical care but also health-promoting living. The question remains, why is the green revolution used in most African countries and less in the western Countries? Considering analysing and answering this question, it will be easy to deal with the issues of public health in Africa.

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