Chapter

Impact of Beef and Milk Sourced from Cattle Production on Global Food Security

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Abstract

Bovine meat and milk play a major role in the diet of humans and they have positive impact on global food security. The aim of this review work was to investigate the impact of bovine sources of meat and milk on food security in the low, medium and high income countries. Bovine source meat and milk could have impact on the nutritional, health, work, income, educational and recreational needs of humans. However, the feeding needs of bovine are mainly met with forage materials which do not compete with human foods. The beef and dairy cattle are raised mainly under the extensive system of production in the low and medium income countries, while the intensive system of production is that which is adopted majorly in the high income developed nations. The production of healthy beef and milk products may be observed to go a long way in preventing disease occurrence in both the cattle and the human consumers. The raising of fewer numbers of more genetically productive breeds of cattle under the intensive, semi-intensive and extensive systems of production could also have positive impact on global food security, sustainability and the mitigation of green house gas (GHG) emissions.

Keywords: bovine protein food sources, production systems, global food security

1. Introduction

Beef and milk sourced from cattle are important sources of protein in the human diet. Globally there is increasing demand for food, feed and fiber sources. Animal protein sources are usually found to be of higher cost and of high demand in the quest to solve and meet the demand for human food security. Bovine protein sources were described [1] to have high density of macro and micro nutrients per 100 g. Again, they were reported to contain essential nutrients difficult or impossible to find in other foods, they have micronutrients in biological forms that enhance their uptake into the body system (bioavailability). Furthermore, bovine protein sources were characterized to have high digestibility and high biological value of proteins with amino acid profile of essential and non essential amino acids that meet the human body system requirements [1]. The rearing of beef and dairy cattle is found to be of great importance in the promotion of food security strategies, as they serve as sources of nutrients dense foods, regular income and other benefits [2]. Some previous authors [3–5] have given the World Health Organization definition of food security as "When all people at all times have access to sufficient,

safe and nutritious food to maintain a healthy and active life". Yearly, more than enough food is produced world-wide to its entire population, yet food security remains unattained globally with hunger existing in many parts of the world, especially in the developing countries [5]. There exist a lot of wastage through the food supply chain from post-harvest losses to manufacturing and retail spoilage and thus directly threatening food security [5]. These problems are often found to cause increased global food prices, while there is very low purchasing power in several developing countries.

The three most common ruminant livestock are the cattle (bovine), sheep ((ovine) and goats (caprine), out of which bovine are the most prominent and the most predominantly and highly valued. This is evidenced by the fact that cattle meat (beef) and milk are the highest consumed world-wide, probably due to their large body size and weight, but low monetary value per animal. The bovine protein livestock is found to be of great importance in the promotion of food security strategies, as they serve as sources of nutrient dense foods, regular income and other benefits [2]. In a previous review work [3], it is reported that livestock production and marketing are very important to livelihoods of more than one billion poor people in Africa and Asia (which is one-seventh of humanity world-wide). These researchers also stated that beef production and marketing in West Africa provide sources of income to about 70 million people and dairy production supports about 124 million people in South Asia and 24 million people in the Eastern Africa. Another research finding [5] outlined that in a low income country (annual agricultural GDP of PPP$0.92 billion) livestock (particularly beef, dairy and draft cattle) ownership development increased income, raised the food security of those holding animals and altered the food environment of the people to enhance the diets of the livestock recipients' communities.

The challenge of food and nutrition security is reported to occur in both low and high income countries world-wide [3], though in different proportions and extents, similarly over-nutrition and over-weight do not exist only in the developed countries but also among few poor urban dwellers in underdeveloped countries of the world. This review is aimed to investigate the impact of beef and milk sourced from cattle production on global food security.

2. The contribution of bovine livestock production to global food security in the high, medium and low income countries

Cattle production could be practiced under the intensive, semi-intensive and extensive or range management systems. The beef and dairy cattle could also be managed under the mixed crop-livestock production system.

In high income countries, livestock keeping and production is mainly practiced under the intensive system and few farmers are involved [6]. Long term structures are used and the structures and building infrastructure are usually highly capital intensive. There is usually the use of exotic and high producing breeds of beef and dairy cattle. The production is usually defined as to either beef cattle production or dairy cattle production, and there is not a combination of these two. In the developed countries of the world, countries such as the United States of America, Holland and Argentina, production is highly specialized. Farming in the high income countries may involve land use regulations which may lead to high housing prices which are not affordable for the middle and low income countries households [7]. Economic opportunities for income generation intensive livestock production in the developed world usually involve a fewer number of people as compared to the larger numbers engaged in keeping livestock in the middle and low income nations [6]. Some

previous researchers [8] also pointed out that livestock keeping in all the three of high, middle and low income regions may be associated with other benefits related to leisure, recreation, tourism, education and inspirational opportunities.

In the low and middle income countries, majority of the households that keep livestock were reported [9] to have access to high consumption of livestock derived food such as bovine meat and milk than others who were not involved in livestock farming. In some of the low and medium income countries, about 40% of the livestock derived food was found to be obtained through importation from other countries rather than being sourced locally [9]. However, there is the need to continue to increase the local and global livestock production sectors, and also to have the plan to develop the small holder livestock production inclusive policies [9].

In the low and middle income nations, the international trade markets offer alternative means of meeting the nutritional need of the populace. Trade based strategies such as cross-border food supply networks are employed. Also, the net-exporting countries have been known to step down their food export during the times of food scarcity and thus posing increased threat of food unavailability to the net-importers [10]. Thus, the increased production of livestock derived food such as beef and dairy products, alongside the importation of food products from high income countries could be found to be an adequate strategy to meeting up with the increasing food demand and food insecurity in the low and middle income nations [11].

3. The intensification of bovine protein livestock production and the adaptation of crop-livestock production systems

There was reported [5] an increasing global population from about 4.4 billion in 1980 to 6.1 billion in 2000 with a 2% yearly increases which is again projected to reach 9.7 billion by 2050 [5]. It is well known that enough food is produced globally to meet the nutritional need of the entire human population, however, this food supply is not within the reach of people in all continents of the world. This is found to be true especially as it concerns the poor populace in the rural areas in developing countries due to some socio-economic barriers, harsh climatic and environmental conditions [12] and these lead to various challenges in the global food security. Therefore, there is the need to outline few of the various steps or projects conducted to investigate some of the bovine livestock production systems adopted worldwide to enhance food security.

3.1 Food security impact of dairy cows and heifers: a field experiment in the Zambia

In a livestock field experiment carried out in the Zambia, the impact of dairy heifers and cows ownership on household income and on household milk consumption was investigated [2]. The dairy heifers and cows were given out as pass-on-gift (POG) to 324 households and 2200 individuals over 5 different communities. Provision was also made for households and individual farmers to own dairy draft cows which also produced milk for sufficient milk consumption at home and some for local sales as source of income. The draft cattle were used for land cultivation and crop production. It was observed that this livestock development project increased incomes, raised the food security of those holding the animals and altered the food environment to enhance the diets of the cow recipients communities. Zambia was classified under the countries with an annual agricultural GDP of less than PPP$1 billion (PPP$0.92 billion). Also, Zambia was

classified as a region with historically low rates of large animal ownership and as a developing or low income country [2].

3.2 The economic and social impact of livestock production systems in the lower and higher income countries

Previous researchers [6] reported that livestock such as dairy cattle were a source of wealth in the lower-income nations and regions. They mentioned that there was a link between livestock ownership, household economic status and social welfare. These workers also stated that dairy production made significant contribution to poverty reduction at both the household and community levels in lower income nations. Dairy cattle ownership was also linked to income-generating activity for women [6]. The female dairy farmers in various lower-income regions such as India and Pondicherry were reported to have the ability to borrow money, obtain employment, have the provision of meat, milk and cow dung for manure or fertilizer, and also had the ability to use cows as draft animals to help reduce labour requirement on their farms.

However in the higher income countries such as in the US, there was stated found the intensification and consolidation within the livestock production sector [6], and these enhanced food and nutrition security.

3.3 The role of beef cattle production systems in food security

In a previous research [4], the importance of animal agriculture was stated to include the production of high quality proteins such as beef and milk for sustaining rural livelihoods and thereby contributing to food security. It was outlined that since the energy transformation efficiency in ruminants is very low, food security can be effectively promoted only if the major feeds given to ruminants (such as forage grasses and legumes) are not in competition with human food.

Beef and other beef products were further classified to possess the following qualities: They contain nutrients such as proteins and amino acids (essential amino acids particularly). These essential amino acids include leucine, isoleucine and valine needed for protein synthesis [13].

Some researchers [14] also mentioned that beef contain high amounts of glutamic acid, arginine, alanine and aspartic acid. Furthermore, protein ingestion from beef sources strongly increases muscle protein synthesis rates, and this effect was said to be due to the stimulatory effect of essential amino acids.

Beef was reported as a source of high quality protein and highly bio-available iron to enhance vitality in humans [15], and they contain lipids (polyunsaturated fatty acids – PUFA and saturated fatty acids – SFA).

3.3.1 Beef production under an intensive system (Argentinean perspective)

In Argentina, beef cattle are mainly raised on grazing lands, and thus the country is known to be a good producer of pasture-fed beef cattle, supplied with grains as energy supplement to bring about the production of pasture finished beef [4]. Beef cattle production in Argentina was reported to entail two major activities, which are: the cow-calf were kept on less productive or marginal lands; and the steer growing and fattening on more fertile soils [16]. These outlined pasture-finished beef is reported to be more likely to be leaner with lower cholesterol concentrations than feedlot beef [17]. The above described beef cattle production system is presented in **Figure 1**.

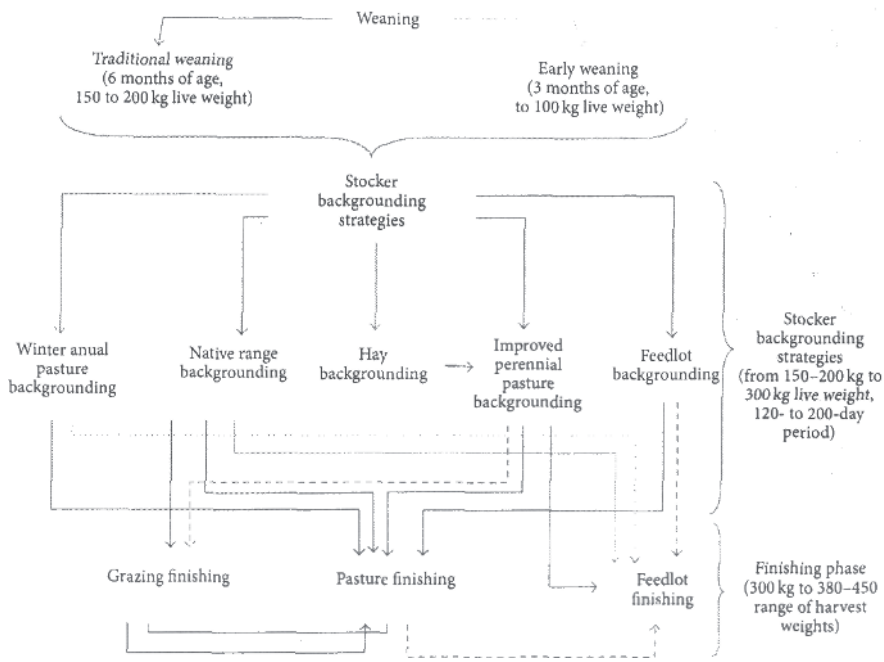

Figure 1.
The beef production system (Argentinean perspective). Source: [4].

Most beef cattle production (more than 70%) in Argentina is mainly carried out under the pasture (cultivated) finishing system (**Figure 1**) [4]. This system is least dependent on grain cropping feedlot but relies on adjusted forage chains depending on rainfall, environmental temperatures and soil quality. This system could however be practiced in rotation with grain cropping forage chains such as legume based pastures (principally alfalfa) and small-grain winter annual crops (rye, oats, rye grass and triticale [4]. Most of the cattle fattening farmers are known to make strategic use of energy supplement when necessary, such as cereal grains (corn and sorghum). These researchers [4] also pointed out that feedlots are more useful in terms of land occupation and judicious land use, but less useful as regards environmental impact, competition with human diets and meat safety. The beef obtained from pasture finished beef cattle were also observed to be leaner and lower in cholesterol concentrations [17]. Therefore, in Argentina, beef production practiced under the pasture finishing system was found to give an improvement of the nutritional value and quality characteristics of beef and improved beef healthiness and global food security.

3.4 The role of the traditional small-scale dairy production sector and its effect on food security (using the strength, weakness, opportunity and threat (SWOT) analysis

A research study [18] was conducted on the role of the small-scale dairy sector (SSDS) in Jordan as it affects food security. The study employed the use of a general survey questionnaire and a participatory rural appraisal survey (PRAS). In the results of the work, the dairy sector in Jordan was classified into small, medium and large scale farming. The small scale farm was graded to have the ownership of not more than 9 cows in order to make a positive impact on food security for the poor householders. In the area of feeding and nutrition, these householders (pastoralists) had the opportunity of using some of the harvested products from their farms for food supply for their families and sold the surplus for income. The PRAS was conducted among these pastoralists using the strength, weakness, opportunity and

	Strength	Weakness	Opportunity	Threat
Small-scale dairy sector	• Pastoralists by inheritance • Dairy cattle herding is a vital source of income, and supports household food security	• Livestock householders are helpless women • Women subjected to greater workload	• Food security • Provide meat and milk • Cash, manure, fibers, draft • Employment generation and security • Gives support for local products production	• Absence of sustainable practices and supporting policies • Lack of awareness of sustainability
Feeding and nutrition	• Source of food for peri-urban areas • Practice of mixed farming system	• Water shortage, food scarcity • Low feed importation and environmental impact	• Low cost culled cows and milk production • Livestock serve as source of cash • Provide support for local fodder and hydroponic fodder production	• Degradation of rangeland resources • Increases of feed prices
Animal health services	• Available veterinary and extension services and support	• No logistic support for disease control and sustainable veterinary services • No regulations for animal health • Lack of training, farmer empowerment	• Increasing milk production • Access to market • Reducing production cost	• Increasing cost of veterinary services and medications
Product processing	• Low processing cost • Added value to products	• Lack oftechnical knowledge and know-how	• Employment generation • There is consumer demand on increasing milk yield	• High cost of energy and technology • No governmental support
Product marketing	• Lower selling price • High demand on traditional products	• No pricing policy but monopolization • Indebtedness to middle men • No skill of handling and packaging	• Marketing in nearby markets • Direct sale of products	• Poor hygiene • Bad roads and market infrastructure

	Strength	Weakness	Opportunity	Threat
Policy and benefits	• Milk and milk products are full food for food security • Increasing poor's income • Generating jobs	• No governmental support of marketing or trading products • Lack of investment in major livestock's infrastructure (eg. Roads, water network, electricity)	• Good investment opportunity • There is increasing demand for milk and products	• No legislation for milk pricing • No hazard or risk supporting fund • High potential of being affected by climate change, natural disasters (eg. drought, storm, earthquake)

Source: [18, 19].

Table 1.
Strength, weakness, opportunity and threat of the small-scale dairy sector.

threat (SWOT) analysis. The observations made were outlined as strength, weakness, opportunity and threat as shown in the **Table 1**, which was however upgraded with findings from another similar research journal article [19].

The results summary was as follows:

The SSDS in Jordan was observed to positively impact food security for the poor householders. They consumed the milk produced from their cows and sold out the surplus milk as source of income.

The main strength observed from the SWOT analysis was that the householders were full-time pastoralists who practiced livestock keeping as their only source of livelihood. The major weakness was scarcity of feed or unavailability of feed resources which was due to water shortage or lack of rains. This in turn brought about increased feed prices, while the selling price of milk did not change, as this was dictated based on the selling price of the large scale dairy sector (LSDS). The greatest opportunity in the SSDS was that the farmers could obtain the training and awareness of technological inputs as regards their animals feeding requirements, milk handling processes, breeding and genetic resources information, disease control, post-harvest storage facilities and access to markets and marketing techniques, as well as policy support.

However, this was more applicable to the holders of exotic dairy cattle breeds. The threat faced was the high cost of milk production without the corresponding increase in their cattle meat and milk prices. It was reported [18] that prices of meat, milk and other products were dictated by the LSDS producers who received sufficient technology and policy support from the government. The government was found to focus more attention on the LSDS meat, milk holders since they were the main providers of meat and milk in the country.

In the concluding points on this research, it was stated that despite the threats and challenges faced by the SSDS producers, they could succeed by practicing the use of better genetic lactating dairy animals such as the exotic breeds of cattle, better animal feeding and milk processing techniques, better market access, by forming an association of SSDS farmers and by planting more fodder on-farm. These steps could assist the SSDS in Jordan to attain food security and poverty alleviation for the resource-poor farm holders.

In another research article, the outcomes of workshops conducted by the State of Palestine Ministry of Agriculture in partnership with FAO on the 28 January 2014 in Gaza, and on 12 February 2014 in Ramallah, the strength, weaknesses, opportunities and threats (SWOT) analysis of the ruminant livestock sectors were outlined [19]. One component of the strength stated was that dairy cattle herding is a vital source of income and supports household food security. The weaknesses outlined included the fact that women were subjected to greater workload than the men. Other weaknesses were as follows: lack of training, extension services and farmer empowerment. In terms of policy and benefits, the weaknesses reported were the lack of the government's investment in major livestock infrastructures such as roads, water networks and electricity. One of the opportunities mentioned was the provision of support for local products production such as the cultivation of local fodder and hydroponic fodder. One of the threats outlined was the high potential of the State of Palestine livestock sector being affected by climate change and natural disasters such as storm, earthquake and drought.

4. Some suggested solutions for the elimination of problems of human diseases associated with the consumption of beef and milk from bovine sources

Livestock such as cattle could cause negative impact on food security by transmitting diseases to humans through the consumption of contaminated meat, milk

and by-products [3]. These diseases could limit peoples' ability to work and earn income to meet their needs. The intake of livestock foods and by-products could also cause some harm to the nutrition and health of humans through the transmission of zoonotic diseases such as listeriosis and toxoplasmosis. These diseases were stated to cause about 2.2 million deaths a year, mostly among the low and middle-income countries [20]. In a research [1] reported that the global burden of food borne diseases resulted from 31 hazards which were considered in 2010 to result to 33 million disability adjusted years (DALYs), and that 98% of this burden fell within the low and middle-income countries. In view of these afore mentioned, efforts to promote the consumption of livestock derived foods such as beef, milk and by-products should go along with suggested solutions to improve and assure food safety [1].

4.1 Practical solutions to human health threats

Practical solutions to human health threats from livestock especially in the developing countries, where there are small scale producer demands collaborations between veterinary and public health researchers and officials such as meat inspectors [21].

i. Overconsumption of animal-source foods can lead to ill-health and affect human well-being, thus causing harm to the individuals, households and impacting whole societies [3].

ii. Livestock sourced foods such as fatty red meats and hard cheeses could cause cardiovascular disease. Similarly, processed meats such as bacon and ham have been associated with the risk of contacting pancreatic cancer [22].

iii. Animal-source foods, particularly the processed food should not be over-consumed but eaten occasionally and in small amounts.

4.2 Management practices that could be adopted in the dairy industries

i. The adoption of practices that reduce microbial contamination should be emphasized [23].

ii. Microbial contamination of milk should be minimized by the observation of hygienic standards that can be easily evaluated. Microbial counts of livestock foods produced should be checked at defined time intervals.

iii. The diagnosis of salmonellosis or listeriosis on dairy farms should be regarded as indications that other potentially infected animals may be present in the herd.

iv. Coliform counts on milk bulk tanks should be routinely carried out and minimum standards of coliform counts should be aimed at. Presence of coliform in milk is an indication of fecal contamination.

v. A reduction in the national regulatory limit for somatic cells count in milk bulk tanks should be considered based on standard milk safety limits.

vi. Raw milk harvested from dairy farms should be pasteurized to destroy pathogenic organisms which are risk factors for food borne diseases.

vii. Inappropriate use of anti-microbial agents should be minimized to prevent the development of antimicrobial resistance in animal/livestock pathogens.

viii. The presence of high somatic cell counts in milk is an indication of poor hygienic practice. Also, the presence antibiotic residues in milk beyond the minimum standard limits could be harmful to both the well-being of the dairy animals and in humans.

ix. Change from the adoption of the hazard analysis critical control point (HACCP) program to hurdle technology in food processing plants: The use of HACCP programs were designed for use in food processing plants [24], and it was not very much accepted for use on dairy farms as it involved the review of existing management processes, the establishment of limits through the identification of critical control points, the use of routine surveillance procedures, effective record keeping, documentation of standard processes and other non-competencies in its use. On the contrary, the hurdle technology described by some researchers [25, 26] was embraced for use to replace the HACCP program. Hurdle technology involve the application of a combination of some selected 'hurdles' or steps to examining microbiological growth in combination with the processing steps that maintain and improve the microbial stability and sensory quality of foods [22].

4.3 Ensuring the production of beef and milk products that are free of antibiotic residues

In the developed countries such as the USA, most dairy farmers do accept responsibility for the safety of the milk and beef produced from their farms [22]. The linkage between farm production practices and the quality of processed products could however be weak.

In order to ensure the production of beef and milk products that are free of antibiotic residues, the beef and dairy cattle farmers should adhere to the antibiotic drugs withdrawal times as specified on the label use of the drug manufacturer [27].

Again, meat and milk samples should be collected from individual the beef and dairy animals and also from the milk bulk tanks and tested for presence of antibiotic residues. The observation of the antibiotic treatments withdrawal period specified is very important as this could dictate the need to discard milk or withhold the cattle from slaughter in order to ensure drug residues are below the determined maximum residue limit allowed by the food and drug administration (FDA) after an animal has received an antibiotic treatment [28]. These previous researchers [28] emphasized that it is important to ensure that meat, milk and milk products are of high quality, safe and free of antibiotic residues before being sent out for human consumption and these could go a long way in enhancing food safety and food security.

5. Contribution of beef and dairy cattle to green house gas (GHG) emissions, climate change and global food security

Climate change could be defined as the raising of temperatures, elevation of carbon dioxide levels and precipitation changes, which will all affect agriculture and food production [12] causing drought and increased temperature extremes in many food production areas world-wide [5]. This increasing global temperatures and extreme heat stress could cause a decline in global food production, food

availability, stability in food supplies and minimized access to food and food utilization [12]. There could be declining yield in major food crops such as maize and soybeans especially in the developing countries. As a response to address the challenge of emerging global climate change, the December 2015 UN Conference on Climate Change was held in Paris, France. There was an agreement adopted by 195 countries to implement the first universal climate agreement to combat climate change (COP21 2015). This agreement was set to limit global warming to less than 2°C as compared to the pre-industrial levels in the 21st Century. To reach this goal, it was estimated that global green house gas (GHG) emissions needs to be reduced by 40–70% by 2050 and carbon neutrality needs to be reached by the end of this century (COP21 2015). This could lead to an improvement in the sustainability of global food production.

Beef and dairy cattle production contributes to climate change through the emission of GHGs, and climate change could affect human health and well-being to a great extent [6]. The impact on human health occurs through morbidity and mortality from extreme climate events. The indirect outcomes of climate change effect could also occur through economic disruption loss of labour productivity, changing availability of food, water and materials [29].

Despite the above mentioned negative effects, how else could the raising of beef and dairy cattle contribute positively to climate change and impact on global food security? One of the ways to achieve this was stated as shifting to raising fewer and more productive animals, particularly ruminants of more productive breeds [3]. This would require enhanced access to breeding, animal health and higher ruminant feed production such as grasses, legumes, concentrate feeds and other inputs to keep such less hardy animals alive and productive. This could also lead to the attainment of lowered environmental temperatures [30] for the livestock. Another approach suggested world-wide is the promotion of tree planting or aggressive agro-forestry programmes in different countries, particularly in the tropics. The planting of forage legume browse plants such as *Gliricidiasepium*, *Laecaenaleucocephala*, *Sesbaniagrandiflora*, *Afzeliaafricana* could help to ameliorate the effect of climate change and at the same time provide fodder leaves for ruminants. Also, environmental preservation laws and policies could be enforced, particularly in the tropical low income countries such as Sub-Saharan Africa and Asia. There should be the encouragement of the formation of more forest reserves and the establishment of biological gardens in different countries in the world in order to minimize the destruction and extinction of valuable tree species. Beef and dairy cattle production could also have positive impact on climate change and global food security through the feeding of feed by-products, feedstuffs, feed ingredients and feed additives that result in the production of less methane gas into the atmosphere. In recent times, some researcher workers [31] observed that the inclusion of yeast (*Saccharomyces cerevisiae*) fermented polished rice or cassava root meal in a livestock diet could produce a feed supplement which could be used as concentrate diet for dairy ruminants. This feed supplement was found to have the capacity to modify rumen fermentation, lower methane production, which also resulted to improvement in growth rate and feed conversion.

6. Development of policies that enhance the benefits of economic growth

It is well reported that the economic growth of a country is crucial for there to occur poverty reduction [6], however, economic growth alone could be insufficient to bring about reduced poverty on a broader scale [32]. There is also the

need for favorable environment for entrepreneurial investment, lack of corruption and improved governance in the public and private sectors, in addition to having a transparent and accountable society [32]. Also the pursuit of poverty reduction needs to be made viable and achievable through being backed up with the development of policies that support the delivery of sound educational system and health services.

7. Future prospects of bovine protein livestock production impact on global food and nutrition security

Future prospects could be considered to direct livestock production, particularly the production of beef and dairy cattle towards the breeding of more productive breeds of livestock globally. This is equally required in the low and medium income countries as it is already happening in the well developed higher income countries. The production of more ruminant feed such as improved perennial pasture production to serve as baseline feed for ruminants should be continually made a priority and the natural grazing lands should be continually renovated into improved pasture lands. There should be continuous development of vaccination and medication programmes to keep ruminants healthy and more productive. The promotion of semi-intensive ruminant production system could be encouraged particularly in the low and medium income nations, so as to lead to realistic, 'easy-to-adopt' farming management practices that have potential to mitigate green house gas (GHG) emission for sustainability and the attainment of global food security.

8. Conclusion

Beef and milk sourced from cattle production was found to play a relevant role in global food security. Cattle meat and milk are found to be the most paramount in the supply of animal source protein in the diet of humans. They contain indispensable nutrients such as high quality proteins, essential and non-essential amino acids, highly bio-available iron and other mineral elements, poly unsaturated fatty acids that are needed for healthy living in humans, in children and pregnant women. Such nutrients may not be obtained in tangible quantities from the consumption of other ruminant livestock meat and milk. The beef and dairy cattle have high feed intake which is met based on the intake of fodder which are not in competition with the human diet.

This review work has shown that the global demand for bovine livestock food resources could only continue to be met through the raising of improved breeds of beef and dairy cattle world-wide. These animals should also be sustained not based on feeds that are in competition with human foods.

The specialized intensive system of production was adopted in the high income countries. However, varying ranges from the extensive to the semi-intensive were practiced within the medium and lower income countries. Despite the nutritional benefits derived from the consumption of bovine meat and milk, there is also the need to take cognizance of the reduction of any health risks in order to attain assured food safety.

There should also be the reduction of GHG emission from beef and dairy cattle production to meet up with the sustainability of the physical environment. There is need to put in place national and global development enabling policies needed to enhance and promote cattle farming practices for the attainment of global environment sustainability and food security now and in the future.

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