



Malnutrition and Its Impact on Economic Development in Rwanda: Case Study of Mushonyi Sector in Western Province of Rwanda

Kalulu Ronald, Ingabire Stella, Twagirayezu Jean Pierre, and Manimfashe Bonheur

Department of Tourism and Hospitality

University of Tourism, Technology and Business Studies, Rwanda

Email: kaluluronald@gmail.com

Abstract: *The study focused on malnutrition and its impact on economic development in Rwanda using a case study of Mushonyi sector in Western Province in Rwanda. The study used both qualitative and quantitative designs with total population being 1500 as per sector population records in 2020. Sample size was 375 determined by using Krejcie and Morgan table (1970). Stratified, clustered, purposive and convenience sampling technique were used. The causes of malnutrition prevalent in the sector were found to be poverty, social exclusion, injustice, political exclusion and imbalances in power, unhealthy eating habits, low level of health education, lack of balanced diets among others. Malnutrition impact on the social livelihoods, and economic development as it increases health care costs, deepens poverty, increases child mortality and those children who are malnourished have poor grades in schools. Therefore, initiation of local community nutrition education and training programs, enhancement of gardening skills, strengthening food security, access to health facilities, and community empowerment as well as frequent provision of Shishakibondo flour (balanced porridge for children) to the poor communities be support in Rwanda. Recommendation was that, a pro-equity agenda that mainstreams nutrition into food systems and health systems supported by strong financing and accountability be implemented by governments, businesses and civil society and that they must step up efforts to address malnutrition in all its forms by tackling injustices in food and health systems by providing health education, supporting community development projects like livestock and agricultural projects so that they become able to get nutritious food.*

Keywords: *Malnutrition, Nutrition, Balanced diet, Economic development, Mushonyi sector*

How to cite this work (APA):

Kalulu, R., Ingabire S., Twagirayezu J. P., & Manimfashe, B. (2022). Malnutrition and Its Impact on Economic Development in Rwanda: Case Study of Mushonyi Sector in Western Province of Rwanda. *Journal of Research Innovation and Implications in Education*, 6(1), 329 – 337.

1. Introduction

Globally, 1 in 9 people is hungry or undernourished, thus 820 million worldwide – are hungry or undernourished,

with numbers rising since 2015, especially in Africa, West Asia and Latin America. Around 113 million people across 53 countries experience acute hunger, as a result of conflict and food insecurity, climate shocks and economic turbulence. At the same time, more than one-

third of the world's adult population is overweight or obese, with increasing trends over the past two decades i.e., 1 in 3 people is overweight or obese and that most people cannot access or afford a healthy diet or quality nutrition care (Save the children report 2020). The latest estimate is that there are around 20.5 million children with low birth weight. In 2018, 42.2% of infants 0–5 months were exclusively breastfed. In 2016, anaemia affected 613.2 million women of reproductive age, 35.3 million of whom were pregnant.

The same report stated that there exist significant barriers to healthy diets and lives yet Poor diet is the leading cause of mortality and morbidity worldwide. This alone has affected the achievement of the Sustainable Development Goals (SDGs) especially where the United Nations (UN) Decade of Action on Nutrition 2015–2025 articulated the goal of eliminating all forms of malnutrition by 2025, a goal underpinned by the principle of universality and achieving food and nutrition security for all. SDG 10 recognizes that equality and the pursuit of equity are inextricably linked in the imperative to 'leave no one behind': (Transforming our world: the 2030 Agenda for Sustainable Development).

The (WHO,2021) report stated that in 2020, 1.9 billion adults are overweight or obese, while 462 million are underweight and that globally in 2020, 149 million children under 5 were estimated to be stunted (too short for age), 45 million were estimated to be wasted (too thin for height), and 38.9 million were overweight or obese. Around 45% of deaths among children under 5 years of age are linked to undernutrition. These mostly occur in low- and middle-income countries. At the same time, in these same countries, rates of childhood overweight and obesity are rising. The developmental, economic, social, and medical impacts of the global burden of malnutrition are serious and lasting, for individuals and their families, for communities and for countries.

According to World Health Organization report (2013), malnutrition status is internationally recognized as a threat to a national economic development. Malnutrition is both an input into and an output of the development process. FAO et al. (2017) argued that a well-nourished, healthy workforce is a precondition for successful economic development, and as such, food security, nutrition, health and sanitation are a responsibility of all development sectors. This is in support of the World Health Organization report (2017) that stated that malnourished adults are less able to work, offer less contribution to local economies, and that children in such families are academically and socially affected, especially in their families. Save the Children (2019) added that malnourished mothers are more likely to have underweight children, who will in turn have a higher risk of physical and cognitive impairment which perpetuates a cycle of poverty and economic stagnation (United

Nations, 2017). Poverty means lack of or limited access to basic necessities, such as safe clean water, health care, shelter, sanitation, nutritious food and basic education due to economic constraints (Connolly-Boutin and Smit, 2016).

In the global perspective, there were 821 million undernourished people in the world (10.8% of the total population) in the year 2017 (23% of the world) were undernourished (World Health Organization report, 2018 and Ministry of Health-Rwanda, 2020). However, there has been an increase of hunger since 2015, when about 795 million, or 10.6%, were undernourished (Connolly et al. 2016). In 2015, Abu et al. (2016) noted that protein-energy malnutrition was estimated to have resulted in 323,000 deaths down from 510,000 deaths in 1990. World Health Organization report (2017) agreed that other nutritional deficiencies, which include iodine deficiency and iron deficiency anemia, resulted in another 83,000 deaths. Save the Children (2012) indicated that about a third of deaths in children are believed to be due to under nutrition, although the deaths are rarely labeled as such. According to Bitew et al. (2010), in 2010, it was estimated to have contributed to about 1.5 million deaths in women and children, though some estimate the number may be greater than 3 million. An additional 165 million children were estimated to have stunted growth from malnutrition in 2017-18 (FAO et al., 2017) though it changed in 2019 where 28.8 children become healthy globally as per the recent report of Save the children.

The number of undernourished people in sub-Saharan Africa rose from 181 million in 2010 to almost 222 million in 2016. Among children, although the prevalence of stunting decreased from 38.3% in 2000 to 30.3% in 2017, the numbers affected increased from 50.6 million to 58.7 million due to population growth. The rate of wasting in 2017 was 7.1% or 13.8 million children, of whom 4 million were severely wasted. Overweight rates are also increasing. The number of children younger than 5 years who are overweight increased from 6.6 million in 2000 to 9.7 million in 2017. For children aged 5–19 years, obesity rates doubled between 2006 and 2016, while for adults, overweight and obesity increased from 28.4% in 2000 to 41.7% in 2016 (WHO,2019).

The combination of direct and indirect deaths from malnutrition caused by unsafe water, sanitation and hygiene practices is estimated to lead to 860,000 deaths per year in children under five years of age (Save the Children, 2012) and some women. For instance, the (WHO, 2013) pointed out that under nutrition were 1.5–2 times higher in women than in men, especially when it stated that women often receive a lower share of food requirements than men all of which contribute to malnourished mothers yet they(mothers) are the ones

caring for children. The reason forwarded was that men get sufficient nutritional values outside families than women who stay at home (Connolly et al., 2016). This was in line with the Centre for World Food Studies (2003) that found that the gap between levels of under nutrition in men and women is generally increasing though the gap varies from region to region and from country to country. Thus, malnourished mothers are more likely to have low birth weight babies; face higher mortality and disease rates, impaired mental and physical development and increased risk of adult chronic diseases while stunted children with inadequate food, health and care become stunted adolescents.

However, the 2019 report saw an improvement of 28.8 children becoming healthy (Save the Children, 2019). Although still there exist poor standards of living among children as stated by Save the children report of 2019, “Only 1 child in 4 meets minimum standards for dietary diversity and more than 39% are stunted, or chronically malnourished. Hungry children get sick more often, so they miss out on school. Even worse – children rarely recover from malnutrition in early childhood. Nutrient deficiencies prevent them from developing to their full potential, both physically and mentally. This is true as most of African continent especially in Malawi, 80% of the continent’s population relies on agriculture for their livelihood including Rwanda where the study was

2. Literature Review

This section presents review of related literature and the various studies in relation to the problem under investigation.

“The Global Nutrition Report calls on governments, businesses and civil society to step up efforts to address malnutrition in all its forms and tackle injustices in food and health systems. Everyone deserves access to healthy, affordable food and quality nutrition care. This access is hindered by deeper inequities that arise from unjust systems and processes that structure everyday living conditions.”

Malnutrition: causes and effects on the economy

On 1 April 2016, the United Nations (UN) General Assembly proclaimed 2016–2025 the United Nations Decade of Action on Nutrition. The Decade is an unprecedented opportunity for addressing all forms of malnutrition (WHO,2021). It sets a concrete timeline for implementation of the commitments made at the Second International Conference on Nutrition (ICN2) to meet a set of global nutrition targets and diet-related NCD targets by 2025, as well as relevant targets in the Agenda for Sustainable Development by 2030—in particular, Sustainable Development Goal (SDG) 2 (end hunger,

conducted. Therefore, any upset in agriculture like recurrent droughts and poverty, climate change and its impact etc., brings a lot of misery and causes food insecurity in rural families (World Health Organization report, 2017).

From the social and economic perspective, acceptable nutrition makes an important contribution to economic progress as healthy populations live longer, are more productive and are less expensive to treat (increases health care costs-on both government and on individuals) yet the reverse is true such as increased mortality, increased risk of illnesses and results in lost employment or schooling, especially to young population like school going children as they attain fewer grades of schooling and develop poorer cognitive skills (Ministry of Health, 2017). This was the reason why the researchers conducted this study to find out the impact of malnutrition on economic development in Mushonyi sector. The study was guided by three research questions as follows; i) What are the causes of malnutrition in Mushonyi sector? ii) What are the effects of malnutrition on economic development in Mushonyi sector? iii. What is the relationship between malnutrition and economic development? iv) What appropriate strategies can be employed to overcome malnutrition to achieve economic development in Mushonyi sector?

achieve food security and improved nutrition and promote sustainable agriculture) and SDG 3 (ensure healthy lives and promote wellbeing for all at all ages).

On the other hand, WHO aims for a world free of all forms of malnutrition, where all people achieve health and wellbeing as per the 2016–2025 nutrition strategy. Actions to end malnutrition are also vital for achieving the diet-related targets of the Global action plan for the prevention and control of noncommunicable diseases 2013–2020, the Global strategy for women’s, children’s, and adolescent’s health 2016–2030, and the 2030 Agenda for sustainable development. WHO and the Food and Agriculture Organization of the United Nations (FAO), the UN Decade of Action on Nutrition calls for policy action across 6 key areas:

- a) creating sustainable, resilient food systems for healthy diets;
- b) providing social protection and nutrition-related education for all;
- c) aligning health systems to nutrition needs, and providing universal coverage of essential nutrition interventions;
- d) ensuring that trade and investment policies improve nutrition;
- e) building safe and supportive environments for nutrition at all ages; and

- f) strengthening and promoting nutrition governance and accountability, everywhere.

This means that malnutrition is a big concept that require concerted efforts by all sectors ad actors as there is a clear link between infant and young child feeding practices and household characteristics. Continued breastfeeding up to 1 or 2 years of age is less common for children in wealthier households, urban areas or with a more educated mother. In contrast, rates of solid food introduction and minimum diet diversity are substantially lower for children in the poorest households, in rural areas or with a less educated mother. Although more granular high-quality nutrition data is needed, we have enough to act.

In this case, various scholars have varying description of what malnutrition is. The World Health Organisation (WHO,2021) describe malnutrition, to all its forms of undernutrition (wasting, stunting, underweight), inadequate vitamins or minerals, overweight, obesity, and resulting diet-related noncommunicable diseases. Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. The term malnutrition addresses 3 broad groups of conditions:

- undernutrition, which includes wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age);
- micronutrient-related malnutrition, which includes micronutrient deficiencies (a lack of important vitamins and minerals) or micronutrient excess; and
- overweight, obesity and diet-related noncommunicable diseases (such as heart disease, stroke, diabetes and some cancers).

Others like (Abu et al., 2016) stated that it is a condition that occurs when a person's diet doesn't contain the right amount of nutrients. For them, malnutrition is categorized as under nutrition and over nutrition. Under nutrition refers to an insufficient provision of energy and nutrients, such as good quality protein with an adequate balance of essential amino acids, vitamins and minerals, and an inability to meet the requirements of the body to ensure growth, maintenance, and specific functions. There are 4 broad sub-forms of under nutrition: wasting, stunting, underweight, and deficiencies in vitamins and minerals. Over nutrition is defined as the overconsumption of nutrients and food to the point at which health is adversely affected (Abu et al., 2016).

Jean (2018) stated that the biggest problem of under nutrition especially in developing economies while over nutrition is affecting the giant economies. Over nutrition

is often associated with prevalence of obesity, hypertension and cancer, which entails substantially increasing healthcare costs and productivity losses to the individual and the society (FAO et al., 2017). For example, the costs attributable to overweight and obesity in China are expected to rise from about US\$50 billion in 2000 (or 4 percent of gross national product [GNP]) to about US\$112 billion in 2025 (or 9 percent of GNP) (Derek et al., 2012). Studies by (Bitew et al. 2010, & Sachs et al. 2017) associate nutritional deficiencies with increased poverty, less productive life, lost time and income in sick-time, and that this condition increases public expenditure on individuals hence affecting national development, prevents people from reaching their full potential, damage to physical and cognitive development during the first two years of a child's lifespan, children have weaker immune systems, more infections and illnesses, stunting and its accompanying problems (Abosedo et al.,1991; Connolly et al., 2016 and FAO, 1998). It is true as urged by experts of the WHO, (2017) as children who suffered from under nutrition have less lean body, retarded body growth, achieve lower educational levels than healthy children and that the low education levels attained, often makes them less qualified for work, thus reducing their income-earning potential for non-manual work and taking days off work means lost productivity and lost wages.

In 2020, malnutrition remains a pressing global challenge. Even though some progress has been made towards ending malnutrition, it has been too slow and unfair (Global nutrition report,2020). For instance, childhood stunting has dropped globally from 165.8 million in 2012 to 149 million in 2018, representing a 10% relative decrease. No country worldwide has managed to reverse the rising overweight and obesity trend. The Global Nutrition Report 2020 reveals that one in nine people are still hungry or undernourished. There are also 149 million children under the age of 5 who are still affected by stunting globally. Meanwhile, the world has transitioned to one in which more people of all ages are obese than underweight, with one in three people either overweight or obese. In addition to this, the outbreak and spread of COVID-19 presents new risks and threats for nutrition all over the world. During these uncertain times, countries are often unprepared to face the global nutrition crisis. (Mannar, Venkatesh, Micha & Renata, 2020).

Majorly, malnutrition, according to (WHO, 2017 and FAO,2018) is a result of poverty due to unemployment, income disparity, political instability, ignorance due to low education (NISR et al., 2015), inappropriate dietary choices, difficulty obtaining food, food insecurity, shortage of quality water, scarce resources, lower farming skills, lack of healthy education in rural areas, increasing food prices; governance issues as well as

demographic characteristics of society (Derek et al., 2012). However, the World Bank link malnutrition to lack of arable land especially to war zones or immigrants, adverse weather, lack of farming technologies or resources needed for the higher yields such as fertilizers, pesticides, irrigation, machinery and storage facilities (World Bank, 2015). However, what is not clear and was not part of this study was the demographic behaviours of families as far as food security is concerned. This may require other studies to be undertaken to find out how family composition affects nutritional provisions.

So, for malnutrition to be dealt with so that its adverse effects are minimized, there is need for a robust mechanism and a combined effort by both central government, local government and sectorial leadership to make it known to the public in form of health and dietary education with intention to deliver the value of health eating especially rural communities as this can reduce the enormous social and financial costs of malnutrition. So is investing in low-cost solutions like good nutrition, agricultural programs reform that provide health and nutritious foods to communities is widely recommended.

3. Methodology

The study was conducted among rural communities in Mushonyi sector who total to 15,000 residents as per recent census report by National Institute of Statistics of Rwanda (NISR, 2012). Sample size was 375 determined by using Krejcie & Morgan table (1970). The study employed qualitative designs although at some point, there was need for triangulation of measurement processes and this was utilized to merge quantitative and qualitative research methods as supported by (Aliaga and Gunderson, 2002). The data collection included observation and structured questionnaires to find out the causes of malnutrition and its effects on the economy. Additional essential data was also collected through interviews, especially to key sector and cell leaders and local authorities in western province of Rwanda, members of the community of Mushonyi sector, health experts and NGOs operating in the sector and responses were analysed using descriptive statistics. A 5-point Likert scale was used to measure the level of agreement. However, the data gathering faced hardships such as the spread of the families in the district as well as language of communication made the data collection hard due to the fact that most rural residents did not understand English hence creating a language bottleneck. Despite the above limitations, the research team utilized the available means to achieve the goals by getting interpreters, permission from authority. The questionnaire was pilot tested on 60 residents surrounding University of Tourism, Technology and Business Studies, Rubavu campus (UTB) as they tended to possess the same characteristics. This was also more practical as nearby

Other avenues such as initiation of supplemental food distribution centers as these types of facilities have already proven very successful in countries such as Peru and Ghana (World Health Organization report, 2017). Other basic services are clean water supplies, literacy and nutrition education programs and village development projects activities like building village fish ponds, creating safe water sources, poultry rising and other projects that focused on helping the rural poor to improve their economic status and household food security (FAO et al., 2017).

You cannot manage malnutrition in society without empowering the mother. It is alluded that women take the full responsibility of most families in the world as far as nutrition and food balance is hence have responsibilities for their families' nutrition on addition to constant breast feeding of infants for 6 months before introduction to other feeding patterns. This is supported by many scholars like (Derek, 2012; WHO,2018; World bank 2017, Ministry of Health, Rwanda Hotel Associations,2018 and NISR,2015).

residents are more accessible as suggested by Ashmore, (2008).

4. Results and Discussion

This section provides the responses, implications and general discussions about the impact of malnutrition on economic development in Rwanda. The study was undertaken to achieve and to answer a variety of questions which concerned youth entrepreneurship as an engine of social economic development. It specifically answered questions like i) What are the causes of malnutrition in Mushonyi sector? ii) What are the effects of malnutrition on economic development in Mushonyi sector? iii. What is the relationship between malnutrition and economic development? iv) What appropriate strategies can be employed to overcome malnutrition to achieve economic development in Mushonyi sector? Literature was reviewed, data was collected and analyzed and eventually presented in tables, figures and narratives.

4.1 Demographic findings

The study revealed that majority of the sector residents in Mushonyi were females, which is in agreement with the recent (NISR 2012) as well as the World Bank report about distribution of gender. Most of them live in rural areas, are of mature age with limited, inadequate or no education. This is true to the fact that most under malnourished are in rural areas and have less education due to poverty levels (Ashmore, 2008; Rashid and Wilhelm, 2016; Auken, 2006). However, what is

surprising is that most mature residents are married with each family having a minimum of 4 persons. The form of employment most common and engaged in by the is

agriculture, others did not have any earning capacity while other respondents were involved in casual occupations.

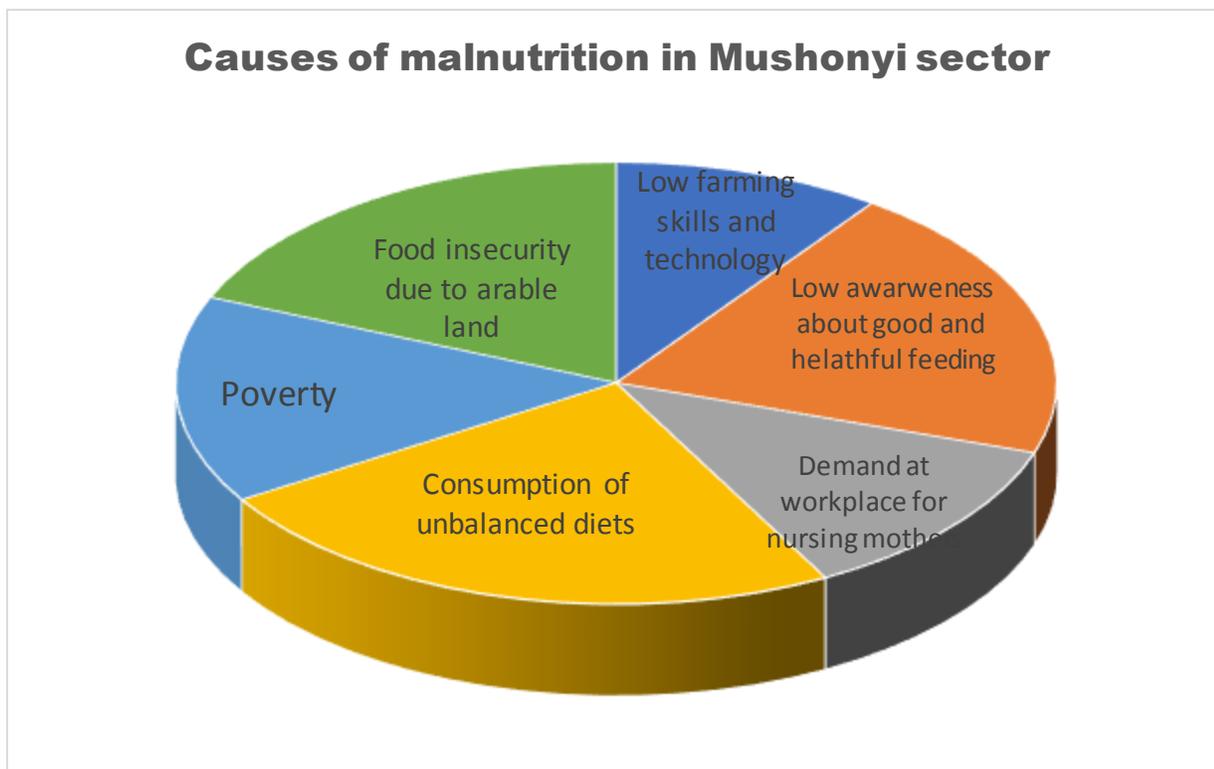


Figure 1: Causes of malnutrition in Mushonyi sector

The above figure 1 reveals that consumption of unbalanced food is common in the sector as most residents do not change their diets often due to various reasons. This is followed by food insecurity due to limited arable land not only in the sector but also in the country. This affects the quality of food people get as most of them do not have enough land for growing crops or grazing animals yet this is the source of food. The same figure also reveals that low education and awareness about health feeding is a major cause for malnutrition in most villages in the sector. However, what is surprising is the fact that many mothers have little time for their babies especially in breastfeeding them and providing them good nutrients due to demand

at workplace especially in private informal businesses. Some leave their babies with housemaids so they can attend to workplace stations.

The figure clearly shows how local residents are in need of health feeding services or proper education regarding balanced diet. But balanced diet is possible if food is available. One way of doing this is employing modern farming techniques that can boost garden harvests. These include; mechanization, application of fertilizers, proper harvest techniques among others. Hence, there is a need of strategic ways of overcoming malnutrition to achieve economic development.

4.2 Effects of malnutrition on economic development in Mushonyi sector

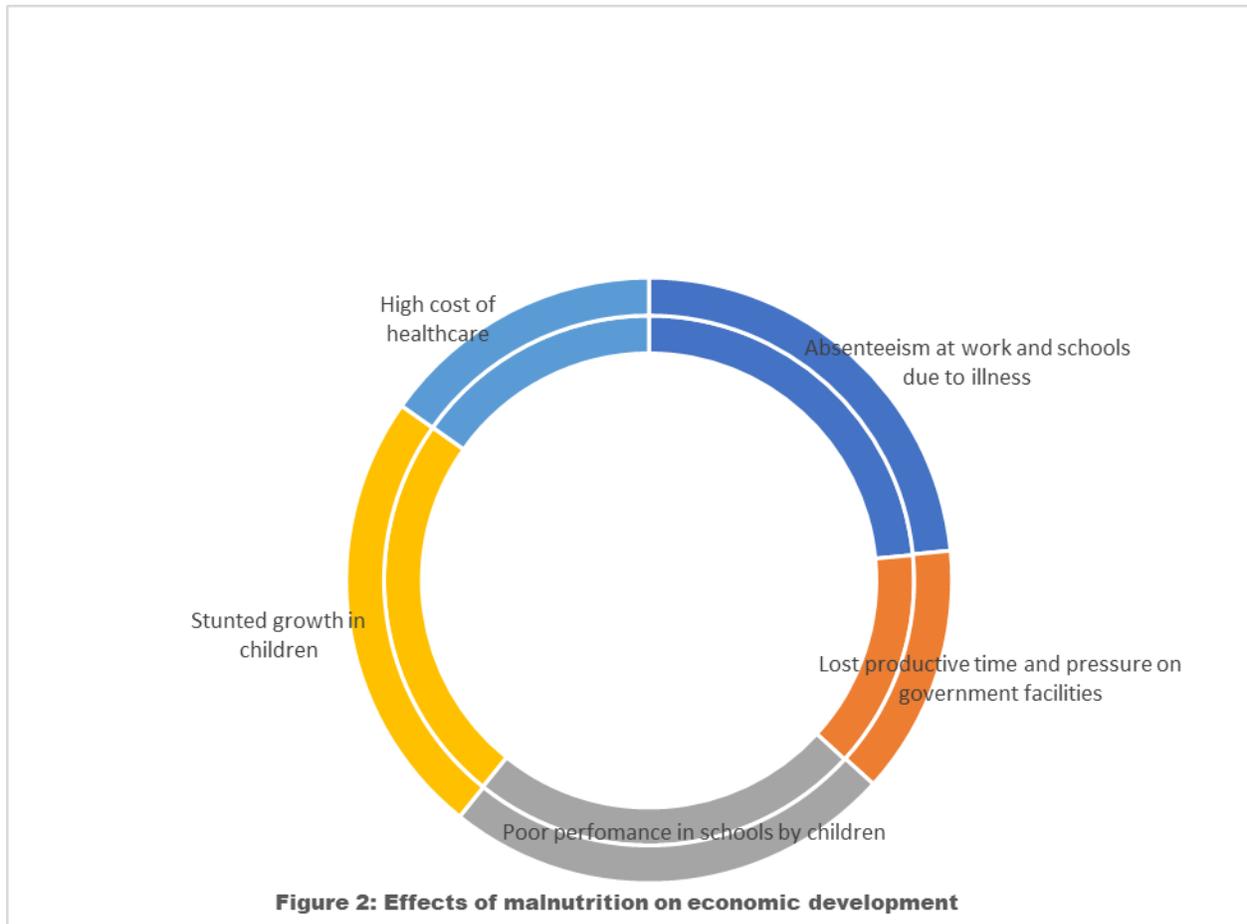


Figure 2 has indicated that malnutrition has an adverse effect on the economy with the highest impact being poor performance in schools by school going children yet the development of any nation, depends on the quality of education provided. Thus, if children cannot comprehend well the concepts taught, it will affect their future application hence indirectly impacting on economy.

Furthermore, malnutrition leads to high cost of healthcare services as individuals are always sick and in need of medical treatment. In addition, malnutrition according to figure 2, result into lost time that would be used for productivity in the economy. This not only leads to poverty, but also puts a lot of pressure on local government in areas of hospital bills among others.

The study found out that there is a significant positive relationship between good feeding and economic development ($r=.870$, $p<.01$). In fact, well fed people are able to generate productive ideas that can develop their communities and so are well fed children at school as they grasp well class concepts and easily achieve good grades. It was also revealed that balanced feeding was positively correlated with community economic wellbeing ($r=.687$, $p<.01$) than that poorly fed (Beta = $.370$, $p<.01$).

4.3 The appropriate strategies to curb malnutrition

Investment in awareness about the value of good feeding in communities, bringing government services nearer to the communities, especially in Mushonyi sector to cater for increasing malnutrition levels. These may include, training programs, village development projects activities like building village fish ponds, farming technologies, home garden skills, rural job creation programs, community empowerment, increased provision of “Shishakibondo flour” in large amounts to the poor communities, clean water supplies among others.

5. Conclusion and Recommendations

5.1 Conclusion

After data analysis and interpretation, the study concluded that malnutrition is an existing challenge in local communities and that it affects a large percentage of people especially rural residents and thereafter, affects economic progress of those communities. However, the study lacked statistical information on urban population as far as malnutrition is concerned.

5.2 Recommendations

Based on the above discussions and conclusions, and after coming to the end of the study, we propose the following as appropriate recommendations to reduce or manage malnutrition levels as below;

- a) There is a need for a concerted effort by various stakeholders (i.e., central government, local government, universities, NGOs, world food

programs, save the children etc.) to work together towards helping rural communities in managing nutritional needs to avoid malnutrition levels. Governments, businesses and civil society must step up efforts to address malnutrition in all its forms by tackling injustices in food and health systems

- b) Local authorities in Mushonyi sector should support the community development projects like livestock and agricultural projects so that they become able to get nutritious food..
- c) The ministry of agriculture and ministry of health should allocate nutrition experts to each sector in Rwanda with a view of educating communities about the value of good but balanced diets.
- d) **Shishakibondo flour** (balanced porridge for children) should be given more funds as it may solve some of the problems associated with malnutrition so that people become healthier and participate in economic development in Rwanda.

Areas for further study

- a) The study was done in rural communities in Mushonyi sector. The same study can be conducted to ascertain the malnutritional levels of urban population.
- b) A study be undertaken to investigate the role of tertiary institutions in helping rural communities get empowered towards health eating.
- c) The role of women in fighting against malnutrition in Rwanda

References

- Abosedo, O. & J.S. McGuire 1991. Improving Women's and Children's Nutrition in Sub-Saharan Africa. An Issues Paper Pre-Working Paper Series 723. Population and Human Resources Department. The World Bank, Washington, DC
- Abu, G. A., and Soom, A. (2016). Analysis of factors affecting food security in rural and urban farming households of Benue State, Nigeria. *Int. J. Food Agric. Econ.* 4, 55–68. doi: 10.22004/ag.econ.231375
- ACC/SCN 1991. Nutrition Policy Discussion Paper No. 8. Managing Successful Nutrition Programmes. J. Jennings, Stuart Glimpse, J. Mason, Mashed Lotfi & T. Scialfa. ACC/SCN of the United

Nations. pp- 79,77,82,88,90, 97,109,112,113,121,136.

- ACC/SCN, 1996. Summary of Results for the Third Report on the World Nutrition Situation. Update on the Nutrition Situation 1996. ACC/SCN of the United Nations
- ACC/SCN, 2000. 4th Report on the World Nutrition Situation. ACC/SCN in collaboration with IFPRI, Geneva, Switzerland.
- Aveyard, H. (2010). *Doing a literature review in health and social care: A practical guide* (2nd ed.). Berkshire, Great Britain: Open University Press.
- Bailey, K., 1994, *Methods of Social Research*, Fourth Edition, New York: The Free Press.

- Bitew FH, Telake DS. Undernutrition among women in Ethiopia: rural-urban disparity. Calverton: ICF Macro, 2010.
- Blakely, Edward J. and Bradshaw, Ted K. *Planning Local Economic Development*. Third Edition. Thousand Oaks, California: Sage Publications, 2002.
- Connolly-Boutin, L., and Smit, B. (2016). Climate change, food security, and livelihoods in Sub-Saharan Africa. *Region. Environ. Change* 16, 385–399. doi: 10.1007/s10113-015-0761-x.
- Curedale, R. (2013). *Design Research Methods: 150 Ways to Inform Design*. Topanga, CA: Design Community College Inc
- Derek Headey, International Food Policy Research Institute (IFPRI), “Turning Economic Growth into Nutrition-Sensitive Growth,” *2020 Conference: Leveraging Agriculture for Improving Nutrition and Health* (February 2011), accessed on Aug. 20, 2012.
- FAO, 1998d. Participatory development of a household food security and nutrition improvement programme in Kano State, Nigeria. C Dirorimwe. Food, Nutrition and Agriculture 36-43. Vol 22. Rome, Italy
- FAO, IFAD, UNICEF, WFP, WHO. (2017). *The State of Food Security and Nutrition in the World 2017. Building Resilience for Peace and Food Security*. Rome. Available online at: <http://www.fao.org/3/a-I7695e.pdf>.
- Kothari, C. R., (2000) *Research Methodology and Techniques*, New Age Inter National Publishers, New Delhi, India.
- Krejcie & Morgan in their 1970 article “Determining Sample Size for Research Activities” (*Educational and Psychological Measurement*, #30, pp. 607-610).
- Laurel, B. (2003). *Design Research: Methods and Perspectives*. Cambridge, MA: MIT Press.
- Leedy, D. Paul & Ormrod, Jeanne Ellis (2005) *Practical Research, Planning and Designing* 8th Ed. Pearson Education: New Jersey.
- Ministry of Health (MOH) [Rwanda]. 2017. Rwanda Demographic and Health Survey.
- Ministry of Agriculture (MOA) [Rwanda], and World Food Programme. 2015. Comprehensive food security and vulnerability analysis.
- National Institute of Statistics of Rwanda (NISR) 2015. Rwanda Demographic and Health Survey 2014-15.
- NISR (2013): Census 2012 in belief. *Report No. 03-02-03 (2012)*: Kigali Rwanda).
- NISR. (2013/2014). *Integrated Household Living Conditions Survey*.
- Sachs, J., Schmidt-Traub, G., Kroll, C., Durand-Delacre, D., and Teksoz, K. 2017. *SDG Index and Dashboards Report 2017*. New York, NY: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).
- Salil Kumar, V., (1996) *Methodology of Research for Project Work*, Publication Division, Institute for Social Sciences & Research, Vellore, India
- Save the Children, “Nutrition in the First 1,000 Days: State of the World’s Mothers 2012” (May 2012), accessed Aug. 20, 2012.
- Strauss and Corbin, 1990, p. 17. The concept of reliability as it pertains to data from qualitative studies. Paper Presented at the annual meeting of the South West Educational Research Association.
- United Nations, D. o. (2017 Revision). *World Population Prospects*. Department of Economic and Social Affairs, Population Division.
- USAID. (n.d.). *Preparing Youth for Livelihood, Work, Life and Citizenship Learning and Earning for Youth. EQUIP3/Youth Trust*.
- Worldometers. (2008). *Global population report*.
- World Bank, (March, 2000). *Can Africa Claim the 21st Century? World Bank*.
- World Health Organization. Global nutrition policy review: what does it take to scale up nutrition action? 2013
- World Health Organization. Malnutrition: fact sheet. May 2017. <https://www.who.int/news-room/fact-sheets/detail/malnutrition>