



Quantifying the impact of diet quality on hunger and undernutrition

Yibo Luan^b, Günther Fischer^c, Yoshihide Wada^c, Laixiang Sun^{c,d}, Peijun Shi^{a,*}

^a State Key Laboratory of Earth Surface Processes and Resource Ecology, Academy of Disaster Reduction and Emergency Management, Ministry of Civil Affairs & Ministry of Education, Faculty of Geographical Science, Beijing Normal University, No.19, XijieKouWai Street, Beijing, 100875, China

^b School of Geography and Ocean Science, Nanjing University, 163 Xianlin Ave., Qixia District, Nanjing, Jiangsu Province, 210023, China

^c WAT, International Institute for Applied Systems Analysis, International Institute for Applied Systems Analysis (IIASA), Schlossplatz 1, A-2361 Laxenburg, Austria

^d Department of Geographical Sciences, University of Maryland, University of Maryland, 2181 Samuel J. LeFrak Hall, 7251 Preinkert Drive, College Park, MD 20742, USA

ARTICLE INFO

Article history:

Received 28 March 2018

Received in revised form

10 August 2018

Accepted 8 September 2018

Keywords:

Nutritional adequacy

Undernutrition

Hunger

Diet

Africa

Representative socioeconomic pathways scenarios

ABSTRACT

Food and nutrition security has been a persistent major challenge to human societies and this challenge continues into the 21st century, especially taking into consideration the targets set by the UN Sustainable Development Goals, which call for eradicating hunger (goal 2), ending poverty (goal 1), sustainably managing and using natural resources and ecosystems (goal 15), and combating climate change (goal 13). The way food is consumed and produced affects the human well-being as well as the environment. Avoiding food losses and adopting a balanced healthy diet is also an important step towards sustainability. Promoting dietary standards and monitoring their adoption is a potentially important policy tool for mitigating environmental impacts of food production as well as monitoring food security and nutrition. There is relatively little research to measure nutritional adequacy of food intake according to dietary standards, and to explore the relationship with health outcomes. In this study we choose the well-established WHO global-level dietary recommendations as a reference to quantify nutritional adequacy by developing an energy and macronutrient intake index (ENI), and to assess its relation to indicators of hunger and undernutrition. We find strong negative association between nutritional adequacy of dietary intake and prevalence of undernutrition at national level, and we illustrate that ENI could be an effective tool to inform national food security strategies. Under different future socioeconomic development scenarios, almost all sub-Saharan African countries achieve an adequate per capita energy intake level but their nutritional status varies with many countries deviating from recommended levels because of the unbalanced development of macronutrient intake levels; more improvement exists in fat and energy intake levels and less agreement in fruit-vegetable and animal protein intake levels. Scenario application proves that the relationship between ENI and undernutrition could readily be applied in future scenarios generated by integrated assessment models to provide insights into the impacts of various climate change scenarios, socioeconomic development pathways and alternative global trade policies on global hunger and undernutrition status.

© 2018 Elsevier Ltd. All rights reserved.

1. Introduction

Although considerable progress has been made in reducing these food and nutrition insecurity, ending hunger and malnutrition – as asked for in the UN Sustainable Development Goals

(SDGs) universally adopted in 2015 – remains a crucial and multifaceted topic of global concern. Worldwide, more than 800 million people do not have enough food to satisfy their calorie needs on a daily basis (FAO, 2017). Roughly 159 million children (~25% of all children with age under-five children) suffer from stunting growth, 100 million (~17% of all under-five year old children) experience moderate or severe underweight, and about 50 million (~3% of all under-five children) suffer from acute undernutrition (wasting, i.e. low weight for height) (WHO, 2015). This widespread, and in some cases, a growing issue of hunger and undernutrition reflects differences and deficiencies of dietary

* Corresponding author.

E-mail addresses: whuyimu@hotmail.com (Y. Luan), fisher@iiasa.ac.at (G. Fischer), wada@iiasa.ac.at (Y. Wada), lsun123@umd.edu (L. Sun), spj@bnu.edu.cn (P. Shi).

quality which exist both between and within countries.

Inadequate dietary intake and prolonged undernutrition may have severe consequences for a country's social capital, and through its impact on economic development could affect almost every facet of society (Headey, 2011; Huang et al., 2013). There is overwhelming evidence that undernutrition contributes to higher morbidity, disability, mortality, lowered reproductive performance, and even decreasing economic productivity (Deaton and Drèze, 2009; UNICEF, 2013).

Food nutrition and security depends on a range of factors (UNICEF, 1990; Schmidhuber and Tubiello, 2007), in which diet is an essential determinant of human health (Tilman and Clark, 2014). Inadequate dietary intake results from low quantities of food consumed and poor diet quality and diversity. The typical diet across many low and middle-income nations falls below quantity, quality, and diversity requirements. Many studies have previously characterized diet quality in different ways and quantified their contribution to hunger and undernutrition (Arimond and Ruel, 2004; Lloyd et al., 2011; Remans et al., 2014). In addition to calorie supply, which has long been treated as a major characteristic of diet affecting nutrition outcomes, dietary diversity has become another important one. Using different metrics, researches has shown that the level of dietary diversity determines people's broader nutritional status in many situations. In addition to directly measuring diet quality, dietary guidelines, WHO global-level recommendations (WHO, 2015) and national-level nutritional plans (Fisher and Garnett, 2016) are also used as standards to guarantee the food and nutrition security, and indirectly evaluate current diet quality (Ritchie et al., 2018; Springmann et al., 2016). According to these dietary standards, yet there is relatively little research measure nutritional adequacy of dietary intake, and explore its relationship with nutritional outcomes.

The way food is consumed and produced affects the human well-being as well as the environment (He et al., 2018). Avoiding food losses and adopting a balanced healthy diet is also an important step towards sustainability, especially when taking into consideration the targets set by the UN Sustainable Development Goals, which call for eradicating hunger (goal 2), ending poverty (goal 1), sustainably managing and using natural resources and ecosystems (goal 15), and combating climate change (goal 13) (United Nations, 2017). Development of dietary pattern could change the structure of agricultural systems, and indirectly affect the natural resources and environment (Alexander et al., 2016; Davis et al., 2016). Dietary patterns have been closely related to economic income, parental education, food availability and access (Kearney, 2010). In short, along with the acknowledgement of the key role of diets in linking food security, environmental sustainability and socio-economic development, accepted dietary standards are a potentially important policy tool for mitigating environmental impacts of food production as well as monitoring food security. Therefore, in this study we choose well-established WHO global-level recommendations (WHO, 2003; WHO, 2015) as a reference to measure the nutritional adequacy of dietary intake, and to quantify its relation to hunger and undernutrition.

Many terms are used to describe hunger and undernutrition. According to food security's definition from FAO (Pinstrup-Andersen, 2009), there are four dimensions of food security and various indicators have been developed with the aim to capture the relevant aspects of food insecurity at different scale levels, correspondingly (Gross et al., 2000). Among them, two kinds of indicators are widely used: the FAO estimated undernourishment (Svedberg, 2000), and anthropometric measures derived from household survey (de Onis, 2006). The FAO undernourishment is among the most widely used measures to understand the ability of a society to acquire enough food to meet the daily minimum

dietary energy requirements at the country level. It focuses on food availability in terms of calories (Cafiero and Gennari, 2011). In fact, the FAO argues that undernourishment is synonymous with hunger (FAO, 2016).

Derived from household surveys, anthropometric measures are often considered as proxy measures of food utilization, assessing nutritional outcomes at individual level (Svedberg, 2011). Among them, under-five child stunting (low height for age) and underweight (low weight for age) are most commonly used in estimation of undernutrition, offering insights into chronic and/or medium term nutritional problems for the most vulnerable population (de Onis and Blössner, 2003; de Onis et al., 2012; WHO, 2009). Methods for the measurement of nutritional outcomes in the adult population are available but are rarely used (Masset, 2011). In contrast to the body size of adults, the growth potential of children under five does not differ significantly by ethnic origin (WHO, 2006). Undernutrition refers to a physical state and is non-specific with regard to particular nutrients. It is caused by two aspects, the shortage of energy and nutrition intake, and the health status (FAO, 2000). Both of these two aspects further caused by a range of socioeconomic factors such as sanitation, social inequality, diseases, or maternal factors (Fotso and Kuate-Defo, 2005; Headey et al., 2017; Smith and Haddad, 2015; UNICEF, 1990). So essentially, anthropometrics is particularly complementary and to some extent more comprehensive than the FAO undernourishment in many respects, especially in linking health, sustainable diet, society development and agricultural systems (Dora et al., 2015).

This paper addresses three research questions: 1) What has been the dynamics of dietary nutritional adequacy across nations? 2) What is the contribution of nutritional inadequacy to hunger and undernutrition at national scale? 3) Under different scenarios of future diet development driven by socio-economic development, how is hunger and undernutrition expected to evolve in sub-Saharan Africa? The FAO undernourishment indicator describes the prevalence of deficits in aggregate food energy provision (in short, prevalence of hunger), and under-five child stunting and underweight indicate different aspects of the impact of undernutrition on the most vulnerable population segment. It should be noted that we do not distinguish between the moderate and severe level of stunting and underweight, nor do we analyze in this study the impacts of climate change or of future global food trade on food and nutrition security. To answer the three research questions, we develop an energy and macronutrient intake index (ENI) by combining important macronutrients and food categories. With the ENI we link diet quality in terms of nutritional adequacy to chronic nutritional outcomes in terms of children under-five stunting and underweight. Dynamics of ENI across all nations from 1991 to 2010 are analyzed. By statistical analysis, we examine the performance of ENI and establish relationships of ENI with two anthropometric measures (under-five stunting and underweight). To test applicability of the ENI method in scenario assessment, we select sub-Saharan Africa as our study region. We apply the ENI method to the projected food consumption of sub-Saharan African countries to estimate future levels of hunger and undernutrition status in the 2050s under different population and socioeconomic scenarios.

2. Methodology

The data used in this study are presented in Appendix F, Table 1. The methodology is described in the two following sections below.

2.1. Composing the ENI

We construct the energy and macronutrient intake index (ENI) to measure the diet quality using the following steps. First, we

Download English Version:

<https://daneshyari.com/en/article/10156304>

Download Persian Version:

<https://daneshyari.com/article/10156304>

[Daneshyari.com](https://daneshyari.com)