

Millets and Sorghum Potential for Telangana State, India

Francis Eddu

Society for Economic and Environment Development
India

Email: franeddu [AT] yahoo.com

ABSTRACT---- *Telangana State is a semi-arid and comparatively backward state due to neglected policies by the past association with the unified Andhra Pradesh state and presence of feudalism. Telangana State was bifurcated from the rice-dominant Andhra Pradesh in the summer of 2014 after six decades of struggle. This paper examines ways to revert to the growth of traditional, region-specific cereals for health and food security in the new state. The potential of sorghum and millet to end food insecurity and similarities among other semi-arid zones in the world are discussed. These two cereals can help to overcome malnutrition and contribute to household food security. Research and planning to improve drylands have been scant and a majority of agricultural innovations for drylands by the formal sector do not reach the farmers. Building of local capacities is critical for dietary changes. Closing the gender gaps and establishing strong linkages between cereal production and consumption will benefit the new state.*

1. INTRODUCTION

A cereal is a grass that is cultivated for its edible grain or seeds for food such as rice, wheat, corn, millet and sorghum. Worldwide cereal grains dominate the food sector and are grown in large numbers than any other crop and are considered as staple crops, acreage-wise wheat covers a wide area, followed by rice and corn. Humans first recognized wheat and barley then as wild plants during the Stone Age, instead of cultivation they collected these cereals to prepare meals. Today cereals are used for human and animal consumption and in the industrial process and they belong to *Graminaceae* family (Differencebetween.info, 2014).

In most of the developing countries, grain in the form of wheat, rice, millet, sorghum or maize/corn supports daily sustenance of millions of people. In Western parlance, cereals are viewed as breakfast items such as cornflakes, oats or rye and as baking components. Though there are over 350,000 plant species on earth, no fewer than 20 plant species supply over 90% of human food requirements. The top five grains that are consumed in the world: corn/maize, wheat, rice, barley, and sorghum are indeed cereals (Food and Agriculture Organization [FAO], 2015).

An average Indian meal always revolves around a cereal – wheat, rice, millet, maize, or sorghum which replenishes 70% of per capita calorie intake (Sen, 2009). Next are lentils followed by beans, peas and pulses. Meat, fish and vegetables complement in small amounts to spice up the main grain. Though India attained high growth per capita incomes in the last decade, it is paradox that the country's per capita food consumption (in kcal/person in day) did not improve (Alexandratos & Bruinsma, 2012). Small and marginal farmers up to 80% constitute Indian agriculture and the country's sustainable agriculture and food growth depends on the role of small and marginal farmers.

Telangana state was part of Andhra Pradesh state for more than 60 years until its separation in the summer of 2014. Earlier Telangana belonged to Hyderabad State that was ruled by Muslim dynasties from 14th century until the Hyderabad State disintegrated after India's independence from Britain in 1947. The last Asaf Jahi dynasty signed a treaty of subsidiary alliance with the British Empire. The other parts of Telugu-speaking provinces that were under the British Empire were joined with Telangana after Independence, much to the apprehensions of Telangana people who have their own distinct culture. From the beginning Telangana merger with Andhra people had signs of discontent, for Andhra people who were better educated dominated the region. Telangana people resented Andhra elite and their political and administration monopoly and waged a violent struggle with scores dead and finally the alliance ended in the summer of 2014 (eTelangana, 2015). Apart from issues with Andhra people, Telangana history is characterized by peasant struggles and statehood agitations with erstwhile Hyderabad State as well and the agriculture situation of Telangana is closely linked with these struggles (Pionetti, 2005).

With the celebration of everything local, it is pertinent to look within the Telangana dietary patterns, crops and turn the region into a breadbasket. The majority of farmers in the semi-arid Telangana are small farmers and the region is geographically similar with a mean annual rainfall of 940 mm, however, Mahbubnagar and Nalgonda districts have lower values of 713 mm and 741 mm respectively (Siegfried, 2010). For agriculture only 40% of the total geographical area is utilized and a sizeable part, around 23% of total geographical area, is fallow ground. The presence of large fallow land in the region indicates the neglect of agriculture and absence of investments or underutilization of land for development. Soils and climate are critical for agriculture development. The need to feed increasing population in the country requires regular assessment of its natural and climate resources for proper land use. India has a wide range of landscapes and climate conditions which is evident from the presence of various types of soils and vegetation. Barring a few soil orders (Andisols and Spodosols), most of the soils on earth are represented in India. Soils in India are made up of eight major groups, out of which four soils are essential for agriculture: alluvial, black, red and lateritic (FAO, 2005).

The semi-arid regions are characterized by rainfed agriculture; there are semi-arid regions in Africa that share common characteristics. Throughout the world and in India, rainfed farming is the dominant type of agriculture, despite the efforts to lead arable land under irrigation (Pionetti, 2005). The effects of climate change is manifested in crippling droughts that have become more frequent in drier areas in recent years pushing large number of people to harsh living conditions, impacting crop production (Warrier, 2013). Historically rich cereal-based diets have been relegated by new technologies such as Green Revolution whose twin crops wheat and rice were promoted for intensive farming at resource-rich regions under irrigated situations have had negative implications and diminished the importance of traditional cereal and legume crops. Cultivation of rice and wheat requires large quantities of irrigated water.

For instance, to cultivate 1 kilogram of rice 4000 liters of water is required (Deccan Development Society [DDS], n.d.). At global level, irrigated agriculture covers less than 20% of the entire cropland area, harvests 40% of agricultural output, and utilizes almost 70% of overall developed water supply. In Telangana, 85 percent of irrigation is from tanks and wells and 15% is from canals.

For the new state, the high priority is to restore and strengthen dryland farming to handle large water-scarce semi-arid regions. It is necessary for both civil and political leaders to create awareness on the virtues of strengthening and reversing to traditional dietary practices of consuming of millets, and sorghum in lieu of expensive rice and wheat. Telangana should not depend on Andhra coastal areas for rice and find new alternatives for food security with a focus on regional solutions and strengths. Earlier because of low market prices, poor yields and changing consumer behaviors, farmers were avoiding millet and sorghum instead cultivating commercial crops such as sugarcane, soybean, cotton, corn, etc. However, the production of sorghum and pearl millet has increased from the 1970s due to the development and distribution of high-yielding varieties. Over the years disease-resistant and productive varieties have raised yields and positively impacted 6 million millet-producing households and 3 million sorghum-producing households. Effective collaboration between public research and private industry has been the reason for the poor and small farmers' adoption of improved varieties in the India's semi-arid lands (Pray & Nagarajan, 2009). In new Telangana State, civil and political leaders should create awareness on the virtues of strengthening and reversing to traditional dietary practices of consuming of millets and sorghum in lieu of expensive rice to increase household food security.

In West Africa's semi-arid tropics (WASAT), compared to other cereal crops, sorghum and pearl millet are widely cultivated and are the main staple diets for the people. In this region of Africa, too, sorghum and millet took a dip in production, more so in urban areas but regained the production. It was found that small-scale coarse grain food processing industry had the potential to support these two cereals production (Ndjeunga & Nelson, 1999).

According to Telangana agriculture minister, the government is crafting initiatives for sorghum seeds exports to benefit small farmers for food and income. Acknowledging these two cereals importance to small farmers, the new government intends to support the food processing sector through new policies, incentives, industrial parks and research (ICRISAT, 2015).

2. DRYLAND CEREALS – SORGHUM AND MILLETS

According to International Crops Research Institute of Semi-Arid Tropics (ICRISAT) (n.d.), in the semi-arid tropical regions of South Asia and sub-Saharan Africa millet and sorghum are important sources of staple diet and for economic returns in predominantly subsistence cropping systems. Nearly 80% of dryland cereals are consumed on farm, providing food security for the poorest.

In more than 30 countries, 500 million people depend on sorghum for a staple diet, for example, jowari roti or jonnarotte (unleavened bread from sorghum) is widely consumed in Telangana region and more than 90 million people in Asia and Africa sorghum is eaten as flat bread and porridge (Prasad & Staggenber, 2009). In drylands, for crops to thrive there are fewer options and millet and sorghum do exceedingly well in harsh, drought conditions. Because of climate change and large numbers of land getting drier, dry land cereals are seen as viable alternatives where other cereal crops fail. They are easy to produce, inexpensive and grow quickly, adaptable to various soil conditions, improved farm methods can yield higher returns, with bare external inputs, and responsive to minimal water and fertilizers.

Sorghum is the fifth most produced cereal crop on earth after corn, wheat, rice, and barley (FAO, 2015). Sorghum adapts well to tropical and subtropical environments but substantial part of crop comes under drought-prone, semi-arid tropical regions on earth. With limited inputs and rain and low soil fertility, its growth is limited, so also the yields. However, there is a tremendous potential for sorghum under favorable conditions. Unfortunately a large percentage of subsistence farmers are failing to maximize its potential due to absence of better management practices. Experts are of the view that sorghum production in semi-arid tropics (SAT) can be improved by seed-based inputs such as cultivars that can withstand drought, poor soil fertility and diseases and pests (ICRISAT, 1997).

Telangana shares some of the characteristics of Africa due to semi-arid conditions. The origins of sorghum lie in Africa and Africans have good knowledge of cultivation and consumption of sorghum and it is the second most important grain in Africa, and is considered as the 21st century grain for Africa (Africa Harvest, 2010).

Sorghum dominates in rural households' menus compared to urban areas. With large rural populations migrating to cities, efforts should be made not only by nutritionists but also local businesses and NGOs to strengthen sorghum supply chain.

Millet is a collective term to refer a range of small-grained cereal grasses that is cultivated in fields with low soil fertility and rainfall. In semi-arid regions, it is an important staple, globally its production is only 2%. Millets are being cultivated for more than 10,000 years. Around 95%, millet production occurs in Asia and Africa, with 40% in Asia and the rest 55% in Africa. The most common species of millet are: a) pearl millet (*Pennisetum glaucum*) has several local names, including bulrush millet, babala, Ddukn (in Sudan), and bajra or ragulu (Telangana), and b) finger millet (*Eleusine caracana*). Pearl millet is the largest produced millet (Prasad & Staggenber, 2009).

The unique quality of the grain is the hard to digest outer shell which deters insects and it can easily last for several years without storage facilities. It is an ideal food during emergencies, floods and droughts as it can withstand extreme climate and weather changes and has the ability to tackle the dire predictions of the doomsday. Compared to other grains such as rice and wheat that have a short shelf life – normally a year or two – millet can be stored for years without elaborate storage arrangements. It is easy to grow and do not need any pesticide and a small portion of urea is sufficient. It is a rainfed crop and cultivates within a 3-month period and is highly recommended for babies and during convalescence as it contains protein, iron, mineral and calcium. It is inexpensive to purchase and costs half the price of wheat or rice, yet with more rich nutrients for health (Gopal, 2012).

They have essential nutrients to combat malnutrition not only in Telangana but also in other dry regions. Large concentration of iron in sorghum and millet can reduce anemia. Finger millet has half of the daily iron requirements, and pearl millet has 100% iron daily dietary requirements. Stunting can be reduced as sorghum and millet have high levels of zinc (Isalker, 2010). Finger millet has several nutrients for lactating women and children and is viewed as a possible source to eliminate malnutrition in Africa. Apart from numerous health and ecological benefits for humans, they also offer food for the livestock sector in the form stover for dairy animals and seeds to birds and poultry.

Millets consume less water; the rainfall required for sorghum, pearl and finger millet is less than 25% that of banana and sugarcane, and 30% of rice (DDS, n.d). As water and food crisis loom large in the future for us, these cereals can contribute to food security. In general, poor farmers are the holders of low fertile and marginal lands in India. The crops most suitable for this kind of terrain are millets and offer multiple securities such as food, fodder, fiber, health, ecology and livelihood. For more than half century neglect of millet has contributed to rise of diseases like obesity, diabetes, cardiovascular, etc., and the restoration of these grains can next 'evergreen revolution' (National Academy of Agricultural Sciences, 2013).

For instance, millets thrive in the Sahelian soil environments in West Africa where around 74% of millet is cultivated in Africa and 28% of the global production. If grown easily in such African ecological zone where average rainfall is below 500 mm, it proves their ability to sustain in very harsh conditions.

Millet Network India, Deccan Development Society and FIAN, India, report titled *Future Food and Farming* has brought to the forefront many issues. According to the report, it is necessary to foster institutional methods as millets require many such as local-bred livestock suitable to local ecosystems to develop symbiotic alliances between farming and pastoralism for organic manure, stover, dairy production and diverse incomes for farmers. It is necessary to focus on improving productivity of the rainfed lands where millets are cultivated through special watersheds on millet lands and require government's support from sowing to harvesting of millets. By default millet farms are bio-diverse and efforts should be made at multicropping and not on one crop only. Generous institutional finance and insurance are available to rice farmers, similar packages should be available for millet farmers. Research institutions should provide new impetus to millet and sorghum issues as they come with rich micronutrients.

3. MALNUTRITION OR MISMANAGEMENT: ROLE OF CULTURE

In developing countries, rural people constitute high percentage of the malnourished and hungry. As such, developments in agriculture and rural sector become paramount for inclusive growth. India has the highest number of undernourished people in the world, around 194.6 million people (“India Tops World Hunger”, 2015). According to Svedberg (2008), “The high and persistent incidence of child malnutrition may seem surprising considering that India has done remarkably well in economic terms since the policy reform process gained momentum in the early 1990s” (p. 2).

For decades, public health researchers were puzzled to explain the determinants for high levels of malnutrition in India, despite of high economic growths. Researcher Ramalingaswamy and his colleagues referred this conundrum as “South Asian enigma” to imply low birth weight, gender inequality and poor hygiene as underlying factors for this phenomenon. Indian society is dominated by patriarchal norms which perpetuate low status of women that result in a gender bias in disbursement of health care and food in intra-household. Lack of timely and useful information on pre- and post-natal care contributes to malnutrition in children and a large percent are poor people (Kanjilal, Mazumdar, Mukherjee, & Rahman, 2010).

According to UNICEF, girls and women in South Asia are in unfavorable situations compared to their sub-Saharan African counterparts, as empirical studies have proved life expectancies between men and women in Asia is skewed against females and stands below the worldwide norms. South Asian society, families, and spouses are found to care less girls and women and is observed mothers feed their sons the best available food in lieu of their own and daughters. “Women in both regions, indeed in all regions, may be subordinated; but the demands made in patriarchal South Asian societies on the time and energies of women are visibly more excessive and unfair than in other regions of the world” (Ramalingaswami, Jonsson, & Rohde, 1997, para. 17).

Malnutrition is preventable as it is the case in Vietnam, Thailand and China (Reich & Balarajan, 2012). Nutrition education is critical. The poor (and to certain extent the middle class and the rich) make poor nutritional choices by not including high energy and healthy sources. For instance, millet and sorghum based porridge, ambali, in Telanagana was widely eaten for breakfast and in summer months and newer generations should be made aware this nutrition, yet cheap source of rich energy.

According to a study conducted by Cornell University found that pearl millet to be loaded with iron and can reverse iron deficiency in India's school children within a short span of six months—and four months were sufficient to improve iron levels compared with ordinary pearl millet. During the study period, school children who were iron-deficient were provided iron-rich pearl millet unleavened bread called ‘bhakhri’ during midday and evening meals and the outcomes saw iron levels improved (“Iron-rich Pearl Millet”, 2015).

Though there are a wide variety of healthy, cheap dietary options available for the humans today, only a fraction of plant species are being used as food crops. A recent study conducted by People's Voice for Child Rights (PVCN) and Child Rights and You (CRY) has reported a dismal picture of the state's children health status with nearly 40 percent being malnourished. For optimum human development balanced diet and nutritious food is important. Malnutrition has adverse impacts on the people's productivity and on the development of the region (Reddy, 2010).

The gender education and non-involvement of men in the decision making related to cooking and household chores in an Indian household are a few of factors. A recent global survey indicated that Indian men ranked as the least participants in the household chores. A vast majority of South Asian men do not participate either a nurturing a child or in choosing meals in a house. Promotion of gender equality in South Asia is critical to reducing malnutrition—equal rights, opportunities and autonomy for women within and outside home. A better educated woman can address health and nutrition problems at micro-level. A paradigm shift from welfare to human rights approach with an accent on community empowerment will have better child nutrition outcomes (Ramalingaswami, Jonsson, & Rohde, 1997).

Nutritional counseling for parents, along with changing the cooking pattern, healthy recipes promotion and dietary practices can mitigate the malnutrition problem. Wheat and bread based diets of non-South Indians bring to the fore that the South Indian rice-based diets are faulty and devoid of nutrients to a large extent. For example, the watery, thinner dal (lentil soup) served along with rice drained of water is the common staple diet in many poor households do not hold any nutrition value and is protein-poor compared to thick dals/lentil soups that accompany bread of North Indians—therefore, physically more stronger than South Indians. Similarly, Africans are poor, too, yet their diet consists of maize/corn porridge and corn ugali have better physical outcomes. It is essential to revert to traditional Telangana diet of millets (finger and pearl millets) and sorghum to alleviate nutrition problems.

Awareness campaigns are being taken regularly by the College of Home Science, Telangana State Agricultural University, Hyderabad, among the rural and urban communities on the virtues of including millets in daily diet and ways to develop markets for millet farmers. The College of Home Science regularly performs research to create millet-based processing technologies for snack and meal items to promote consumption for rural women. It is necessary to disseminate the lessons learned on millets to wider national and international audiences (Milletfest.org).

4. CONCLUSION

Telangana is characterized by dryland agriculture that requires synergy between cropping patterns and dietary choices. It is necessary to explore institutional innovations, establish partnerships, and develop capacities to tackle food insecurity, malnutrition and gender inequalities. Large urban and non-traditional families should be made aware of millet and sorghum nutritional value and revitalize markets to generate a demand for Telangana these two cereal crops. Policy makers attribute to historical political reasons for the neglect of the region and perhaps it is the best time for viable policies and programs to harness the region's natural resources.

The promise of new state does bring renewed energies and focus to develop linkages between dryland agriculture and enhanced nutrition. In both urban and rural areas, use of appropriate processing technologies can usher in value-added and health products. A pro-active government that combines agriculture, nutrition and health, and extension can make effective targeted interventions to alleviate food insecurity and health problems. In the state's capital, Hyderabad, there are several NGOs and top-notch academic institutions with impressive research and extension capacities. The new Telangana administration needs to collaborate with them to address interrelated development agenda of the region and improve the nutrition of the people.

Millennium Development Goal target (MDG1) envisions of halving the hunger in people between 1990 and 2015. Poor diet, faulty food habits and sickness contribute to malnutrition. Directly or indirectly nutrition is related to most of MDGs, in turn, are intimately related and the right to good nutrition and food (FAO, n.d.). Though several organizations are working to promote sorghum and millet but lots to be done to create awareness for the new generation, urban consumer to harness semi-arid resources (ICRISAT, 2014).

5. REFERENCES

- Alexandratos, N., & Bruinsma, J. (2012). *World agriculture towards 2030/2050* (The 2012 Revision). Rome, Italy: Food and Agriculture Organization. Retrieved from <http://www.fao.org/docrep/016/ap106e/ap106e.pdf>
- Africa Harvest. (2010). *Why sorghum*. Retrieved from http://biosorghum.org/why_sorghum.php
- Deccan Development Society. (n.d.). *Millets: Future of food and farming*. Retrieved from <http://www.swaraj.org/shikshantar/millets.pdf>
- Dev, M. (2012). *Small farmers India: Challenges and opportunities*. Retrieved from <http://www.igidr.ac.in/pdf/publication/WP-2012-014.pdf>

- Differencebetween.info. (2014). *Difference between cereal and millet*. Retrieved from <http://www.differencebetween.info/difference-between-cereals-and-millet>
- eTelangana.org. (2005). *History of telangana*. Retrieved from <http://etelangana.org/home/history>
- Food and Agriculture Organization. (n.d.). *Fertilizer use by crop in India*. Retrieved from <http://www.fao.org/docrep/009/a0257e/a0257e02.htm>
- Food and Agriculture Organization. (2012). *World agriculture towards 2030/2050 (The 2012 Revision)*. Retrieved from <http://www.fao.org/docrep/016/ap106e/ap106e.pdf>
- Food and Agriculture Organization. (2005). *Fertilizer use by crop in India*. Retrieved from <http://www.fao.org/docrep/009/a0257e/a0257e02.htm>
- Food and Agriculture Organization. (n.d.). *Nutrition and the MDGs: Accelerating progress towards 2015*. Retrieved from http://www.fao.org/fileadmin/templates/tci/pdf/Investment_Days_2010/Session_I/SCN_State ment_Nutrition_and_the_MDG.pdf
- Food and Nutrition Board. (2008). *Nutritious recipes for complementary feeding of infants and young children*. Retrieved from [http://wcd.nic.in/publication/1176-iyct%20nutritious%20recipes%20english%20final%20\(29.10.07\).pdf](http://wcd.nic.in/publication/1176-iyct%20nutritious%20recipes%20english%20final%20(29.10.07).pdf)
- Food and Agriculture Organization. (2015). *Information on post-harvest operations*. Retrieved from <http://www.fao.org/inpho/inpho-post-harvest-compendium/cereals-grains/en/>
- Gopal, S. (2012, March 27). Include millets in regular diet, say experts. *The Hindu*. Retrieved from <http://www.thehindu.com/news/national/andhra-pradesh/include-millets-in-regular-diet-sayexperts/article3248602.ece>
- India tops world hunger list with 194.5 million people. (2015, May 29). *The Hindu*. Retrieved from <http://www.thehindu.com/news/national/india-is-home-to-194-million-hungry-peopleun/article7255937.ece?homepage=true>
- International Crops Research Institute for Semi-arid Tropics. (2014, June). *India's minister for agriculture Radha Mohan Singh visits ICRISAT*. Retrieved from <http://www.icrisat.org/newsroom/latest-news/happenings/happenings1629.htm>
- International Crops Research Institute for Semiarid Tropics. (1997). *Development of cultivators and seed production techniques in sorghum and pearl millet - Training manual*. Retrieved from <http://www.icrisat.org/what-we-do/learning-opportunities/lisu-pdfs/development.pdf>
- International Crops Research Institute for Semiarid Tropics. (n.d.). *Why dryland cereals?* Retrieved from <http://www.icrisat.org/Images/Why-dry-land>
- International Crops Research Institute for Semiarid Tropics. (n. d.). *Pearl millet*. Retrieved from http://exploreit.icrisat.org/page/pearl_millet/680
- International Crops Resesarch Institute for Semi-Arid Tropics. (2015). *New initiatives in to boost export of seeds and sorghum products from Telangana, India*. Retrieved <http://www.icrisat.org/newsroom/news-releases/icrisat-pr-2015-media6.htm>
- Iron-rich pearl millet reverses iron deficiency in children: Study. (2015, May 19). *The Hindu*. Retrieved from <http://www.thehindu.com/news/national/telangana/ironrich-pearl-millettereverses-iron-deficiency-in-children-study/article7221908.ece>
- Isalker, U. (2010, June 14). Bring millets back to the table, it's healthy. *Times of India*. Retrieved from <http://timesofindia.indiatimes.com/city/pune/Bring-millets-back-to-the-table-itshealthy/articleshow/6045102.cms?referral=PM>
- Kanjilal, B., Mazumdar, P., Mukherjee, M., & Rahman, H. (2010). Nutritional status of children in India: Household socio-economic condition as the contextual determinant. *International Journal of Equity Health*, 9, 19. doi:10.1186/1475-9276-9-19
- Milletfest.org. (2015). *Milletfest*. Retrieved from <http://www.milletfest.org/about-event-2015.html>
- National Academy of Agricultural Sciences. (2013). *Role of millets in nutritional security of India*. Retrieved from <http://naasindia.org/Policy%20Papers/Policy%2066.pdf>
- Ndjeunga, J., & Nelson, C. (1999). *Prospects for a pearl millet and sorghum food processing industry in West Africa semi-arid tropics*. Retrieved from <http://oar.icrisat.org/4891/>

- Pionetti, C. (2005). *Sowing autonomy: Gender and seed politics in semi-arid India*. London, UK: International Institute for Environment and Development.
- Prasad, V., & Staggenber, S. (2009). *Growth and production of sorghum and millets*. Retrieved from <http://www.eolss.net/sample-chapters/c10/e1-05a-14-00.pdf>
- Pray, E. C., & Nagarajan, L. (2009). *Pearl millet and sorghum improvement in India* [IFPRI Discussion Paper]. Washington D.C.: International Food Policy Research Institute. Retrieved from <http://www.ifpri.org/sites/default/files/publications/oc64ch12.pdf>
- Sen, C. (2009, March). *The Indian meal - The Indian meal, nutritional values of the Indian meal*. Retrieved from http://www.colleensen.com/index.php?option=com_content&view=article&id=87%3Atheindian-meal&catid=22%3Aarticles-a-papers&Itemid=65&limitstart=3
- Siegfried, T. et al. (2010). *Modeling irrigated area to increase water, energy, and food security in semiarid India*. Retrieved from http://water.columbia.edu/files/2013/01/2010modelling_irrigated.pdf
- Svedberg, P. (2008). *Why malnutrition in shining India persists* [Paper presented at ISI conference]. Retrieved from http://www.isid.ac.in/~pu/conference/dec_08_conf/Papers/PeterSvedberg.pdf
- Ramalingaswami, V., Jonsson, U., & Rohde, J. (1997). *Commentary: The Asian enigma*. Retrieved from <http://www.unicef.org/pon96/nuenigma.htm>
- Reddy, A. A. (2010). Regional disparities in food habits and nutritional intake in Andhra Pradesh, India. *Regional and Social Economic Studies*, 10(2), 125-134.
- Reddy, A. (2012). *Regional disparities in Andhra Pradesh, India*. Retrieved from <http://lec.sagepub.com/content/28/1/123>
- Reich, M., & Balarajan. (2012). *Political economy analysis for food and nutrition security*. Retrieved from <https://openknowledge.worldbank.org/bitstream/handle/10986/13569/769210WP0Polit00Box374391B00PUBLIC0.pdf?sequence=1>
- Warriar, G. (2013, August 6). Telangana: Stone or diamond? *The Hindu*. Retrieved from <http://www.thehindubusinessline.com/opinion/telangana-stone-ordiamond/article4996206.ece>