Chapter 2

Challenges to ensuring good health and well-being

Diogo Denardi Porto
Lúcia Helena Piedade Kiill

Introduction

Over the past 15 years, international cooperation efforts intermediated by the United Nations (UN) and implemented by governments and non-governmental organizations in several countries have resulted in significant improvements for the quality of life of lower-income populations. The incidence of contagious diseases, premature deaths from non-contagious diseases and infant and neonatal mortality rates are declining (United Nations, 2017). These efforts now need to be expanded so that good health and well-being targets are met.

In 2030 Agenda, SDG 3 is represented by nine targets (Table 1) seeking to "ensure a healthy life and well-being for all, at all ages" (United Nations, 2018). Among them, Embrapa RD&I actions have contributed to reach two targets (3.4 and 3.9), which will be contextualized here.

Premature mortality due to chronic non-communicable diseases

According to the World Health Organization (WHO), chronic non-communicable diseases (NCDs) have become a major health problem in many countries. Diseases such as hypertension, type 2 diabetes, chronic cardiovascular and respiratory problems, as well as certain cancers have been reported as the cause of about 56 million deaths worldwide in 2015. This indicator accounts for 70% of all registered deaths, with more than 90% occurring in low and middle-income countries. In addition, the impact of these diseases also reflects in the high rates of years of life lost, in the reduction of the workforce and daily activities (World Health Organization, 2013, 2017b).

In 2007, in Brazil, NCDs accounted for 72% of deaths; the most prevalent diseases were circulatory system diseases (31.3%), neoplasias (16.3%) and diabetes (5.2%)

Table 1. Sustainable Development Goal 3 targets, with emphasis on those that count on the contributions of Embrapa.

Target	Description
3.1	By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births
3.2	By 2030, end preventable deaths of newborns and children under five years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births
3.3.	By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases
3.4	By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being
3.5	Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol
3.6	By 2020, halve the number of global deaths and injuries from road traffic accidents
3.7	By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes
3.8	Achieve universal health coverage, including financial risk protection, access to essential, quality good health services and access to essential, safe, effective, quality and affordable medicines and vaccines for all
3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
3.A	Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate
3.B	Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all
3.C	Substantially increase health financing and the recruitment, development, training, and retention of the health workforce in developing countries, especially in least developed countries and small island developing States
3.D	Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global good health risks

Source: United Nations (2018).

(Schmidt et al., 2011). The loss of labor productivity and the decrease in family income resulting from the presence of some NCDs would probably have led to a loss in the Brazilian economy of US$ 4.18 billion between 2006 and 2015 (Abegunde et al., 2007).

Among the main determinants of NCDs increase are the demographic, epidemiological and nutritional transitions. In this last one, the changes in dietary patterns stands out because of urbanization and industrialization that have led people to adopt high-energy diets based on meat, milk and high fat derivatives with low nutritional values (Pan American Health Organization, 2014).

These changes also related to the increase in obesity of the population in developing countries. In Latin America, around 58% of the adult population (about 360 million) is overweight, which is similar to the Brazilian population tendency, according to the Pan American Health Organization (2014), Brazil (Brasil, 2017) and FAO (2017) research. These changes are even more pronounced when observing the evolution in cases of obesity and NCDs in less privileged ethnic and racial groups, such as the indigenous, Afro-descendants and vulnerable populations suffering from iniquities (Schmidt et al., 2011).

Therefore, in the last decades, there has been an intensification of research on the relationship between food, nutrition and good health. In addition to contributing to NCDs reduction, studies show the importance of diet in improving mental and physical performance, as well as in strengthening the immune system, among other benefits.

Contamination of people and the environment through agricultural activities

A large number of people become ill every year due to the consumption of contaminated food, even in developed countries. In more severe cases, hospitalization and even death may occur. Therefore, there is a significant demand for safe food.

Safe food consists of food free from contamination by biological, physical and chemical agents harmful to human health. This contamination may come from several sources, potentially present from the primary production and along food supply chains. In primary production, food can be contaminated as a result of the use of areas where the environment itself is a threat to food safety, with

the presence of dangerous substances or outbreaks of pathogenic organisms. However, even if produced under suitable premises, food may become unsafe during transport between the facility and the place of supply to the final consumer due to inadequate handling and lack of control measures.

Food safety has received increasing attention from international organizations, which reflects, for example, in barrier clauses as part of trade agreements and periodic inspections of productive facilities such as agro-industries. International control agencies such as the World Trade Organization (WTO) closely monitor food safety standards in order to ensure product quality and safety.

Consumption of contaminated water is another serious problem, affecting millions of people every year. The number of deaths due to diarrhea reaches 1.5 million annually (World Health Organization, 2017a). Approximately half of these deaths may occur due to contamination of water for human consumption. In addition to diarrhea, the consumption of contaminated water can cause illnesses such as cholera, hepatitis, typhoid fever and poliomyelitis.

In addition to biological agents as microorganisms that cause infections and diseases, contaminated water can contain chemical agents, such as medicine residues, poisons and other toxic substances, even radioactive, which can cause serious illnesses such as cancer. Certain harmful substances may remain in the water even after effluent treatment. This is the case of chemical compounds called endocrine interferons, which can cause intoxication even at very low concentrations.

In Brazil, although the supply of water in quantity is not a problem in most of the territory, an increasing number of places has problems with water quality on their sources. There are several causes for water contamination; the most common are the urban and industrial sewage disposal without treatment directly in the environment and the indiscriminate use of toxic chemicals in agricultural activities.

Some agricultural technologies have risks associated to their use and, in this regard, environment and human contamination with synthetic pesticides is a relevant matter, especially in Brazil. The country is one of the world leaders in agricultural production; however, it is the one that most consumes synthetic pesticides. The use of this input has grown rapidly in the last decade, and Brazil is currently responsible for approximately one fifth (20%) of the world consumption of pesticides.

Uncontrolled application of synthetic pesticides in rural areas can cause several problems both to the environment and to human health. Rainwater can carry

chemical residues present in the soil and accumulate them in the water sources, which will then be used in the human supply. In addition to environmental contamination, the exposure of rural workers to synthetic pesticides is another problem associated with the lack of control in the use of these products. The number of intoxication cases among farmers is high and often originates from inadequate handling. Figure 1 shows a map with the distribution of the use of synthetic pesticides in Brazilian municipalities.

Several countries recognized the problems generated by the indiscriminate use of synthetic pesticides and began to adopt policies to discourage their usage. These new policies started to stimulate the search for alternative forms of food production and the establishment of certifications regarding the prohibition or the correct usage of synthetic agrochemicals. One of the greatest challenges of agricultural production is to combine compliance to standards and required certifications along with production yields sufficient to meet all demand for food.

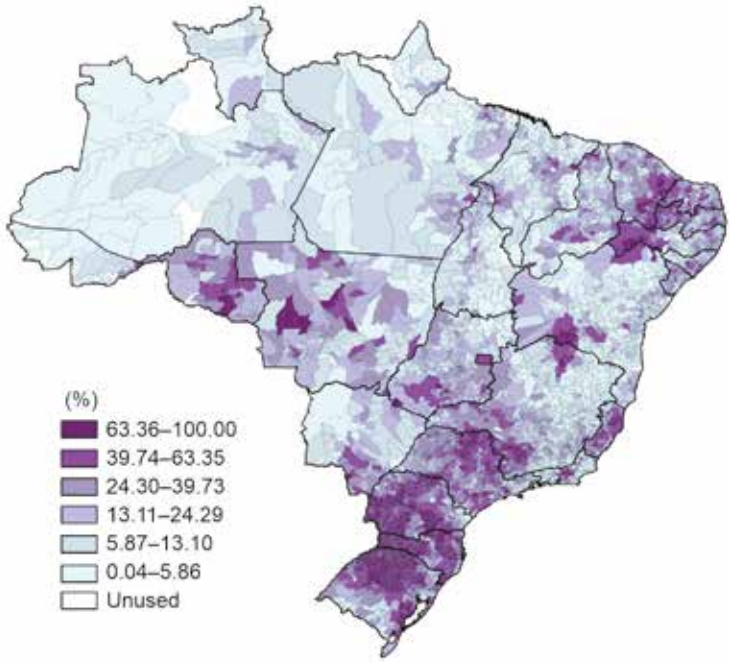

Figure 1. Percentage of establishments that use pesticides in relation to the total of rural establishments in Brazilian municipalities.

Source: Adapted from Bombardi (2017).

Reference standards for food safety

The Joint WHO/FAO Food Standards Program has set out a number of recommendations for safe food production. These standards are compiled in the collection called Codex Alimentarius (from the Latin "food law" or "food code"), which in turn serves as a reference for food safety standards used worldwide.

The Codex is applied to all types of food, including processed, semi-processed and *in natura*. The maximum limit of chemical residues in food is an example of an established standard. For this standard, the presence of a list of substances used for various purposes in food production, such as pesticides, antibiotics and hormones, is evaluated. The concentration of these substances in the food has a maximum threshold, which stands as a safety reference. The rationale behind these thresholds is that the amount of residue found in food should be safe to the final consumer and as little as possible.

In addition to chemical contaminants, Codex establishes standards and norms for controlling the presence of pathogenic microorganisms in food. Measures to ensure food hygiene need to be applied throughout the production chain, including transport, storage and supply to the consumer. Among these measures are the control of sanitary conditions of raw materials and production area, the hygienic elimination of all rejected material in the production process, the maintenance of an adequate hygiene level among the people involved and the quality control of product storage.

Standards that regulate food safety are constantly changing with new milestones in which the use of an increasing variety of toxic products is banned, and progressively lower chemical levels are tolerated in food. Meanwhile, new technological strategies, especially those derived from biotechnology and nanotechnology, are incorporated into productive means; however, even these are subject to regulation and not all are accepted in importing countries.

Increasing food nutritional quality

With the development of the global cargo transport network, the consumption of fresh products from other continents has become a tangible possibility. However, in addition to transport infrastructure, the products had to tolerate long periods in various storage modalities without losing quality and nutritional properties. This is still a challenge for a wide range of products and, considering

the restriction on the use of potentially hazardous chemicals, it may require highly innovative approaches. Not only have the populations that import fresh products for consumption benefited from their greater conservation. Among other advances, the greater product durability can confer less food waste, greater use of production and lower price of these products for all consumers.

Another way of ensuring the preservation of nutrients in food is forms of processing that, while eliminating the presence of pathogenic microorganisms and guaranteeing product preservation for long periods, preserve the substances responsible for their functional properties. One of the most traditional methods of preserving food is the treatment with high temperatures followed by packaging in tightly sealed containers. Although effective and easily incorporated into the industry, this method eliminates several beneficial natural substances, such as vitamins and antioxidants.

Thus, advances in food industry technology have contributed as one of the means for improving the population's quality of life, reducing heath costs with diseases associated with poor nutrition as well as consumers' opportunity for healthy, practical and sensorially attractive foods.

The development of technologies aimed at supplying foods with differentiated nutritional composition capable of contributing not only to the supply of nutritional deficiencies but also the prevention of diseases and maintenance of the population's good health is fundamental. Therefore, functional foods are one of the main world trends in this segment and the fastest growing in the food industry. Such products promote the good health and well-being of consumers through biochemical and physiological effects that go beyond basic nutritional functions, representing a new frontier for the sciences that study the relationship between food, nutrition and good health, and providing an opportunity for technological innovation with potential impact on the population's good health.

In line with this demand, Embrapa has been developing RD&I actions on target compounds with nutritional impact or biologically active compounds with beneficial effects on good health in order to develop more nutritious and healthy foods, as well as strategies or technological tools capable of promoting variations in concentration (increase, reduction or elimination) of the proposed target compounds. These actions aim at contributing to the development of these foods, as well as studies that qualify such products in relation to nutrition and good health aspects. These research actions were gathered in the portfolio of Food, Nutrition and Good Health projects, aiming at promoting the advancement

of knowledge and the development of technologies for expanding the supply of functional and healthy foods, as well as food for groups of the population with specific needs (diabetics, hypertensive people, allergies or food intolerances, among many others), systematically exploring the connections between food, nutrition and good health.

On the other hand, research actions aiming to fill technological gaps and contribute to strengthening of initiatives focused on the production of safe food are part of the Safe Food portfolio. The projects seek to induce the desirable synergy of knowledge and accumulated experiences to trigger an integrated national agenda on the frontier of knowledge, in order to strengthen the Brazilian competence in food safety.

In the line of contamination of production and the environment, the Rationale Management for Agrochemicals portfolio, in turn, aims to offer strategies and technologies to improve use efficiency and avoid or reduce environmental impacts associated with agrochemicals. Thus, it can reflect on the improvement of human and animal well-being, mainly in the rural area. In addition, contamination of water resources can affect rural and urban populations that use this natural resource. Workers and families living in agricultural areas, as well as rural schools, should be exposed to fewer pesticides.

Finally, the Biological Control portfolio has the scope in the research for alternative methods of pest control by the use of living organisms. Thus, the idea is to contribute to the production systems with low environmental impact inputs and safety for producers and consumers' good health.

Embrapa, through RD&I actions, has been contributing for the development of practices and friendly and innovative processes in the quest for sustainable development and safer food production.

References

ABEGUNDE, D. O.; MATHERS, C. D.; ADAM, T.; ORTEGON, M.; STRONG, K. The burden and costs of chronic diseases in low income and middle-income countries. **The Lancet**, v. 370, p. 1929-1938, 2007. Available at: <http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(07)61696-1/fulltext>. Accessed on: Nov. 19, 2017.

BOMBARDI, L. M. **Geografia do uso de agrotóxicos no Brasil e conexões com a União Europeia**. São Paulo: USP-FFLCH, 2017. 296 p. Available at: <https://www.bdpa.cnptia.embrapa.br/consulta/busca?b=ad&id=1081091&biblioteca=vazio&busca=atlas uso agrotoxicos&qFacets=atlas uso agrotoxicos&sort=&paginacao=t&paginaAtual=1>. Accessed on: Nov. 19, 2017.

BRASIL. Ministério da Saúde. **Vigitel Brasil 2016**: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília, DF, 2017. Available at: <http://portalarquivos.saude.gov.br/images/pdf/2017/junho/07/vigitel_2016_jun17.pdf>. Accessed on: Nov. 19, 2017.

FAO. **Statistical yearbook 2013**. Available at: <http://www.fao.org/3/i3107e/i3107e00.htm>. Accessed on: Nov. 19, 2017.

PAN AMERICAN HEALTH ORGANIZATION. **Plan of action for the prevention of obesity in children and adolescents**. Washington, DC, 2014. 35 p. Available at: <https://www.paho.org/hq/index.php?option=com_content&view=article&id=11373:plan-of-action-prevention-obesity-children-adolescents&Itemid=4256&lang=en>. Accessed on: Nov. 19, 2017.

SCHMIDT, M. I.; DUNCAN, B. B.; SILVA, G. A.; MENEZES, A. M.; MONTEIRO, C. A.; BARRETO, S. M.; CHOR, D.; MENEZES, P. R. Chronic non-communicable diseases in Brazil: burden and current challenges. **The Lancet**, n. 377, v. 9781, p. 1949-1961, 2011. Available at: <http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(11)60135-9/fulltext>. Accessed on: Nov. 19, 2017.

UNITED NATIONS. **Sustainable development goal 3:** Ensure healthy lives and promote well-being for all at all ages. Available at: <https://www.un.org/sustainabledevelopment/health/>. Accessed on: Feb. 27, 2018.

UNITED NATIONS. **The sustainable development goals report 2017**. New York, 2017. Available at: <https://unstats.un.org/sdgs/files/report/2017/TheSustainableDevelopmentGoalsReport2017.pdf>. Accessed on: Feb. 27, 2018.

WORLD HEALTH ORGANIZATION. **Health topics**: chronic diseases. Geneva, 2012. 2013. Available at: <http://www.who.int/topics/chronic_diseases/en/>. Accessed on: Apr. 20, 2012.

WORLD HEALTH ORGANIZATION. **WHO's work with countries**: WHO country cooperation strategies and briefs. Available at: <http://www.who.int/countryfocus/cooperation_strategy/ccsbrief_tha_en.pdf>. Accessed on: Nov. 19, 2017a.

WORLD HEALTH ORGANIZATION. **World health statistics 2017**: monitoring health for the SDGs, Sustainable Development Goals. Geneva, 2017b. Available at: <http://apps.who.int/iris/bitstream/10665/255336/1/9789241565486-eng.pdf>. Accessed on: Feb. 7, 2018.