Education and nutrition

Learn to eat well

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Global Education Monitoring Report

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LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

Research Consortium for SHN

GLOBAL EDUCATION MONITORING REPORT

Education and nutrition

LEARN TO EAT WELL

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The Education 2030 Incheon Declaration and Framework for Action specifies that the mandate of the *Global Education Monitoring Report* is to be 'the mechanism for monitoring and reporting on SDG 4 and on education in the other SDGs' with the responsibility to 'report on the implementation of national and international strategies to help hold all relevant partners to account for their commitments as part of the overall SDG follow-up and review'. It is prepared by an independent team hosted by UNESCO.

The *Global Education Monitoring Report* team

Director: Manos Antoninis

Daniel April, Marcela Barrios Rivera, Madeleine Barry, Yekaterina Baskakova, Catarina Cerqueira, Anna Cristina D'Addio, Rafaela Maria Da Silva Santos, Dmitri Davydov, Francesca Endrizzi, Stephen Jacques Flynn, Tuamanaia Foimapafisi, Pablo Fraser, Chiara Galasso, Lara Gil Benito, Baptiste Gorteau, Pierre Gouëdard, Priyadarshani Joshi, Maria-Rafaela Kaldi, Josephine Kiyenje, Jodi Klue, Camila Lima De Moraes, Kate Linkins, Kassiani Lythrangomitis, Aurélia Mazoyer, Anissa Mechtar, Claudine Mukizwa, Yuki Murakami, Judith Randrianatoavina, Kate Redman, Maria Rojnov, Amina Sabour, Diana Sharafieva, Divya Sharma, Laura Stipanovic, Aziah-Katiana Tan, Dorothy Wang and Elsa Weill.

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Short summary

What are the links between education and nutrition?

Global food insecurity is a growing risk that has been compounded by climate change, conflict and economic instability. Meanwhile, obesity rates have surged due to food production practices, the marketing of unhealthy dietary patterns, and sedentary lifestyles. Part of a series exploring education's interrelationships with other Sustainable Development Goals (SDGs), this paper explores the critical intersection of education and nutrition. It advocates for a systemic, life-cycle approach to both sectors, aiming to enhance the global nutritional landscape.

Investment in education is a core strategy for achieving SDG 2, namely, zero hunger. Education develops skills and informs choices for improved nutritional outcomes. Transforming food systems – addressing industry challenges and fostering sustainable farming – requires advanced skills gained through higher education, effective farmer training and the expertise of skilled professionals.

At the same time, food security and improved nutrition amplify educational achievement. Adequate early childhood nutrition is fundamental for growth, educational attainment and overall well-being. Educational settings that offer nutritious school meals and experiential learning opportunities help orient individuals to pursue dietary choices that benefit both personal health and planetary sustainability. Sustained public awareness campaigns throughout adulthood, coupled with the expertise of nutrition and health professionals, are crucial for fostering a comprehensive shift towards healthier nutritional practices.

Despite the clear interdependencies, the linkages between education and nutrition remain under-researched. In addition to monitoring indicators for health and nutrition outcomes robust monitoring of the effectiveness of school meal programmes is crucial.

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"Since wars begin in the minds of men and women, it is in the minds of men and women that the defenses of peace must be constructed"

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KEY MESSAGES

EAT WELL, LEARN WELL

Nutrition and education are deeply interconnected, influencing well-being throughout life.

- **Early childhood nutrition is crucial for lifelong learning and well-being**. Adequate nutrition, including breastfeeding, supports optimal brain development and improves the cognitive function and other life outcomes. Stunted children in Jamaica who benefitted from a targeted programme in the 1980s were learning more by age 22 than those not targeted.

- **Universal access to nutritional school meals improves school attendance and learning outcomes.** It has been estimated that USD 100 spent on school meals per child in low- and middle-income countries increases a quality-adjusted measure of schooling by up to a half a year and mathematics and reading achievement by up to 0.20 of a standard deviation.

- **School meal quality matters but receives insufficient attention**. In Sweden, a 1959 reform to improve school meal quality eventually increased the probability of university enrolment. But as of 2022, only 93 out of 187 countries had legislation, compulsory standards or guidance on school food and beverages. Globally, 27% of school meal programmes do not employ nutritionists to advise on their design and implementation.

- **Food insecurity impacts adult cognitive outcomes.** In South Africa and the United States, food insecure university students were less likely to concentrate, perform well academically and graduate. Food insecure adults are more likely to experience faster cognitive decline.

LEARN WELL, EAT WELL

Education is critical for addressing malnutrition and obesity; life-long healthier dietary behaviours; and planet-friendly and sustainable relationships with food.

- **Educated mothers improve maternal and child nutrition.** The Alive and Thrive programme in Bangladesh, which reached 8.5 million mothers, improved feeding practices. In low- and middle-income countries, children of mothers with at least secondary education are less likely to be stunted, underweight and wasted than children of less educated mothers.

- **Public campaigns raise awareness about healthy eating**. The LiveLighter campaign in Australia and the Save the Food campaign in the United States increased public awareness of health challenges and food waste. C40 cities are working to shift consumption patterns by promoting healthier food options in schools, hospitals, and public spaces.

- **Schools are vital for learning to eat well for health, and for the planet**. Many high-income countries integrate nutrition into subjects like science and home economics and involve parents. Japan's Shokuiku approach emphasizes the cultural and sustainability aspects of food.

EDUCATE FOR PROFESSIONAL NUTRITION CAPACITY

Investment in health, agricultural development and planning capacities is critical to achieve sustainable transformation on food and nutrition issues.

- **Health professionals are not sufficiently trained in nutrition matters**. In 2022, only 14% of countries adequately covered the topic of feeding infants and young children in the pre-service curriculum of medical doctors, nurses and midwives and other professionals.

- **Farmer education can improve agricultural productivity sustainably.** Agricultural extension programmes enhance critical thinking, especially when based on experiential and peer learning. A systematic review of studies up to 2021 found that education helped farmers access information about and appreciate the benefits of organic farming, influencing the adoption of such practices.

- **Food system transformation requires major shifts in thinking across sectors**. Higher education courses in Asia, Europe and North America increasingly emphasize interdisciplinary and experiential learning approaches to explore food systems' social and environmental impact. Effective nutrition leaders in Bangladesh, Ethiopia, India and Kenya were those who engaged across sectors and were able to translate knowledge into policy.

FIT MONITORING TO OUR AMBITIOUS EDUCATION AND NUTRITION GOALS

Monitoring of education and nutrition issues needs to extend beyond the current focus on the first 1,000 days to reflect a lifelong perspective.

- **Nutrition outcomes of school-age children and adolescents need to be monitored.** Global nutrition monitoring strategies focus almost exclusively on maternal, infant and young child nutrition indicators – and need to expand to cover school-age populations to better understand interlinkages with education.

- **The monitoring of school meal programme should be refined.** Globally, at least 459 million children, or 47% of primary school students, are covered by school meals. But the indicator needs to develop further to align better with national policy objectives, including on quality, and data need to be collected in a more efficient way.

NUTRITION AND EDUCATION

Global Education Monitoring Report

Access to nutritious food is not merely a necessity; it is a human right (Milian Gómez, 2024). Yet malnutrition affects billions of people with a serious impact on their health and well-being.

Undernutrition takes four forms: stunting (being too short for one's age), wasting (being too thin for one's height), underweight, and deficiencies in vitamins and minerals. While many countries focus on tackling undernutrition, the number of those still affected is far too high. Of those children under 5, 148 million (or 22%) were stunted, while 45 million (or 7%) were wasted in 2022 (UNICEF et al., 2023). About 390 million adults above 18 were underweight (WHO, 2024b). In recent years, global food insecurity has been rising, due to climate, conflict and financial shocks. It is estimated that 2.3 billion (or 29% of the global population) were moderately or severely food insecure, lacking consistent access to adequate and nutritious food in 2023 (FAO et al., 2024).

Overnutrition is a growing problem. Between 1990 and 2022, almost all countries saw a sharp increase in overweight or obesity rates in children, adolescents and adults, driven by shifts in food production and dietary habits, in addition to sedentary lifestyles. Obesity rates more than doubled for school-aged girls and boys in most countries (NCD Risk Factor Collaboration, 2024). In 2022, 37 million children were overweight or obese (UNICEF et al., 2023). No country is on track to meet targets for diet-related non-communicable diseases related to obesity (Development Initiatives, 2022).

The transformation required to meet Sustainable Development Goal 2 (SDG 2) targets related to nutrition requires interventions at various levels, both on the production front (e.g. fostering agricultural productivity, while mitigating biodiversity loss and climate effects) and on the demand-side front (where efforts must focus on fostering affordable food, healthier and more diversified diets, and reduced food waste) (United Nations, 2023).

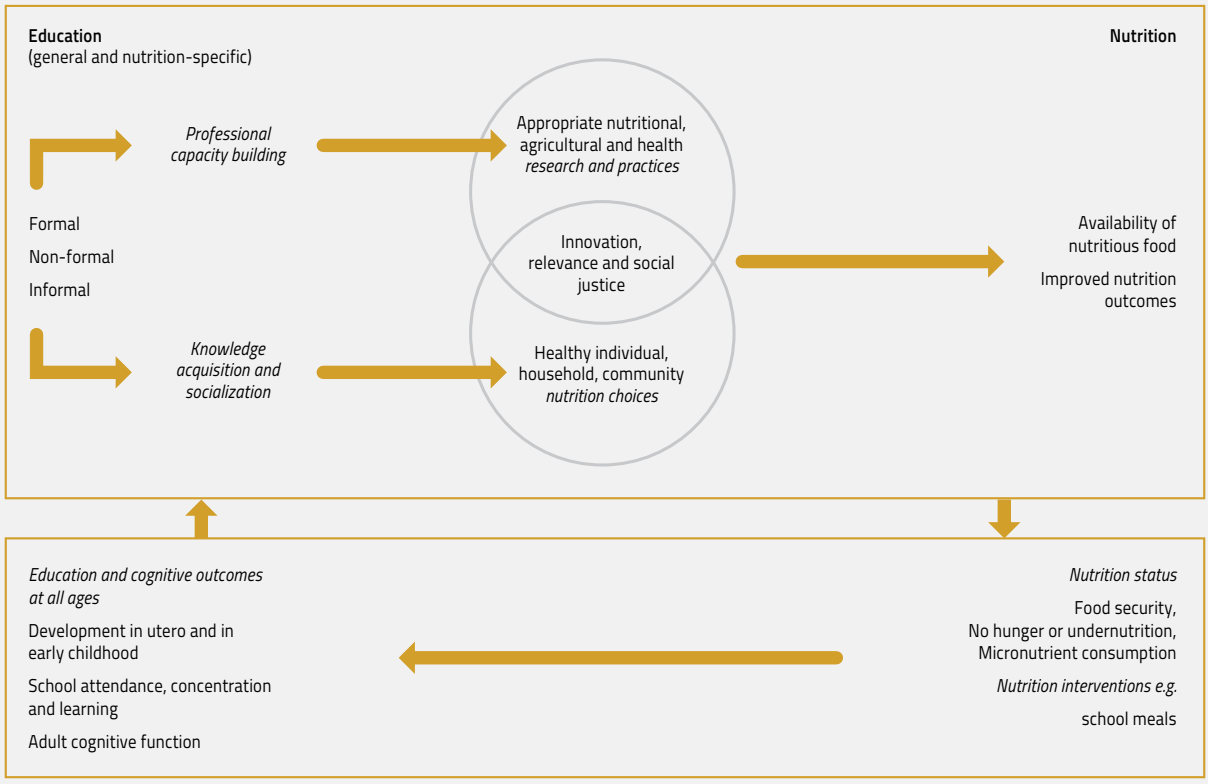
Education is at the heart of many of these efforts. It develops skills, shapes attitudes and influences choices that lead to better nutritional outcomes. In turn, education depends on nutritional status, which itself influences school attendance and learning outcomes. This paper explores the interlinkages between education and nutrition. It examines the latest evidence and policy trends. Drawing on insights from the Research Consortium for School Health and Nutrition, it advocates for a systemic, life-cycle approach to nutrition and education, while paying particular attention to schools. It concludes with recommendations for strengthening linkages between education and nutrition in policy and practice, research and monitoring.

NUTRITION AND EDUCATION ARE INTERLINKED

Nutrition and education outcomes are linked in many ways (ICSU, 2017). Inadequate nutrition impairs brain development and disrupts schooling and learning, from early childhood through to adulthood. Food insecurity in the household often translates into diminished academic achievement: families cannot afford to allocate resources to education, children miss school because they work or, if they are in school, they cannot concentrate and their cognitive function is impaired due to hunger and nutrient deficiencies.

Education, in turn, can serve as a lever to improve nutrition outcomes. Formal, informal, and non-formal education can influence individual, household and community decisions around food production and consumption. Educated mothers are better placed to make the right nutrition decisions for their children's physical and cognitive development. During school years, education that develops critical skills, nutrition education that teaches lifelong healthy habits, physical education and the provision of nutritious school meals, as well as other broader health services, contribute to improved lifelong nutritional status. Among adults, education and awareness can shape informed choices for personal health, family well-being and environmental sustainability. Finally, education systems build the capacity of professionals to influence both individual behaviour and the broader food systems that determine nutrition outcomes (**Figure 1**).

FIGURE 1:
Nutrition and education can be highly complementary



Source: GEM Report team.

NUTRITION STATUS AFFECTS EDUCATION AND LEARNING THROUGHOUT LIFE

Much of the research on the impact of nutrition on education focuses on the period before birth and the early years but there has been renewed interest in assessing the impact of malnutrition throughout life.

Early childhood represents a critical period for growth and neurological development. Adequate nutrition in the early years has long-lasting health and- eventually- educational benefits (Grantham-McGregor et al., 2007). Breastfeeding is an important component of infant nutrition that has short- and long-term benefits and is a key global nutrition recommendation. In a sample of low-educated mothers from the United Kingdom, breastfeeding in the early years was found to have substantial effects on their children's cognitive development in the first seven years of life (Fitzsimons and Vera-Hernández, 2022). Adults from Brazil who had been breastfed in infancy for 12 months or more had higher cognitive ability scores, more years of education and higher monthly income by the age of 30 (Victora et al., 2015).

Analysis of 2,150 children born between 2008 and 2009 in the Republic of Korea found that those breastfed for more than three months scored higher on a vocabulary test of cognitive development, even after controlling for socioeconomic and environmental factors (Kim and Choi, 2020). In Malawi, exclusive breastfeeding for six months reduced the likelihood of children being over-age for their grade between ages 6 to 9 (Mohammed et al., 2023).

Conversely, a lack of proper nutrition in the early years sets the stage for lasting negative impacts. Malnutrition suffered by mothers causes inadequate growth of the foetus, which contributes to poor physical and cognitive development in childhood (Fall, 2013). Chronic undernutrition in early childhood affects brain development and reduces cognitive, socioemotional and motor skills. A longitudinal analysis from Indonesia from 1993 to 2014 found that childhood stunting caused by chronic malnutrition lowers cognitive ability, education attainment, and mathematics test scores in adolescence, although the influence weakens in adulthood (Lestari et al., 2024). A 40-year study from Barbados

found that experiencing one episode of moderate to severe malnutrition during infancy is associated with a significantly elevated incidence of impaired cognitive development in adulthood, even when physical growth is completely restored (Waber et al., 2014).

Analyses of a survey of children from 100 villages in the Gansu province of China show that even after controlling for socioeconomic status, long-term nutrition status and prior achievement, children in food-insecure households who are stunted or severely underweight have significantly lower literacy scores (Hannum et al., 2014). In Ghana, longitudinal evidence shows that children in persistently food-insecure households had lower literacy and numeracy skills, and lower short-term memory (Aurino et al., 2020). In Ethiopia, early childhood stunting has a significantly negative association with children's cognitive performance. Controlling for individual and socioeconomic factors, stunted children scored 16% less than well-nourished children on a vocabulary test and 49% less on a quantitative skills assessment test at age 8 (Woldehanna et al., 2017).

Targeted interventions can mitigate the effects of malnutrition. In India, an evaluation under the Integrated Child Development Scheme showed that 20 years after receiving a balanced protein-energy supplement, children in intervention villages were 9% more likely to have completed secondary school and 11% more likely to have completed university than those in control villages (Nandi et al., 2018). Longitudinal evidence from experiments that had targeted stunted children in Jamaica in the 1980s showed higher cognitive skills at ages 7 and 11; higher reading achievement, attention, behaviour and self-esteem at age 17; and higher earnings at age 22 than those children who had not been targeted (Walker et al., 2022). A longitudinal study of protein supplementation in eastern Guatemala showed improved cognitive functioning for beneficiaries in adolescence and adulthood (DiGirolamo et al., 2020).

A systematic review of food-based, single and multiple micronutrient interventions on 2- to 6-year-olds in 9 low-, middle- and high-income countries found significant positive effects on cognitive outcomes in 8 interventions. Iron and multiple micronutrient supplementation were the most beneficial for undernourished children; fish consumption was the most beneficial for nourished children (Roberts et al., 2022).

Good nutrition in school years provides a second window of opportunity. The school-age years are characterized by rapid growth, psychosocial development, and establishing lifelong dietary and lifestyle habits. A longitudinal analysis across Ethiopia, India, Peru and Viet Nam found that children who recovered from stunting by age 8 had significantly caught up in mathematics, reading comprehension and vocabulary compared to those who were persistently stunted (Crookston et al., 2013).

Undernutrition during school years and adolescence further exacerbates adverse effects on cognition (Partridge, 2020). Episodes of short-term hunger impair enrolment, concentration and achievement, while micronutrient deficiency hinders learning capacity. Persistent, severe food insecurity in Indian households between 2009 and 2016 was negatively associated with education attainment and test scores (Argaw et al., 2023).

In middle- and high-income countries that took part in the 2022 Programme for International Student Assessment (PISA) learning achievement survey, over 8% of 15-year-old students reported not eating at least once a week in the past 30 days due to lack of money to buy food. In 18 countries, more than 20% of students reported not eating at least once a week, rising to one third of students in Baku (Azerbaijan), Jamaica and the Philippines, and over two thirds in Cambodia. There is a negative correlation between food insecurity and mathematics performance (OECD, 2023a). Data from the 2019 Programme for the Analysis of Educational Systems of CONFEMEN (PASEC) learning assessment in francophone Africa have shown that on average, 4 in 10 primary students are often or always hungry at school. In Burundi and the Democratic Republic of the Congo, one in three students was always hungry (UNESCO, 2022). Reading scores were lower by one third of a standard deviation for those who were always hungry and by one fifth for those who were often hungry compared to those who were never hungry (CONFEMEN, 2020).

Academic performance at university is impacted by food insecurity. A systematic review of food insecurity found that it consistently led to adverse academic outcomes among university students (Bruening et al., 2017). In the United States, food insecurity among university students has increased, as the intake of low-income students has grown. A nationally representative survey found that 14.5% of university students suffered from food insecurity, which was associated with a lower probability of graduation (Wolfson et al., 2022). Analysis from a university in California showed that students' food insecurity was linked to lower student academic performance, both directly and indirectly as a result of through poor mental health (Martinez et al., 2020).

At the University of Alberta, Canada, 60% of food bank users reported at least one adverse academic experience as a result of food insecurity, and several were less likely to be able to concentrate in class or during an examination (Farahbakhsh et al., 2017). In the University of KwaZulu-Natal, South Africa, a survey found that almost one third of over 1,000 female students reported often having lower concentration as a result of hunger (Munro et al., 2013). Nutrition interventions can help student performance; providing iron-biofortified beans to iron-depleted female students at the University of Rwanda helped improve memory and spatial attention, compared to consuming conventional beans (Finkelstein et al., 2019).

Cognitive function in adulthood is influenced by dietary habits and food availability. Food-insecure adults are likely to experience faster cognitive decline (Na et al., 2020). A poor diet can hinder an adult's ability to read, understand and apply information effectively. A review of 61 randomized controlled trials on dietary interventions found that healthy food consumption improved cognitive function in adults (Gutierrez et al., 2021). In the United States, a study following 12,600 people between 1998 and 2016 showed that middle-age and older adults who had experienced food insecurity exhibited slightly faster memory decline.

Macronutrients (fats, proteins and carbohydrates) and micronutrients (vitamins, iodine and iron) are essential for brain health and cognition. Certain diets are linked to a lower risk of cognitive decline and dementia. A clear overlap between cardiovascular and diabetes risk suggests that dementia should be included in current non-communicable disease management programmes in primary health care and in broader public health programmes (Puri et al., 2023).

SCHOOL MEALS IMPACT ENROLMENT, ATTENDANCE AND LEARNING

School meals are part of a broad set of school health and nutrition interventions (including micronutrient supplementation and deworming) that can help overcome challenges faced in early life and deliver several positive effects on child and adolescent development and well-being (Bundy et al., 2018). It has been estimated that providing healthy school meals for every child by 2030 would help lift 120 million of them out of undernourishment, improve dietary health in adulthood and even reduce deaths from non-communicable diseases by up to 3 million in low- and middle-income countries (Springmann, 2024).

Moreover, school meals have a positive impact on education outcomes. The first Cochrane Systematic Review of 18 rigorous studies found that school meals had a positive impact on attendance, mathematics achievement and short-term cognitive tasks (Kristjansson et al., 2007). The second Cochrane Systematic Review of 38 studies from 25 countries concluded that school meals for poor children in low-income countries increased enrolment by about 3% and mathematics achievement scores by 14% but had little to no effect on reading achievement scores. School meals were not significantly related to school attendance in three randomized and four non-randomized studies (Kristjansson et al., 2024). Another review of nine studies from six sub-Saharan African countries found that school feeding improved enrolment, attendance and, in some contexts, academic performance in preschools and primary schools (Wall et al., 2022). Finally, a review of 57 studies in low- and middle-income countries found that school feeding significantly increased attendance but not mathematics achievement (Wang et al., 2021).

School meals have been found to compare favourably to other interventions in terms of improved education outcomes. A systematic review found that primary school feeding programmes were among the few education interventions to improve both participation and learning, especially in areas with high food insecurity and low access to school (Snilstveit et al., 2016). Every USD 100 spent on school meals has been shown to increase a quality-adjusted measure of schooling by half a year and mathematics and reading achievement by up to 0.20 of a standard deviation (Angrist et al., 2024). Another meta-analysis found that enrolment, attendance and learning increased by 0.12 to 0.15 of a standard deviation. School feeding had the most consistent impact across all three types of education outcomes compared to other interventions, such as cash transfers or community-based monitoring (Acosta and Bedasso, 2024). A cost–benefit analysis of school feeding programmes in 14 countries estimated that an initial investment of USD 11 billion per year had resulted in a return of USD 156 billion through increased school attendance (Verguet et al., 2020).

Individual studies also show the positive impact of school meal programmes. In China, the Nutrition Improvement Programme significantly improved children's social competence, learning behaviours and autonomy, especially among girls and children with lower educated mothers (Su, 2024). In India, a child who had received a meal throughout the five years of primary school scored 18% higher in reading and 9% higher in mathematics than a child who benefited for one year (Chakraborty and Jayaraman, 2019). In Andhra Pradesh state, children who received a school

meal for four years increased their verbal test scores by 10 percentile points and their mathematics test scores by 21 percentile points (Cavapozzi et al., 2024).

An evaluation of the McGovern Dole Food for Education Program in rural Guatemala and Honduras found that it improved reading comprehension – especially in the early years – when accompanied by other components, such as teacher training, interventions to reduce teacher absenteeism and school improvement support (Crea et al, 2021). An evaluation of the Home Grown School Feeding Programme in four districts in Malawi found that it increased attendance rates (WFP, 2024a). Nigeria launched its Home Grown School Feeding Programme in 2014 to provide a free, universal nutritionally balanced hot meal each day in all public primary schools and reduce the number of out-of-school children by 30% (Adesanmi et al., 2024). Following expanding coverage from 1 million in 2017 to 10 million in 2022, it is reported that the primary enrolment rate increased by 20% (Ikongshul, 2024). In Togo, a school canteen provided 60% to 75% of the students' daily needs in calories and proteins, and increased enrolment rates by 6% (Togo ANADEB, 2021).

School meals with higher nutritional content are more impactful. A study of the China school nutrition programme found long-term positive effects on reading and mathematics test scores. A reform that enabled rural schools to include vegetables, milk, eggs and high-quality proteins, minerals and vitamins increased children's nutrient intakes, improved mothers' labour-market participation and income, and raised households' investments in education (Fang and Zhu, 2022). In the Indian state of Maharashtra, consumption of bio-fortified pearl millet, which improved iron status, also improved attention and memory among adolescents (Scott et al., 2018). However, a global assessment of the food offered in school meals shows that a large majority of programmes reported the use of refined or milled grains, which are not the healthiest option (GCNF, 2024m).

A study on the long-term impact of the United States National School Lunch Programme found that individuals who received school meals had substantially better education attainment at ages 24 to 39, but did not improve health, which may be linked to a lack of nutritional guidelines before 1995 (Hinrichs, 2010). The 2010 Healthy, Hunger-Free Kids Act strengthened nutrition standards for meals and beverages. It required the U.S. Department of Agriculture to update federal school nutrition programme regulations. An evaluation found that the standards helped decrease the risk of obesity for children in poverty (Kenney et al., 2020). A longitudinal study before and after the law's implementation found a small but significant decline in the average body mass index of more than 14,000 5- to 18-year-old school children (Chandran et al., 2023).

School meals have impact through various channels, not all of which can be identified

School meals achieve their impact through a combination of mechanisms, whose relative influence depends on context. Improved concentration in school, improved well-being through better nutrient intake, and easing of poor households' budget constraints are some of those channels. In Ghana, a randomized control trial showed that two years of the implementation of a school feeding programme led to moderate increases in reading and mathematics test scores for students in targeted areas, which were larger for girls and disadvantaged communities. Lower education costs, reduced morbidity-related absenteeism, better nutritional status, and improved attention and memory were identified as pathways of impact (Aurino et al., 2023).

In South Africa, an evaluation of the National School Nutrition Programme, which targeted the poorest 60% of public schools, found that school feeding was a motivator for children to attend school, and breakfast was a motivator to arrive at school on time (Hazell, 2016). Teachers noted that children concentrated better and were more sociable (Tabunda et al., 2016). In the United States, analysis of the effect of Community Eligibility Provision, the largest free school meals programme, which increased breakfast and lunch participation, found that mathematics performance improved in districts with low free meal eligibility at the baseline, particularly among Hispanic students (Ruffini, 2022).

Despite growing evidence, the difficulty of linking school meal provision to learning outcomes needs to be recognized. First, programme coverage and implementation vary considerably (**Box 1**). Second, improvements in learning are affected by several factors, of which school feeding is only one. Most evaluation studies are not conducted over a long period of time, which may be required to assess gains in learning outcomes (Bedasso, 2022). Third, an emphasis on expanding programme coverage and enrolment reduces the focus on measuring nutrition intake or following nutritional standards. Finally, lack of integration of school health and nutrition policies is a disadvantage. Learning about nutrition requires an intentional integration of school meal delivery with nutrition education, careful assessment of nutritional intakes, and monitoring and research around shaping healthy eating habits.

BOX 1.

Variation in the implementation of school meal programmes limits their potential education impact

School meal coverage, targeting and financing vary widely across the world. Countries that target part of the population use various criteria: level (e.g. up to primary school); school type (e.g. only public schools); individual characteristics (socioeconomic status); vulnerability (emergency contexts); and location (e.g. rural, remote or poor areas) (**Table 1**).

A global overview of 175 countries shows that at least 459 million children, or 47% of primary school students, receive school meals in 2024, up from 418 million as reported in the State of School Feeding Worldwide 2022. Coverage rates are positively correlated with country income.

In 2022, 60% of 184 school feeding programmes expected families to contribute towards costs; and over one third did not have adequate funding to achieve their targets, ranging from 8% in high-income countries to 41% in low-income countries and 53% in lower-middle-income countries (GCNF, 2024m). Near universal coverage across the three levels is found only in a handful of countries, including Brazil, Estonia, Finland, Luxembourg, the Republic of Korea and Sweden.

It is estimated that funding for school meals has reached USD 80 billion. As observed in the State of School Feeding Worldwide 2022, domestic funding accounts for over 98% of total school meal expenditure, but low- and, to a lesser extent, lower-middle-income countries may rely significantly on external funding sources. Countries such as Burkina Faso, Eswatini, Kyrgyzstan, Lesotho and Nepal receive at least 80% of funds from international sources at the primary level (GCNF, 2024m).

TABLE 1.

Selected school meal programmes' coverage, targeting and financing, 2022

	Coverage (% enrolled)				Financing (%)	
Country	Pre-primary	Primary	Secondary	Targeting	Domestic	International
Brazil	100	100	100	Universal	100	0
Malawi	74	52	0	By grade, school type, academic performance, food insecurity and emergency situation		99
Netherlands	0	31	6	Schools participate if at least 30% of their students come from low-income families	94	
Romania	50	88	89	Geographic (isolated or hard-to-reach), disadvantaged social or poor environments	85	
Togo	15	11	0	By incidence of poverty, food insecurity, socio-health structures, and remoteness; net primary school attendance or dropout rate	17	69

Sources: GCNF (2024a, 2024g, 2024h, 2024i, 2024l).

Low- and lower-middle-income countries report the lack of sufficient financing from domestic resources as a major issue, which burdens already stretched communities with school meal fees and in-kind contributions (GCNF, 2024m). Analysis of 51 low- and lower-middle-income countries' school meal policies shows that, while some have long-established national policy frameworks, countries tend to be weak in programme design, implementation and financial adequacy (Schultz et al., 2024). In the Central African Republic, the nationwide home-grown school meals programme aims to provide safe and nutritious school meals, increasing coverage from 150,000 students in 2023 to up to 400,000 by 2027. However, an evaluation of the programme in 2018–22 found that impact had been constrained by limited funding (WFP, 2023).

Continued on the next page

BOX 1. *Continued*

In India, the school meals programme (PM-POSHAN, formerly known as the Mid-Day Meals Scheme) was nationalized after a landmark Supreme Court order in 2001. Evaluations of the scheme have highlighted positive enrolment impacts on girls and other disadvantaged groups (Kaur, 2021). The bulk of its budget comes from the 2% education tax paid by the public for basic education. However, the release of funds from the federal government to the states is often very slow. In 2022/23, no funds were released in the first quarter due to technical reasons. While an online real-time monitoring system was established, daily reporting on access to school meals remains low. In the second half of 2022, only 18% of schools reported to the system (Kapur et al., 2023). An assessment found that mid-day meals were served in over 95% of rural schools in eight states, but in less than half of rural schools in three states (ASER, 2023). States are responsible for 40% of the funding; state leadership is therefore a key determinant of success. Tamil Nadu state pioneered school meal programmes in 1925, and added a breakfast programme in 2022 (Gopinath and Rengalekshmi, 2023). A state evaluation found that the breakfast scheme helped improve attendance in public schools from about 60%–70% to 90%–95% (The New Indian Express, 2024).

Related challenges also affect high-income countries. In England (United Kingdom), the 2013 School Food Plan introduced universal free school mealsfor infants, while free school meals are means-tested from year 3 onwards (Hartgen-Walker and Lally, 2023). As of 2023/24, 25% of pupils were eligible for free school meals but it is estimated that restrictive eligibility criteria at the local level prevent about 900,000 children, or one in three children living in poverty, from accessing school meals (Child Poverty Action Group, 2023a). Funding has not kept pace with inflation, losing 16% of its value in real terms since 2014. In contrast, there is universal coverage in Scotland and Wales, while in Northern Ireland, the earnings cap is much higher, leading to a lower percentage of poor children not being eligible for school meals (Cribb et al., 2023).

Universal school meal programmes have important advantages

Targeting students from low-income households in school meal provision has the disadvantage of stigmatizing and shaming beneficiaries. A longitudinal analysis of free school lunches in the Republic of Korea showed that beneficiaries experienced a stigma effect in schools where there is a low proportion of students receiving free lunches (Yu et al., 2019). Universal school meals are an attempt to trade-off efficiency with effectiveness. In London, England, parents and principals have highlighted that means-tested eligibility for school meals causes feelings of stigma, as neither parents nor children want to be singled out or ostracized. Analysis in six primary schools in two boroughs found that shifting from means-tested to universal meals created a richer educational experience and a more positive school-home relationship (Child Poverty Action Group, 2023b). In New Zealand, students were calmer and more alert after the universal Ka Ora, Ka Ako programme was introduced (McKelvie-Sebileau et al., 2022), a fact also observed by school principals (Vermillion Peirce et al., 2022).

In the United Kingdom, an evaluation of free school meals found that a pilot programme to universalize their provision increased school meal uptake, as students shifted away from packed lunches. Students in targeted areas made between four and eight weeks' more progress in their learning than similar pupils in comparison areas. The change was more substantial among pupils from less affluent families (Kitchen et al., 2013).

In the United States, a study of Community Eligible Provision, which covered schools where at least 40% of the students were from low-income families, found that universalized free meal interventions increased participation and academic performance. In South Carolina, mathematics test scores increased by 0.06 of a standard deviation among grade 3 to grade 8 students (Gordanier et al., 2020). In New York City, an intervention providing universal free meals in lower secondary schools, regardless of income, improved academic performance for both poor and non-poor students (Schwartz and Rothbart, 2020).

Universal, nutritious school meals have had major impact on long-term educational attainment and learning in the Nordic countries. Finland was the first country to offer universal free school meals in 1943 and today these are part of a multidimensional food education programme from primary to vocational and university levels (Kuusipalo and Manninen, 2023). National policies commit to school feeding as a key investment in learning and as a means to maintain children's ability to study and learn about proper nourishment (Pellikka et al., 2019).

In Norway, hot meals served to children around dinner time in the 1920s were criticized for their lack of nutrition and vegetables. The medical officer responsible for school

meals at the time suggested replacing that meal with a nutritious breakfast. This led to a change in breakfast habits, from coffee, plain bread and cold porridge to whole grain bread, milk, fruits, vegetables and cod liver oil. An assessment of the long-term effects of the introduction of school breakfasts for the cohort born between 1910 and 1932 showed that there was a 1.7 percentage point increase in the likelihood of finishing secondary school, as a result of enhanced daily nutrient intake, a stronger incentive to go to school, and lower poor household expenditure on food (Bütikofer et al., 2018).

In Sweden, the universal free school meal programme began in 1946. Motivated by concerns about the quality of the food consumed – with breakfast comprising coffee, tea or hot chocolate with white bread, and lunches relying on cold food, milk and cheese sandwiches – new nutritional contents introduced in 1959 led to significant changes in protein, vitamins A, B and C, iron and phosphorous. A long-term impact study found that the programme generated substantial long-term benefits if students received school meals throughout their basic education. Receiving nine years of school meals increased schooling by 0.3 years and the likelihood of entering university by 1.5 percentage points (Lundborg et al., 2022).

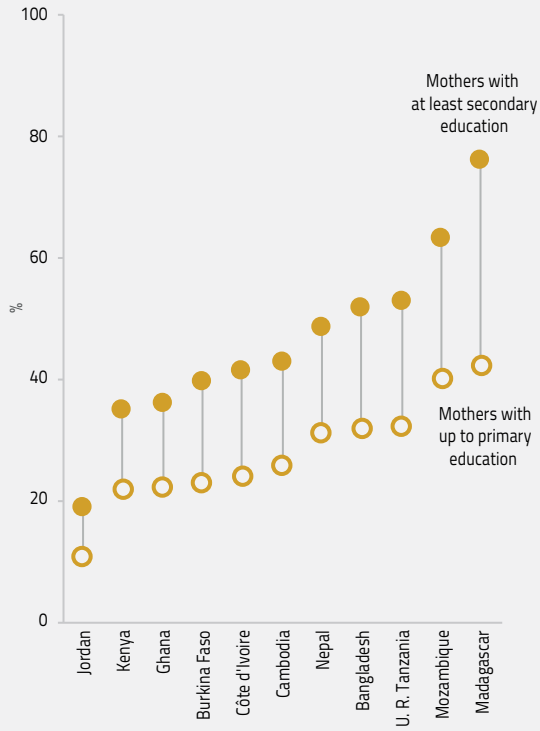
EDUCATION ATTAINMENT AFFECTS NUTRITION OUTCOMES

Education affects nutrition through two major channels. The first channel is intergenerational. Educated mothers' choices affect the health and nutrition status of their children. Maternal education is among the most consistent factors determining childhood nutrition outcomes (Vaivada et al., 2020; Vollmer et al., 2017) (**Figure 2**). A systematic review of 37 studies on the determinants of under-5 malnutrition found that lack of maternal education was the most significant factor associated with child malnutrition in more than half of the studies. Educated mothers are more likely to be knowledgeable about child nutrition and childcare practices, provide healthy environments for children, and have higher awareness of the utilization of child health-care services (Katoch, 2022). In 56 countries, children whose mothers have secondary education (but not children whose mothers only had primary education) were more likely to have better nutritional status than children whose mothers had no education (Alderman and Headey, 2017). Analysis of 14 studies in low-, middle- and high-income countries found that maternal education was also a strong predictor of improvements in child growth (Nisbett et al., 2023).

FIGURE 2.

Children of more educated mothers are less likely to be stunted

Stunting rate, by maternal education, selected low- and middle-income countries, 2021–23



Source: Demographic and Health Survey StatCompiler.

In Bangladesh, analysis using data from five waves of the Demographic and Health Survey (1996–2011) found that the prevalence of malnutrition decreased as maternal education attainment levels increased (Hasan et al., 2016). In Indonesia, mothers with primary education or less were 1.6 times more likely than mothers with a college education to have stunted children under 2 years of age (Laksono et al., 2022). In Nigeria, analysis of the 2018 Demographic and Health Survey showed that children born to mothers who had no education were 55% more likely to experience stunting than those born to mothers who had at least secondary education (Lawal et al., 2023). In Pakistan, while both mothers' and fathers' education positively influence child nutrition, mothers' education has a much higher impact on the probability of stunting (Sarwar et al., 2024).

The second channel is the impact of education on individual choices, which is mediated through income and cognitive or non-cognitive skills and can influence receptivity to nutrition messages. This channel is explored in depth in the next section. Analysis of 185 countries between 1990 and 2018 from the Global Dietary Database shows that globally, dietary quality is higher among more educated individuals. Higher education was linked to greater consumption of fruits, non-starchy vegetables, whole grains and plant oils. The largest variation due to education attainment was observed in Central and Eastern Europe, Central Asia, South Asia, and Latin America and the Caribbean (Miller et al., 2022). In wealthier countries, more education is associated with choosing healthier foods. In London, England, analysis of food purchases from one major retailer showed that more educated consumers consumed more fruits, vegetables and fish and enjoyed more nutritional diversity together with a low caloric intake compared to less educated consumers who had higher consumption levels of sweets and red meats (Fard et al., 2021).

However, this link between education attainment and improved nutrition is not straightforward. Education can negatively affect eating behaviours, as higher income may result in unhealthy lifestyles and nutrition choices, for instance, due to the perceived higher status conferred by highly advertised food items. However, over time, as the availability of accurate health information and choices increases, the relationship between education and healthy behaviour has the potential to become more positive. Overweight and obesity prevalence varies by education attainment. A systematic review of 289 articles from 91 countries found that the association between education attainment and obesity was negative in high-income countries and positive in low-income countries (Cohen et al., 2013). In Chile, women with fewer than eight years of education were far more likely to be obese compared to adult women with medium or high levels of education, although the same relationship was not observed among adult men (Mujica-Coopman et al., 2020).

EDUCATION IS A KEY COMPONENT OF NUTRITION INTERVENTIONS

Food behaviours are shaped by personal, interpersonal, cultural and social influences. A strong focus is needed, therefore, on understanding what drives behavioural change towards recommended practices, and the role of systemic factors and the food environment (Contento, 2016) (**Box 2**). Formal, non-formal and informal education over the life cycle is one of the factors that can impact knowledge, attitudes and behaviours on nutrition. Nutrition and food literacy are often used interchangeably. Nutrition literacy focuses on how food impacts the body, while food literacy encompasses the knowledge, skills, and attitudes needed to interact with the food system and make informed decisions about food and its health effects. In countries with rising and high obesity rates, nutrition education is viewed as essential to help reduce the risk of non-communicable diseases such as heart disease, stroke, diabetes and cancer (Silva et al., 2023).

Countries develop dietary guidelines to meet nutritional needs and prevent deficiencies. In 1996, the World Health Organization and the Food and Agriculture Organization joint expert meeting pushed for the preparation and use of food-based dietary guidelines, which became a reference across the world (WHO, 1998).

A comparison of dietary guidelines from 96 countries found that most countries develop such guidelines with pyramid and circle metaphors. While cultural practices and needs shape these recommendations, there is consistent emphasis on increasing fruit and vegetable consumption, drinking water and physical activity, and on decreasing salt, sugar and oil intake (Rong et al., 2021).

BOX 2.

There are several determinants of nutrition behaviour

Our relationship with food consumption depends on its availability, affordability, accessibility and acceptability, our social environments (home, school, work), and our individual preferences and peer influences (FAO and European Union, 2019). From a physiological response perspective, eating is triggered by many factors, including the sight, smell and memory of food, and the anticipation of food associated with activation of well-defined regions of the hypothalamus. The dopamine system is critically involved in food behaviours. For instance, sadness and stress can lead to greater willingness to consume unhealthy food items. Self-control in dietary choice may depend on a balance of signalling and information exchange (Leng et al., 2017).

Childhood and adolescence are key for establishing the foundation for eating habits. In early childhood, appropriate complementary feeding requires behaviours such as introducing food at the right age, feeding children a variety of foods, feeding in the right quantity and consistency, and feeding the right number of times. Caregivers need to prepare and feed children hygienically, in a responsive manner, and use a variety of nutrient-rich foods along with ongoing breastfeeding. Systematic attention to gender and social norms that influence dietary practices can promote community and household reflection on these norms to create an enabling environment for change (USAID, 2021).

The design and implementation of programmes can support the development of food literacy and healthier, more sustainable eating habits. Food literacy includes functional competencies (i.e. knowledge and skills about food planning, preparation, consumption and disposal), relational competencies (i.e. practices, cultural competencies and emotional associations that enable children and adolescents to develop healthy and sustainable eating patterns) and critical competencies (i.e. cognitive skills to analyse information and recognize the social, economic and environmental impacts of food systems) (Ares et al., 2024).

A major challenge is an increasingly obesogenic environment (an environment that promotes obesity), which is saturated with messages encouraging unhealthy food consumption through food marketing, advertisements and sponsorships (Kansra et al., 2021). Marketing strategies are complex and deliberately misleading by producing incorrect nutrition labels, creating attractive packaging targeted at children, and placing products strategically to influence purchasing choices (Merritt and Ramli, 2024).

In high-income countries, food systems are characterized by the wide availability and affordability of ultra-processed food products, creating social norms that perpetuate food habits which are hard to break. In contrast, campaigns on healthy choices tend to be highly focused on individuals and emphasize the negative consequences of unhealthy eating, which can be discouraging and make people less likely to change their behaviour, opting instead for actions such as skipping meals, eating very little and using diet pills, or lately, weight-loss injectables. Analysis of 14 government obesity strategies and 689 related policies in England (United Kingdom) between 1992 and 2020 found that the majority of policies made demands of individuals to engage effectively with the interventions, while ignoring more structural policy shifts (Theis and White, 2021). One of the strongest predictors of weight gain is weight loss dieting. A study of nearly 15,000 adolescents in the United States found that those who practised dieting, whether frequently or infrequently, had gained more weight (Field et al., 2003). Emphasizing the health risks of obesity may lead to behaviours that exacerbate the problem. In England (United Kingdom), analysis examining three cohorts of adolescents born between 1980 and 2010 showed that dieting behaviour had increased and had detrimental impacts on their mental health (Solmi et al., 2021).

When healthy eating campaigns target individuals or a specific element of food intake, instead of providing a holistic approach and an enabling environment, they may improve knowledge and awareness but not motivate effective action. Behavioural scientists and health psychologists argue that behavioural change needs to be targeted at both individuals and the system. Those designing interventions need to engage with the target population, understand their motivation to change, and adapt interventions to contexts, taking into consideration relevant food environment factors and social networks. It is necessary to understand competitive ways to market a healthy food product over its unhealthy alternatives. Campaigns need to consider cultural nuances, socioeconomic status and specific dietary needs. They need to get into the psychology of consumption and step away from moralizing language around food (de Ridder et al., 2017; Moseley, 2021).

Continued on the next page

BOX 2. *Continued*

Analysis of major campaigns around healthy eating in Australia, Canada, Mexico, the United Kingdom and the United States found that message recall – a key indicator of reach and impact – was very low (Goodman et al., 2021). In Mexico, the Chécate, Mídete, Muévete campaign (Check, measure, move yourself) did not achieve its goals (Hernández et al., 2020). Health Canada's mass media Eat Well Campaign reached poorer and less educated parents who then held positive attitudes towards meal planning to maintain a healthy diet (Fernandez et al., 2019). In the United Kingdom, the Change4Life campaign was explicitly concerned with obesity but avoided using the term (Piggin and Lee, 2011). A quasi-experimental study found that the campaign encouraged families to make small changes (Wrieden and Levy, 2016). Later, the Better Health campaign, initiated during COVID-19, focused on individual responsibility while reinforcing weight stigma (Pearl and Schulte, 2021). The 5-a-day campaign encouraging people to eat five daily portions of fruit and vegetables was launched in 2003; while 85% of individuals say they were aware of the message, average intake remained stubbornly low and has been stagnant for over 40 years (Buszard et al., 2023). Tackling obesity may be best achieved through other steps, such as limiting advertising, improving labelling and increasing support for people who wish to lose weight.

Surveys of nearly 30,000 people from 31 countries and territories in 2023 found that 27% of younger populations, and 16% of older populations, reported eating vegetarian or vegan food most or all of the time – for both environmental and health motivations. Of consumers who find it difficult to buy healthy and sustainable food, more than half attribute this to lack of affordability, and a third to lack of availability. Only about half of consumers (52%) think governments are doing an adequate job in helping the public eat healthy and sustainable diets, while three quarters of consumers worldwide think chefs and NGOs are helping consumers (EAT and GlobeScan, 2024).

MANY COUNTRIES INCLUDE EDUCATION ELEMENTS IN THEIR NUTRITION POLICIES

While many of the global nutrition targets focus on maternal, infant and young child nutrition, such as the importance of investing in the first 1,000 days, they also highlight the importance of girls' education and their awareness of nutrition as future mothers, and the use of schools as a platform for nutrition education and for school meal delivery (Development Initiatives, 2017, 2018, 2020, 2020; IFPRI, 2014, 2015, 2016).

In 2021, the first Nutrition Accountability Framework was launched at the Tokyo Nutrition for Growth Summit. A review conducted for this report of the commitments and goals articulated as a result of the Summit by 65 governments shows that most focus on improving the financing adequacy and prominence of nutrition in the overall government agenda. The few commitments related to education included improving knowledge on good practices (e.g. exclusive breastfeeding, healthy diets) through campaigns and nutrition education, and improving the size and capacities of the nutrition workforce (Development Initiatives, 2024).

Analysis of nutrition policies, strategies or plans from 68 countries (16 low-, 30 lower-middle-, 10 upper-middle and 12 high-income countries) conducted for this report shows that most cover education issues at three levels: (i) at school level: nutrition education in curricula, school-centred initiatives such as school meals and gardens, teacher training; (ii) at the community level: awareness campaigns, training of community health and nutrition professionals, targeting of vulnerable groups; and (iii) at national level: issues such as multisector collaboration, educating on food standards and nutrition guidelines (**Table 2**).

TABLE 2.

Education-relevant themes in national nutrition policies, by level

Institution	Community	National
School feeding	Engagement and public awareness	Education integration in policy
School gardens	Social protection	Research, monitoring and evaluation
Curriculum development	Vulnerable groups	Multisectoral collaboration
Teacher training	Equity	National food standards
Vocational training	Community health worker training	Dietary guidelines
Higher education	Farmer training	Food labelling

Source: Kwansa (2025).

Mapping the prevalence of these themes shows that most policies emphasize nutrition education in school curricula, the need for multisector collaboration, following standards and guidelines, and community engagement and public awareness (Kwansa, 2025). In order to deliver nutrition education in school settings, teachers need to be trained, while teaching materials and resources need to be developed. An emerging area of emphasis is nutrition education in vocational training centres. Outside school, policies highlight the need to train community health workers and to engage with communities and their leaders. Vulnerable groups highlighted for focused attention include pregnant women and teenage girls, and out-of-school adolescents. Low- and lower-income country policy documents are more likely to include mention of school-centred initiatives, such as school feeding programmes, and to emphasize vulnerable groups (**Table 3**).

TABLE 3.

Percentage of countries covering education themes in their nutrition policies, by income group

	All	Low income	Lower middle income	Upper middle income	High income
Schooling					
School-centred initiatives	47	69	57	20	17
Curriculum development	72	88	63	60	83
Teacher training	60	81	57	40	58
Communities					
Community engagement and public awareness	85	94	83	80	83
Capacity building and training	79	94	77	70	75
Vulnerable groups, social protection and equity	66	94	63	50	50
National					
Multisector collaboration	84	88	83	60	100
Integration of education into policy	59	69	63	50	42
Monitoring, evaluation, and research	69	69	67	60	83
Promotion of national food standards, dietary guidelines, food labels	62	69	50	60	83

Notes: The mapping was based on policy or plan documents from 16 low-income, 30 lower-middle-income, 10 upper-middle-income and 12 high-income countries. A selection of keywords were adapted for use in generative AI software, to identify all relevant sentences and phrases that contained mentions of education and nutrition.

Source: Kwansa (2025).

NUTRITION EDUCATION FOR PREGNANT WOMEN AND MOTHERS CAN HAVE LONG-LASTING IMPACT

Nutrition education targeted around early-life nutrition outcomes often focuses on combating maternal and child undernutrition, emphasizing best practices such as supplementation during pregnancy, exclusive breastfeeding in the first six months, and complementary feeding. Educational and communication interventions are a key part of behavioural change initiatives.

A systematic review of barriers to exclusive breastfeeding has highlighted poor maternal knowledge of it benefits, lack of antenatal care and of community, family or employer support systems. Providing workplace support for breastfeeding, strengthening health worker skills and improving family and community-level interventions were some of the key action areas (Kavle et al., 2017). According to the 2023 Global Breastfeeding Scorecard, exclusive breastfeeding rates between 0 to 5 months increased by 10 percentage points between 2013 and 2023. Some of the key changes were in improvements in maternity facilities, breastfeeding counselling, paid maternity leave and skilled counselling (UNICEF and WHO, 2023).

Mass campaigns can be important but need to be based on clear theories of how to influence behaviour. The Breastfeed4Ghana social media campaign was implemented over 24 weeks targeting breastfeeding with 60 core materials. Over 90% of those who reported exposure to the campaign believed it was positive but 61% of those exposed reported not knowing or remembering the campaign (Harding et al., 2020). In Indonesia, the national nutrition communication campaign implemented mass media and interpersonal communication interventions to disseminate stunting-related information. Exposure to the campaign improved knowledge of the value of exclusive breastfeeding, the importance of nutrition during the first 1,000 days of life, and having heard of stunting (Moffat et al., 2021). A study of pregnant women exposed to interpersonal communication campaigns reported significantly higher knowledge of iron folic acid supplements and iron-rich foods, but there was no change in actual consumption behaviour (Gamboa et al., 2020).

Nutrition knowledge targeted at pregnant women can improve knowledge and likelihood of supplementation. The Alive and Thrive initiative was designed to advance large-scale implementation of social and behavioural change for maternal, infant and young child nutrition in Bangladesh, Burkina Faso, Ethiopia, India, Nigeria and Viet Nam (Flax et al., 2023). In Bangladesh, the programme scaled up infant and young-child feeding interventions to 8.5 million mothers (Sanghvi et al., 2016). A cluster-randomized, non-blinded evaluation with cross-sectional surveys showed complementary feeding practices were significantly greater in the intensive programme (Menon et al., 2016). But in Nigeria, a weak impact was found on the early initiation of breastfeeding, exclusive breastfeeding and minimum dietary diversity in Kaduna and Lagos states (Flax et al., 2022).

A quasi-experimental study of 194 pregnant women in Indonesia in 2019 found that those who received interactive nutrition and reproductive health education in small groups registered a significant increase in knowledge, attitudes and practices (Permatasari et al., 2021). A systematic review of nutrition education on iron and folic acid supplementation during pregnancy in low- and middle-income countries found that those who received nutrition education during pregnancy were 2.8 times more likely to take the supplements (Engidaw et al., 2024). In Asmara, Eritrea, nutrition education provided by health professionals helped increase knowledge and improved dietary practices among pregnant women (Teweldemedhin et al., 2021). Pregnant women who received six nutrition education sessions in southeast Ethiopia improved the mid-upper arm circumference of their children, a measure of undernutrition (Beressa et al., 2024).

NUTRITION EDUCATION OPTIONS FOR SCHOOL-AGE CHILDREN ARE WIDE-RANGING

Schools are an important location for delivering nutrition education (Xu et al., 2021). Food and nutrition education can be integrated into core subject curricula or across subjects, school projects, extra-curricular programmes or activities, and non-education programmes or services, such as garden-based farm-to-school lessons and skills-based cooking classes (Pastorino et al., 2023). School mealtimes present learning opportunities from a food perspective through supervision, guidance and teaching (Lalli et al., 2023). There is growing recognition of the need to adopt a 'whole school approach' to promote nutrition based on curricula, physical activity, a healthy food environment, monitoring, screening, supplementation and individual engagement of school staff (Hargreaves et al., 2022; Rose et al., 2023).

A systematic review of 19 studies evaluating interventions to improve food and nutrition literacy among primary school students found that various activities were employed, including food preparation, food label literacy, food tasting, gardening and harvesting. The strongest emphasis was on functional skills, such as cooking,

but not interactive and critical skills. The most promising interventions were tailored to student needs and interests, and were well integrated into the existing curriculum (Omidvar et al., 2023). Another systematic review of interventions to improve dietary behaviours aimed at secondary school students found that computer-based feedback, media or messaging, peer and/or parent involvement, and increasing access to healthy foods were important (Capper et al., 2022).

A review of 33 studies on food and nutrition education from Spanish-speaking countries (Argentina, Colombia, Ecuador, Mexico, Paraguay, Peru and Spain) found that most interventions improved knowledge. Longer interventions were associated with changes in the nutritional status of school-age children (Lizárraga-Quintero et al., 2022). In Cambodia, a nutrition education programme found that child dietary diversity had increased one year after the intervention, including the consumption of vitamin A-rich foods, fruit and vegetables (Reinbott et al., 2016). In Indonesia, a gender-responsive package – including food and folic acid supplementation, school-based nutrition education and a social behaviour communication strategy – was associated with greater knowledge and changes in physical activity and supplementation behaviours, with modest changes in diet among adolescents (Oddo et al., 2022). In Nepal, a quasi-experimental study of 12- to 19-year-old students found that receiving 1 hour of nutrition education for 12 weeks improved nutrition knowledge and attitudes among adolescents (Raut et al., 2024). A comparison of two school-based fruit and vegetable nutrition education programmes in the Netherlands targeting 7- to 12-year-olds found that they increased nutrition knowledge compared to the absence of nutrition education (Verdonschot et al., 2020).

Other studies found mixed impacts of nutrition education and knowledge on improving outcomes. In Kazakhstan, students who received a nutrition education programme were able to improve nutrition attitudes and behaviours, as well as sports performance, but not their academic achievement (Mukhamedzhanov et al., 2023). In the United States, a review of school lunch programmes found 11 studies that focused on nutrition education alone, of which 6 were associated with increased school meal consumption and 1 with decreased consumption, while 4 had no association (Cohen et al., 2021).

Addressing adolescent nutrition requires careful consideration of social stigma and peer dynamics. Overweight adolescents face risks of social rejection and bullying (Langford et al., 2022). For female adolescents, achieving a socially acceptable body image is a predominant concern, which can often affect their food choices negatively. Social media exacerbates these challenges. A study of Australian students found that girls were more likely than boys to skip meals or binge eat, driven by an excess focus on their appearance through their use of image-focused applications (Wilksch et al., 2020). A study in Flanders, Belgium, found that adolescents with higher food literacy scores – i.e. knowledge, attitude and behaviours required to plan, manage, select, prepare and eat foods to meet needs and determine intake – were more likely to report higher levels of fruit and vegetable intake, and lower consumption of soft drinks. Adolescents with higher exposure to social media were less likely to consume such foods (Qutteina et al., 2022). A study of a social media campaign promoting healthy eating to adolescent girls in urban Indonesia found that it increased awareness of healthy diets but faced barriers to changing habits such as perceptions of taste, limited choices for healthy but affordable ingredients, and family-related factors (Januraga et al., 2021).

Nutrition education, in curriculum or in practice, has become more popular

Nutrition education has become a cornerstone of school health initiatives worldwide, designed to instil habits that endure for life. Of 160 countries reporting on actions related to school health and nutrition programmes in 2016/17, the most frequently reported component of school health and nutrition was nutrition education in the school curriculum (61%), followed by training of school staff (56%), physical education (54%) and extracurricular nutrition education (29%) (WHO, 2018). A mapping of government-led school nutrition programmes and interventions in 22 countries in Northern Africa, Western Asia and Southern Asia found that nutrition education in the curriculum was the most common intervention (17 countries or 77%), followed by extracurricular nutrition education (14 countries), school food standards (14 countries) and staff training (13 countries), while the least common were school gardens and take-home rations. Some of the topics covered in nutrition education programmes were healthy diets, links between nutrition and health, and healthy cooking practices (Al-Jawaldeh et al., 2023).

How food and nutrition education is integrated in subjects in the curriculum and in practice varies. A systematic analysis of food education curricula in primary education in 11 high-income countries showed that many of them prioritized knowledge-based instead of practical learning.

Only Norway had a food curriculum with food as the central topic. All countries covered food education in science, through topics such as plant knowledge, senses, diet and health. About half of the countries addressed food in the health curriculum and in a home economics practical curriculum. All countries focus on improving confidence and empowerment with food through nutritional knowledge. Some countries also highlight the importance of having a positive relationship with food. Lobbying and media influence on food systems were among the themes addressed as part of competencies around equity and sustainability for food systems. In Japan, physical education is being used to teach healthy eating, while six countries address food literacy in social science (Smith et al., 2022).

A survey-based assessment of school-based food and nutrition education in 30 low- and middle-income countries in 2018 found that integration within the school system is mostly through extracurricular or project-based activities, rather than as a stand-alone subject or across the school curriculum. In only 3 of 28 countries were assessments regularly conducted and used. The assessment information included changes in attitudes and perceptions about food and nutrition, knowledge, food practice, nutritional status, habits and diets (FAO, 2021b).

In England (United Kingdom), cooking and nutrition was introduced in the national curriculum for all 5- to 14-year-olds in 2014 and taught in two subjects: science, and personal, social, health and economic (PSHE) education. While science focuses on understanding human nutrition and digestion, PSHE education focuses on understanding health in a wider context of well-being and food choices. Analysis of its implementation found large disparity between schools regarding the duration, frequency, content and quality of delivery. Practical cooking education experiences are poor, and students were not taught how to apply the principles of a healthy diet in their daily food choices. Students said that their hunger affected their choices, found unhealthy but less expensive food more filling, and preferred the ease of portable, packaged food (Jamie Oliver Food Foundation, 2017). There is also confusion around what constitutes a healthy diet.

About 24% of primary pupils thought that chicken counted towards the '5-a-day' target, and 19% thought so about cheese (Health Food Business, 2022). In another survey, secondary school teachers said that food budgeting, plant-based eating and environmental sustainability, and foods from around the world are some of the skills, knowledge and experience that should be taught (Davies and Ballam, 2023).

Healthy and sustainable menus, clean energy for cooking, reduced food waste and action-oriented and holistic food education can help foster healthier and sustainable habits that will impact food systems. Learning about the interconnectedness between food systems, health and the environment and developing the capacity to act on this information requires holistic and action-oriented food education in school curricula (Pastorino et al., 2024). Efforts to expand understanding around sustainable food systems have evolved over time. In Norway, expected grade 10 competencies include understanding cooking, but also critically examining food production and consumption for their social and planetary implications. This suggests the need for greater focus on connecting theory and practice, more room for discussion and less emphasis on cooking-related activities (Bjørkkjær et al., 2024).

In the Philippines, an evaluation of an integrated school nutrition model, which included a bio-intensive school garden emphasizing indigenous vegetables, nutrition education and supplementary feeding, found that it improved the nutritional status of beneficiaries, improved parent and child knowledge and reduced food waste (Monville-Oro et al., 2020a). The model was subsequently scaled up throughout the country (Monville-Oro et al., 2020b). With a national network of 273 schools and 5,000 seed banks, the Philippines now has a scaled-up approach for supporting garden-based education that can also support climate-resilient, local crops (Anunciado et al., 2023).

Some countries have an intensive approach to engaging with food and nutrition education in their education systems (**Box 3**).

BOX 3.

A few countries have systemically embedded food and nutrition education to develop lifelong habits

In Brazil, the nutrition education programme is one of the axes of the near-universal National School Feeding Programme. It is characterized by a strong effort to link school meals with local agricultural production and efficiency. Food and nutrition education is understood as a strategy to promote adequate and healthy eating, realize the human right to adequate food, and guarantee food and nutritional security. In December 2023, the President signed a decree outlining a comprehensive framework to promote healthy eating habits, which establishes three core pillars for building a healthier school environment: food and nutrition education, restricting ultra-processed products, and safeguarding against unhealthy marketing. Food and nutrition education is expected to require transversal adoption of food, nutrition and healthy life practices with a pedagogical shift to practical and experiential learning, and continuing education efforts focused on teachers and school employees. Analysis of the implementation of food and nutrition education in public schools in Florianopolis found that of 95% had developed some nutrition education actions in 2019. The most frequent were pedagogical activities in the curriculum (96%), school gardens (72%) and hands-on-cooking classes (46%) (Florintino et al., 2023).

In France, school meals are part of a systemwide approach that tackles multiple dimensions of child obesity including socioeconomic status, household food insecurity, and the need for experiential education about healthy eating and nutrition. Meals are viewed as an opportunity for pupils to relax and communicate, and several rules guide the nutritional quality of school meals. The legal framework for school meals integrates nutrition into school curricula and focuses on the food environment, prohibiting vending machines, monitoring food waste and banning plastic. The French school meal guidelines include 15 frequency rules linked to nutrition recommendations on proteins, dairy, carbohydrates and desserts to ensure a balanced diet. Since January 2022, school meals must serve at least 50% sustainable products, focus on reducing waste and use of plastic, and include one vegetarian menu per week. The school meal is subject to very strict hygiene standards, linked to meal safety and European regulations (Avallone et al., 2023).

In the 1960s, Japan had the lowest life expectancy of all countries in the G7, linked to a sudden influx of imported, processed foods. In response, school lunches were designed by nutritionists to be universal. The 2005 Basic Act on Shokuiku (Food and Nutrition Education) gave a legal mandate to a long history of food-related practices in Japanese schools (Rappleye et al., 2024). Various ministries (agriculture, education, health) and agencies (Children and Families Agency, Food Safety Commission, Consumer Affairs Agency) have distinct roles (Japan Health Education and Shokuiku Division, 2023). The Act aims to ensure that food is understood and experienced as an integral part of culture and tradition; 'cultivate a deeper sense of human life through appropriate diet, across the entire lifespan', rooted in ideas of interdependence between nature and people; and encourage experiential, deep awareness of how food is produced and consumed. Students eat with their teachers in the classroom, clean up school meals and are strongly encouraged not to waste food (Rappleye et al., 2024).

In Slovenia, childhood obesity rates skyrocketed in the 1990s but this trend has more or less stopped thanks to a combination of school feeding and physical education, which is a key part of an integrated approach to promoting healthy living. Through the national surveillance system, somatic and motor development of 6- to 18-year-olds has been continuously monitored via anthropometric measures and fitness tests. Physical education teachers were extensively educated in anthropometry in their graduate education, and medical scales were provided in all schools. The School Meals Act, which was adopted along with the National Dietary Guidelines, helped to exclude foods with little nutritional value from school meals, while vending machines were banned. The 2010/11 Healthy Lifestyle initiative supplemented the existing physical education with 2 or 3 hours of physical education per week, reaching at least 20% of 7- to 14-year-olds by 2015 (Sorić et al., 2020).

Teachers are critical for delivering nutrition education. Across 68 countries, 41 nutrition policies mentioned the need to improve teacher and educator capacities on nutrition (Kwansa, 2025). In Honduras, teacher capacity-building workshops on food and nutrition help teachers understand dietary guidelines and develop nutrition content effectively (Honduras Government, 2018). In Mongolia, policy objectives include adding a training module on healthy eating, nutrition and food safety to the core curriculum of teacher training (Mongolia Government, 2015). In Togo, initial teacher training curricula are expected to integrate nutrition modules, and their inclusion monitored at teacher training institutes (Togo Government, 2019). A study of school food and nutrition education found that in 20 of 25 low- and middle-income countries, teachers were mostly trained on school food and nutrition education sporadically, and that the training may not be available to all teachers or use adequate methodologies (FAO, 2021b).

Qualified teachers who can teach nutrition education in primary schools can make an important contribution to the knowledge and dietary habits of children, and to increasing fruit and vegetable consumption (Cotton et al., 2020). Teachers themselves often see nutrition education as part of their remit. Most teachers in Finland, Greece and the United States believed that it was their role to provide food and nutrition education. One third of teachers reported including nutrition competencies in their lesson plans. However, they lacked the time to provide deeper learning on both the theory and practice of nutrition education. Teachers can be motivated to focus more on food and nutrition education if there are changes in national policy or if school districts support them (Esdaile et al., 2024). A qualitative exploration of teachers and other stakeholders' integration of food and nutrition education in Australia found that they all viewed teachers as potentially playing an important role in engaging students in nutrition education, with most highlighting a lack of time to engage with this issue properly (Love et al., 2020).

An overview of how the mandatory subject of food and health was taught in Norway found that less than half of food and health teachers had a formal teaching qualification in the subject, while there were no requirements for formal competences for teachers of lower grades. In contrast, in Finland, a Master's level qualification is required for teachers to teach food and health (Bjørkkjær et al., 2024). Analysis of the food education landscape in England (United Kingdom) found that over two thirds of food teachers and senior leaders in primary and secondary schools highlighted a lack of time as a serious and significant challenge to delivering high-quality food education. While almost all teachers (92%) felt that food education and cooking nutrition should be taught by specialist teachers, this did not happen in their schools (Jamie Oliver Food Foundation, 2017).

Many school meal programmes include a nutrition education component

Most school meal programmes have education goals, alongside nutrition, health and social protection objectives. However, fewer programmes focus on preventing or mitigating obesity. Complementary education programmes help provide a holistic education and enable more effective outcomes from the implementation of school feeding policies. Most school feeding programmes were in place in countries that also had relevant complementary education programmes, of which food- and nutrition-related curricular education components were the most common (**Table 4**).

TABLE 4.

School meal programme objectives related to education outcomes and experiences, 2018–22

	2018	2021	2022
Share of school meal programmes stating particular goal (%)			
Educational	93	85	85
Nutritional and/or health	88	94	92
Social safety net	73	73	65
Agricultural	35	41	44
Obesity prevention or mitigation	25	35	37
Share of complementary education programmes integrated in other curricula (%)			
Food and nutrition	65	84	89
Agriculture	42	49	55
School gardens	47	67	68
Hygiene	69	72	75
Health	63	70	77
Physical education	57	67	62
HIV prevention	46	34	37
Reproductive education	46	34	41
Number of countries	**85**	**139**	**115**
Number of school meal programmes	**160**	**183**	**182**

Sources: GCNF (2019b, 2022, 2024m).

School meals have the potential to shape dietary diversity and eating habits to some degree in school environments. A review of the complementary educational measures associated with the European Union school scheme for fruit, vegetables and milk found that most countries had lessons or materials, farm or food industry visits, cooking classes and tastings, but less so school gardens. Many countries also actively used promotional materials to stimulate healthy eating in schools as well as approaches to raise awareness. While some countries had well-received educational measures, others struggled to produce and provide materials of good quality. Regularly providing information about healthy eating habits was viewed as one of the ways to increase and facilitate sustainable change in the long run. Yet a review of the scheme found that it had a limited impact on shaping children's eating habits, although its impact was more positive for children who might have otherwise lacked access to a wide variety of fruits and vegetables (European Commission, 2023).

In Botswana, the school meals programme began in 1966 and is universal. However, an investigation of 13 primary schools in the South East District showed that the programme had not made a significant contribution to dietary diversity, and required more revision to enhance the dietary quality of meals (Eluya, 2019). In Japan, school meals are universal but not free. Low-income families receive financial support. Analysis of 6- to 12-year-old students in Tokyo found that the intake of fruit and vegetables did not vary by socioeconomic status at school, but it did at home, where more educated mothers were able to provide more dietary diversity to their children. This means that the universal school lunch programme was able to reduce the socioeconomic gap in vegetable intake (Yamaguchi et al., 2018). In Batu Pahat District, Malaysia, analysis of six primary schools found that students receiving school feeding had improved eating behaviours (Teo et al., 2021).

Multi-component interventions are more impactful

An assessment of randomized controlled studies of multi-strategy interventions targeted at 10- to 18-year-olds in high-income countries found that when nutrition education is theoretically based, facilitated by school staff in conjunction with parents and families, and includes changes to the school food environment, it can have a significant impact on diets and anthropometric measures (Meiklejohn et al., 2016).

Parental and community involvement plays a key role in shaping dietary behaviours. A systematic review highlighted that the most effective interventions for reducing intake of carbonated sodas and fruit juices may be modelling or demonstrating appropriate behaviour by parents or other adults (Vargas-Garcia et al., 2017). Yet a systematic review of 42 articles from 17 countries found that most interventions focus on classroom interventions. When parents were involved and provided with nutritional knowledge and healthy cooking skills, it helped young people prepare more healthy and nutritious food at home. These interventions did not affect nutrition knowledge but did affect attitudes towards dietary behaviour and fruit and vegetable consumption (Chaudhary et al., 2020).

In Chile, a nursery school council programme to reduce childhood obesity by cutting the energy content of meals was unsuccessful. Change emerged only after the programme expanded to involve parents and address diets both at school and at home. This dual focus improved fruit and vegetable intake, while reducing fat and snack consumption (Salazar et al., 2014). In Malawi, providing community-based nutrition education to caregivers helped improve children's dietary diversity, even in food-insecure areas (Kuchenbecker et al., 2017). The Nepal school meals programme had reached 600,000 students by 2017. An evaluation of a pilot home-grown school feeding programme found that children in these schools had higher provision of mid-day school meals, higher school meal quality and higher nutritional content. These results were achievable because of the capacity of local stakeholders, and strong community ownership and accountability mechanisms. Capacity building of parents, teachers, caterers and cooks was also key to ensure all actors focused on child nutrition and professionalizing school meal provision. This approach was delivered by teachers who had received training on how to use the materials in their curriculum (Shrestha et al., 2020).

Interventions are likely to be more successful if they integrate physical activity with nutrition education, are delivered in more engaging ways, and involve teachers and parents (Jacob et al., 2021). In Ghana, an intervention targeting children aged 9 to 13 improved both nutritional knowledge and weight outcomes when physical activity and nutrition components were combined (Annan et al., 2021). In Trinidad and Tobago, a curriculum-based intervention on dietary behaviours and physical activity among primary school children showed that students reported significantly lower intake of fried food and sodas and higher knowledge scores compared to a control group (Nichols et al., 2014). The Ajyal Salima intervention among 9- to 11-year-olds in Bahrain, Jordan, Lebanon, the State of Palestine and Saudi Arabia improved dietary and physical activity habits. The intervention included 12 culturally appropriate classroom interactive sessions addressing nutrition and lifestyle behaviours, a family component consisting of meetings and information, and a food service component (Habib-Mourad et al., 2023).

In three regions of China, a cluster randomized clinical trial across 24 schools with 8- to 10-year-olds found that the intervention was successful in reducing obesity prevalence because of its multifaceted intervention, which included behavioural change messages delivered by classroom teachers during health education lessons, physical activity, regular monitoring and feedback, and family engagement (Liu et al., 2022). Italy's Maestra Natura programme similarly enhanced food literacy by integrating theoretical knowledge, practical activities and home engagement. The initiative de-emphasized concepts of 'good' and 'bad' foods, instead promoting holistic food literacy. Evaluations showed significant improvements in fruit and vegetable knowledge (Scazzocchio et al., 2021).

Experiential approaches resonate most when they encourage healthier eating habits. A systematic review of teaching strategies and approaches to promoting healthy eating (e.g. curriculum improvement, cross-curricular approaches, parental involvement, experiential learning, rewards and incentives, game-based approaches and web-based approaches) found that experiential learning was associated with the largest effects on reducing food consumption or energy intake and increasing fruit and vegetable consumption or preference (Dudley et al., 2015). A study detailing the characteristics of successful primary school–based experiential nutrition programmes from 42 studies highlighted that, when combined with taste testing, cooking activities and gardening interventions, nutrition education increased children's willingness to taste unfamiliar foods and increased their nutritional knowledge (Charlton et al., 2021).

School gardening can be an important experience for learning. A systematic review found that school garden

programmes in 12 countries were able to improve knowledge and awareness of eating practices, even though the translation to dietary practices was limited (Chan et al., 2022). In the United States, a study involving students from 16 schools found that gardening, nutrition and cooking interventions improved academic performance, particularly in reading scores for grade 4 students. Improved vegetable intake and reduced sugar consumption drove these gains (Davis et al., 2023). A review of school-based cooking classes found that they can improve vegetable intake, food literacy and diet quality (Vaughan et al., 2024). An intervention that combined school gardens, education, and parent and community engagement in Bhutan, Burkina Faso and Nepal improved students' awareness and knowledge of fruits and vegetables, but was less effective in changing students' consumption patterns (Schreinemachers et al., 2020). An intervention that added a garden-based teaching unit on sustainable healthy diets to a secondary education centre in the US state of Indiana found that students became more aware of the environmental impacts of sustainable healthy diets (Eugenio-Gozalbo et al., 2022).

Holistic education approaches are needed to achieve various outcomes simultaneously. In India, the nutri-school model is an integrated approach that aims to teach children about the importance of adequate hygiene, physical activity, balanced diets and the benefits of biofortified crops, and guide them on how to prepare and choose such meals, while providing high-quality kitchens and health clubs, and utilizing adequately trained teachers and health and nutrition students (Sharma, 2023).

HEALTHY EATING AWARENESS CAMPAIGNS TARGET ALL AGES

Nutrition education campaigns tackling non-communicable diseases typically aim to communicate general healthy eating messages, raise awareness of national food-based dietary guidelines, and are often combined with messages about physical activity. They aim to inform, raise awareness, shape public understanding, change behaviour, build networks and put pressure on decision makers (Segerberg, 2017). The World Health Organization highlights the importance of implementing mass media campaigns on healthy diets, including through reducing the intake of total fat, saturated fats, sugars and salt, and promoting the intake of fruit and vegetables. The United Nations Food and Agriculture Organization's Nutrition Education and Consumer Awareness team provides technical support for policies and programmes to increase public awareness of the importance of eating well, to foster healthy food choices and to build the capacities of individuals and communities to adopt food and nutrition practices that promote health (Macías and Glasauer, 2014).

An assessment of the nutrition knowledge of 8,000 respondents in Egypt, Jordan, Saudi Arabia and the Syrian Arab Republic found that youth up to the age of 24 get their information from social media, while those over 25 do so from television. Only 3% get such information from healthcare providers. However, over 73% lack adequate nutrition knowledge, highlighting the need for higher quality nutritional awareness programmes utilizing media (Bany-Yasin et al., 2023).

Nearly every country has established some type of communication campaign focused on promoting healthy eating for adults and families, drawing on nutritional guidelines or standards for promoting dietary diversity and the consumption of fruit and vegetables. Several countries have campaigns formulated around eating well as a means of living well. Consumer literacy around food labelling is highlighted in some countries (Kwansa, 2025), such as Malta (Malta Government, 2014) and Mongolia (Mongolia Government, 2015).

Some campaigns have been shown to improve knowledge, awareness and recommended dietary practices. Australia's LiveLighter campaign increased public awareness of health challenges and the value of eating well (Morley et al., 2016). In the state of Western Australia, the Go for 2 and 5 campaign increased daily fruit and vegetable intake (Pettigrew et al., 2024). In Thailand, mass media campaigns were used to promote fruit and vegetable consumption through billboards, flyers, radio and television. A community-based programme that advocated for healthy environments such as home and community gardens, with a focus on key influencers at the village, subdistrict and district levels, improved fruit and vegetable consumption (Phulkerd et al., 2022). Other campaigns have had mixed impacts. #ActonFacts – The Food in Schools Matters, a six-week digital campaign in the Caribbean, advocated for healthy school nutrition policies, supported by a number of activities led by the Healthy Caribbean Coalition youth arm. However, a systematic review of such social media campaigns found mixed effects on cognitive, behavioural and anthropometric outcomes (Luo et al., 2024).

Parents are a common target group in campaigns to improve children's diet (IFPRI, 2024), although targeting such education exclusively at increasing fruit and vegetable intake has shown uncertain outcomes. A Cochrane systematic review found that even long-term parent nutrition education trials had no overall effect on child

consumption (Skouteris et al., 2016). Interventions that reported positive effects were those that may have focused primarily on consumption, but involved parents in some intervention component (Hodder et al., 2024). In Bangladesh, education on complementary feeding delivered through mass media, interpersonal communication and community efforts led to improved dietary diversity among children (Menon et al., 2016). An evaluation of the PlayandGrow programme which promoted age-appropriate dietary habits and healthy playtime routines through connection with nature in China, Hong Kong Special Administrative Region found improved feeding practices (Sobko et al., 2017). In Pakistan, interventions that only focused on nutrient supplementation did not have an impact on child undernutrition, unlike nutrition counselling that targeted mothers, which helped increase the number of meals per day (Khan et al., 2013).

In Finland, the Special Turku Coronary Risk Factor Intervention Project studied the effect of dietary interventions initiated in infancy. Participants were recruited at the age of 6 months and followed until the age of 20. Counselling was directed at parents until the children were age 7, and then gradually delivered directly to the child. It was individualized and suggestions were made based on food records, drawing on the Nordic dietary recommendations. An assessment of 534 people found that recipients of the intervention had a substantially reduced risk of adolescent metabolic risks, such as waist circumference, blood pressure, triglycerides, glucose and cholesterol (Nupponen et al., 2015).

In Ethiopia, an innovative social protection programme provided digital access to monthly food vouchers, tailored to household size for an amount based on the cost of a nutritious diet. In rural areas, mothers were provided with vouchers for the purchase of fresh fruits, vegetables and eggs. As a complementary action, changes in social behaviour were encouraged through community counselling and media campaigns to promote dietary diversity. An external evaluation found that the voucher programme had a positive impact on the dietary diversity of mothers and their children (Frölich et al., 2021).

Some campaigns target **older adults**. A systematic review found that older people could achieve better dietary quality if they made diet-related changes after receiving dietary education and healthy meal services. The majority of these studies came from Europe (Zhou et al., 2018). An evaluation of the FOODcents adult nutrition programme delivered in Western Australia state found that it improved food categorization according to how food should be consumed, the correct interpretation of nutrition labels, the appreciation of links between obesity and a range of diseases, and fruit and vegetable consumption, especially for participants with low socioeconomic status (Pettigrew et al., 2016). In Cuenca, Ecuador, an education intervention on healthy eating among older adults, carried out over 24 two-hour sessions improved knowledge of healthy eating, with culturally adapted materials found to be particularly helpful (Ortiz Segarra et al., 2023).

Food safety is a fundamental competency for both consumers and food handlers. Analysis of education and awareness campaigns for food safety and standards in Cambodia, the Lao People's Democratic Republic, Myanmar and Viet Nam showed that they mostly targeted food safety officials and yet gaps remained. In Cambodia, over 52,000 posters about food safety seals and labelling were produced and displayed in public spaces and markets (Nadarajan, 2021). In Viet Nam, analysis of the food safety knowledge and awareness of consumers and street vendors found that while consumers had fairly strong knowledge, food vendors' knowledge was quite poor and 95% of vendors had not received any food safety training (Samapundo et al., 2016).

In Jordan, a review of food service staff in 27 universities confirmed that food safety training helped reduce food poisoning risk as it built knowledge on safe food storage and utilization (Osaili et al., 2018). In the United Arab Emirates, assessments of food safety knowledge in 88 food service establishments found that the food handlers had good knowledge of cross-contamination and cleaning and sanitizing surfaces, and such knowledge was highly correlated with age, experience and education, but was also higher among those who had food safety training (Taha et al., 2020). Analysis of food safety and knowledge in South Africa found that up to 60% of food handlers did not know the correct procedure for washing a cutting board, and 96% had never sanitized utensils and cutting surfaces after cutting up raw meat (Sibanyoni et al., 2017). Some countries highlight how training can help prepare young adults entering the workforce with the knowledge to influence food production and public health directly (Kwansa, 2025). In Saint Kitts and Nevis, the nutrition policy highlights the importance of training food handlers for food safety, storage, preparation and personal hygiene (Federation of St. Kitts and Nevis, 2012). Finland highlights the importance of training for all actors in the food system, including food industry professionals who need training on food hygiene (Finland Government, 2017).

Reducing **food waste** is critical in richer countries. A review of food waste campaigns in Denmark, Japan, Malaysia and the

United Kingdom found that engaging the community through education campaigns has the most significant impact on reducing household waste (Zamri et al., 2020). In Australia, engaging with consumers to co-design food waste strategies led to identifying new pathways and strategies for household waste management, such as a focus on reuse and stronger use of technology (Kim et al., 2020). A study on the impact of a food waste awareness campaign among 9,000 Chinese university students found that those familiar with the campaign were 3% less likely to waste food, but there was no impact on the amount of food wasted (Qian et al., 2024). In Thailand, the Save Food campaign helped reduce food waste at a university campus aided by social media (Manomaivibool et al., 2016). In London, England, the Love Food Hate Waste initiative reduced food waste through multiple approaches, such as radio campaigns, face-to-face engagements and company interventions (Yamakawa et al., 2017).

Workplaces are a key location to address aspects of nutrition among employees or supply chain workers, and improve access and demand for safe and nutritious food (Dhillon and Stone, 2019). Workforce nutrition education programmes can change attitudes towards a specific behaviour, address normative beliefs, and modify beliefs about self-control and the ability to change. These interventions are often delivered through groups with methods such as cooperative menu planning, dissemination of education materials, and interactive information sessions and workshops (GAIN, 2019). A systematic review of studies on workforce nutrition programmes found that only 2 of 26 studies focused on nutrition education interventions alone. The evidence was inconclusive for the effects of stand-alone nutrition education programmes, but comprehensive programmes with a variety of interventions were more likely to affect nutrition, health and business outcomes (Dhillon and Ortenzi, 2023).

A review of workplace interventions in 11 middle- and high-income countries found that most included nutrition education and training programmes. In Brazil, cafeteria managers were educated on how to change the food environment in 29 companies, which helped increase fruit and vegetable availability. In the Republic of Korea, a study provided nutrition counselling for male workers for four months, which included coaching, assessments and dietary habit analysis. The intervention led to a significant decrease in body mass and cholesterol readings. In Spain, as part of a 3-year intervention, workers in 12 work centres were given 5 hours of awareness training sessions, which decreased risky alcohol consumption over the following year (Rachmah et al., 2022).

General communication campaigns need to be sensitive to context and involve the consumer. Analysis of the opinions of citizens, health professionals, communication professionals and digital influencers found that the active involvement of the target audience is critical for the development and effectiveness of campaigns (Capitão et al., 2022). An online study of Uruguayan citizens showed that an effective public awareness campaign aimed at promoting the use of nutrition warnings in decision-making for food choices should emphasize the benefits and increase the perceived severity of negative consequences (Ares et al., 2020).

SYSTEMIC APPROACHES TO THE FOOD ENVIRONMENT ARE NEEDED

The food environment, i.e. the spaces and conditions inside and around the school where food is available or consumed, is central to encouraging people to eat nutritious and healthy food. Nutrition education without any changes to the food environment will struggle to reduce junk food consumption. A systematic review of the effectiveness of interventions on the food environment within and around schools to improve dietary intake and childhood obesity found that they led to weight loss and improved fruit (but not vegetable) consumption (Pineda et al., 2021).

In Ethiopia, various nutrition education interventions (at ceremonies, classroom lessons, school club meetings, peer groups and parent–teacher meetings) were provided over four months to 10-to 14-year-olds and increased dietary diversity incrementally. While students' and parents' knowledge about junk food increased, it did not translate into practice, given its easy availability and addictiveness (Kim et al., 2023). In middle- and high-income countries, obesity is often associated with socioeconomic status, which is also clear in the food environments. In Madrid, there are more fast food outlets (and at closer proximity) around primary schools in disadvantaged areas than in better-off neighbourhoods (Díez et al., 2019). In 14 municipalities with 443 public schools in Santiago, Chile, there was an average of 41 unhealthy outlets near schools in the poorest one third of areas, while for schools in areas of middle-high socioeconomic status, there were about 16 such outlets, demonstrating a clear socio-spatial segregation of unhealthy food environments associated with childhood obesity (Kain et al., 2023).

In 2022, 93 out of 187 countries had legislation, compulsory standards or guidance on school food and beverages. However, only 29% of these 93 countries had measures restricting food and beverage marketing in schools; and only 60% had standards governing food and beverages

sold in cafeterias, food stores and vending machines (UNESCO et al., 2023). Another survey focused on school meal provision found that 72% of countries reported some limitations on food marketing on school grounds, and 52% had national-level prohibitions on foods permitted on or near school grounds in 2022 (GCNF, 2024m).
A review of nutrition policy engagement with food system transformation in high-income countries highlighted that, while most policy actions focused on communication for healthy choice behaviour change, most outcomes in the food environment domain focused on food labelling, product reformulation, providing healthy food in schools and restricting food advertising. There was a lack of emphasis on reducing consumption of unhealthy food or drinks. There was an emphasis on individual responsibility instead of the food environment and on regulatory and legislative reforms (Lee et al., 2020).

Individuals self-report that they are trying to eat healthily. In 2023, 72% of adults in more than 140 countries reported that the food they were eating was mostly healthy, ranging from 54% in Northern Africa to 84% in Europe and in Southeastern Asian (Gallup and Ando Foundation/ Nissin Food Products, 2024). A survey of adolescents aged 10 to 17 years in Australia, Canada, Chile, Mexico, the United Kingdom and the United States showed that while about half are trying to make healthy choices, they are much more likely to be exposed to advertising of unhealthy foods, such as sugary drinks, than of fruits and vegetables (**Figure 3**).

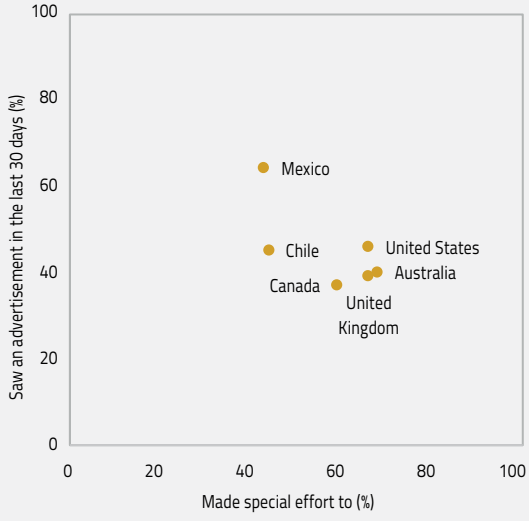
Public opinion surveys routinely note that adults would prefer a ban on unhealthy food marketing to children to reduce exposure to unhealthy food. Nearly 8 in 10 adults in the United Kingdom say that such ads aimed at children should be banned (Bansal, 2024). In 2019, Portugal became the first European Union country to introduce a law to regulate the digital marketing of unhealthy foods to children. Dietary guidelines and nutrition standards are shifting to tackle the consumption of processed foods. In Brazil, the school feeding programme has a mandatory farm-to-school component to increase healthy food in schools and support local farmers. The dietary guidelines state that a minimum of 75% of school meal funds must be spent on unprocessed or minimally processed foods. In Chile, the government created a nutrition profile model which forced some food items to display a black warning label. Several of these products are banned in schools. There was a strong focus on marketing control, with initial restrictions eliminating cartoons and enticement for children from package design, which had a major impact (Popkin and Ng, 2022).

FIGURE 3.

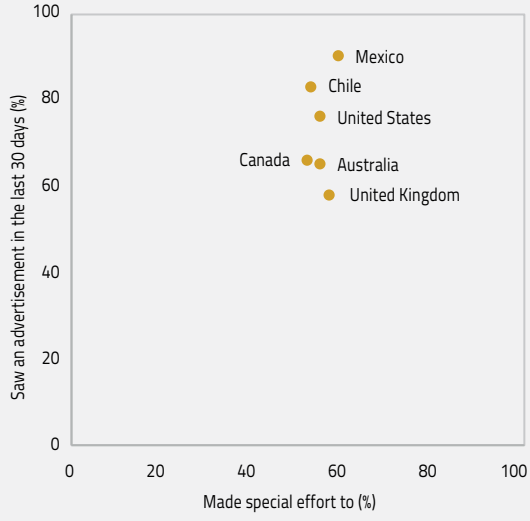
Youth are making efforts to eat more healthily but are highly exposed to marketing for unhealthy foods

Share of adolescents who have made an effort to make a healthier dietary choice and have been exposed to advertisements in the past 30 days, selected countries, 2021

a. Eat more fruit and vegetables



b. Eat less sugar/sugary drinks



Source: Hammond et al. (2023).

In many high-income countries, there is a major emphasis on supporting plant-based diets, given the greenhouse gas emission impact of meat production. Analysis of 100 countries' national guidelines show that 38 have a position on vegetarian diets, and nearly half mention plant-based alternatives to meat and dairy (Klapp et al., 2022). Denmark issued the first action plan to transition to a plant-based food system. It involves plans to promote plant-based foods in school meals through chef training (Mridul, 2023). A review of 84 media campaigns on meat consumption in the United States over the past 100 years found that the dominant model was to promote red and processed meat, with a focus on plant-based meat alternatives only emerging since 2015. In 2021, a survey found that 38% of Americans had heard of the Meatless Monday campaign and its messages were effective at increasing individuals' intentions to reduce meat consumption (Consavage Stanley et al., 2024).

Assessment of meat consumption reduction campaigns in seven high-income countries found that multisectoral partnerships that work with a large group of stakeholders, with adequate involvement of public sector actors, is essential for campaigns to have beneficial impacts (Scalabre et al., 2024) (**Box 4**).

A focus on home-grown and local school meals can have a critical impact on environmental sustainability, biodiversity and local employment in low- and middle-income countries. In Koubri, Burkina Faso, local nutritious food that had been forgotten, such as Bambara groundnut, were intentionally integrated into school menus, accompanied by awareness-raising activities on the benefits of these indigenous crops and their role in diversifying diets, with the intention of maintaining cultural identity and culinary traditions (Borelli and Tognoli, 2024).

BOX 4.

Achieving planet-friendly food systems in cities requires integrated efforts from multiple stakeholders

Since the food system is interconnected, a systematic approach is necessary to build a holistic understanding of the food environment and its relation to health, well-being and, especially, the urban environment. City networks often integrate health in their policies. The Partnership for Healthy Cities, which includes 74 cities, focuses on encouraging healthier food consumption. In Ouagadougou (Burkina Faso), Abidjan (Côte d'Ivoire), Dakar (Senegal) and Freetown (Sierra Leone), mayors have committed to developing food policies and nutritional standards, and to reducing excessive salt consumption in public schools and hospitals (Partnership for Healthy Cities, 2024). In Amsterdam, A Healthy Weight for All Children is a local government initiative which was shown to help reduce childhood overweight and obesity in a three-year period. Its whole-system approach has a 20-year horizon, with goals set for 2018, 2023 and 2033. The city receives EUR 5 million a year and, with a team of 25 dedicated staff first targeted poor communities (Sawyer et al., 2021).

Cities around the world are trying to transform their food systems. C40 Cities aims to achieve a planetary health diet for all by 2030, with balanced and nutritious food, minimizing food waste, reflective of the culture, geography and demography of their residents, through their Good Food Cities Accelerator. Shifting to such a diet can help reduce urban emissions by 60% in just 10 years. The signatory cities have to provide a high-level overview of how they will align food procurement with a planetary health diet, shift away from unsustainable and unhealthy diets, reduce food loss and waste, and monitor these results. In 2023, of the signatories to this action (Barcelona, Copenhagen, Guadalajara, Lima, London, Los Angeles, Milan, Montreal, New York City, Oslo, Paris, Quezon City, Seoul, Stockholm, Tokyo and Toronto), almost half of the actions focused on consumer awareness activities and tools. New York and Seoul, which directly control food served in schools, hospitals and shelters, are changing tenders, reviewing menus, and supporting kitchen staff to make plant-based meals with training, planning, advisors and recipe books (C40 Cities, 2023).

The EAT-Lancet Commission Brief for Cities highlighted the importance of changes to food production, procurement, distribution, marketing, loss and waste strategies, advocacy and governance to allow a substantial shift to plant-based foods (EAT, 2019; Willett et al., 2019). Informed by the Commission, the EAT Foundation is working with business, government and civil society for this major transformation. In Copenhagen, a new food strategy aims to provide healthy food in institutions. A three-year multi-partner project to shift urban diets is focusing on urban youth. Two pilot projects emphasized how the built environment can support healthier food choices by making them the most convenient and attractive options. In Tapada da Ajuda, Lisbon, a project brought urban farmers, local boroughs, families, schools and parents' associations closer together, including by taking children to allotment gardens and promoting safe routes to them (WHO, 2022).

FORMAL AND NON-FORMAL EDUCATION DEVELOPS SKILLS FOR NUTRITION

Education is the foundation for building the capacity to implement national strategies that enhance nutrition outcomes, including goals related to hunger, malnutrition, agricultural productivity, sustainability of food systems and the preservation of genetic diversity – a role that is not fully recognized.

First, from a consumption perspective, nutrition workers, medical professionals and community health workers, whose role is to help individuals adopt recommended nutrition practices, require adequate nutrition education and training. Second, from a production perspective, educated farmers are more likely to be productive, take measures to mitigate climate change effects and adopt new technology. Investment in extension services, research and development are critical for sustainable food systems, for example, to ensure innovation and advice are tailored to local needs and support indigenous knowledge systems. Finally, it is also necessary to help improve nutrition leaders' awareness of the globally connected food system. Policymakers require knowledge to engage with food systems in a positive and productive way.

BUILD CAPACITY TO DEVELOP NUTRITION AND HEALTH PROFESSIONALS' SKILLS...

Developing qualified nutrition professionals based on clearly defined professional competencies can lead to people making healthier nutrition choices. Interventions need to be designed at multiple levels: systemic (e.g. tertiary education institutions), organizational, workforce (e.g. training programmes) and community (e.g. village health committees) (Shrimpton et al., 2014). A review of nutrition policies in 159 countries found that 96% had trained nutritionists or dietitians and 87% mandated supervised practice in dietetic training. Yet the density varies widely, with only 2.3 professionals per 100,000 people in 126 countries estimated in 2016–17 (WHO, 2018). The International Confederation of Dietetic Associations found nutrition professional density ranging from just 0.1 per 100,000 in Nigeria to 42.6 per 100,000 in Portugal (ICDA, 2021).

Some countries promote nutrition professionals as key to healthy and sustainable diets. In Japan, registered dietitians are credited for promoting healthy and sustainable diets and building a nation famous for healthy longevity. The Japanese Dietetics Association aims to support the education, training and upskilling of registered dietitians and nutritionists, and establish systems in other Asian countries. Since 2022, in the Lao People's Democratic Republic, the government of Japan is working to collect information, promote human resource exchanges, establish partners, train dietitians and support their employment through the Nutrition Improvement Project (Japan Dietetic Association, 2022). Bangladesh aims to recruit nutrition officers for all its 64 districts, while Cameroon plans to establish a professional body of nutritionists in the public service, the National Nutrition Council (Development Initiatives, 2024). A review of 156 countries in 2017/18 found that 74% provided higher-level nutrition training, but the ratio was below 66% in Africa and the Western Pacific (WHO, 2018). Even where there are nutrition professionals, they may not be adequately utilized, for example in meal delivery at schools (**Box 5**).

BOX 5.

The involvement of nutrition professionals in school meal programme implementation is unequal

Nutritionists should be involved in school meal planning, policy and implementation to ensure meals are nutritionally balanced, diverse and tailored to local needs, including cultural preferences, allergies and dietary restrictions. Nutrition professionals can help design efficient, cost-effective and sustainable programmes, ensure adherence to dietary guidelines and standards, and shape national and local policies related to school meals.

The number of nutritionists engaged in school meal provision varies widely (**Figure 4**). In 2022, nutritionists were involved in 73% of programmes globally and in as many as 95% of those in Latin America and the Caribbean (GCNF, 2024m). In Brazil, some 7,300 registered nutritionists make decisions on school menu design, emphasizing fresh or minimally processed foods to promote healthy nutrition (GCNF, 2024a). In Japan, about 6,800 nutrition teachers and 4,500 additional school nutrition staff were engaged in the School Lunch Program (GCNF, 2024e). In the Republic of Korea, almost 13,400 nutritionists were involved in the School Food Service programme, at the regional and local government level, with the aim of providing a balanced meal of high quality to all students (GCNF, 2024j).

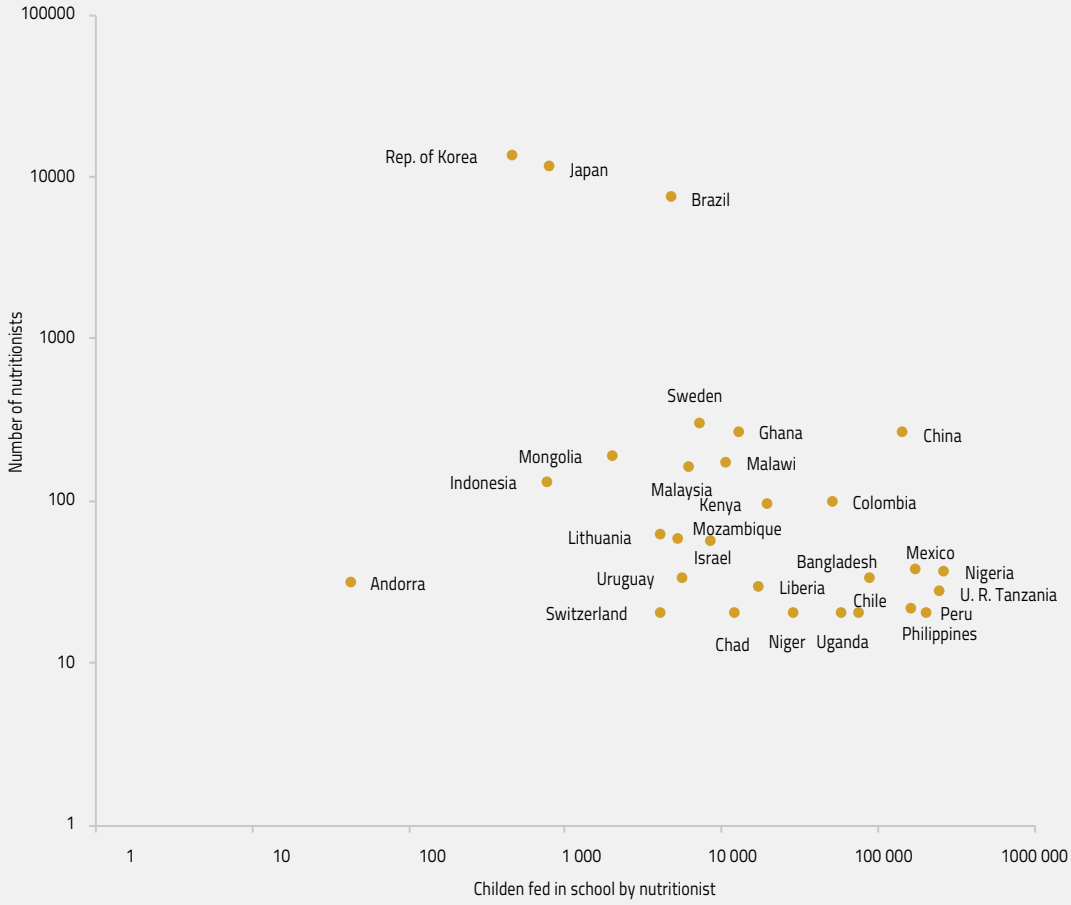
Continued on the next page

BOX 5. *Continued*

FIGURE 4.

There is considerable variation in the use of nutritionists in school feeding programmes

Ratio of students receiving school meals by nutritionist and number of nutritionists, 2022 or latest



Notes: The figure includes countries with at least 20 nutritionists working in school feeding programmes nationally.
Source: Analysis based on GCNF 2019, 2022 and 2024 rounds.

In Colombia, one nutritionist was employed for each of the 97 territorial entities implementing the school meal programme (GCNF, 2024c). The School Feeding Programme of the French local authorities engaged nutritionists paid by regional and local governments. Their role is to implement initiatives to mitigate overweight and obesity, such as setting nutritional standards for food baskets, restricting food and beverages near or in schools, promoting physical education, providing food and nutrition and health education, and supporting classroom interventions by school nurses (GCNF, 2024d). In Indonesia in 2017–18, the programme involved 2 nutritionists per district, adding up to 128 nutritionists (GCNF, 2019a). In Sweden, nearly all of the 290 municipalities – which manage the school meals – have competence in nutrition and/or meal management (GCNF, 2024k).

Donor-funded projects in Africa usually include nutritionists. In Cabo Verde, two nutritionists were engaged in the school feeding programme in 2022 (GCNF, 2024b). In Lesotho, eight nutritionists were employed by the national government and implementing partners in the National Management Agent School Feeding Programme, and five nutritionists were employed by the national government in the World Food Programme Pre-Primary School Feeding Project (GCNF, 2024f). But more nutritional expertise is needed. In October 2024, the Africa Nutrition Society, in collaboration with key partners, hosted a school health and nutrition workshop for the region, bringing together nutrition professionals, policymakers and development practitioners. The participants emphasized the need to increase awareness among African nutrition and health professionals of the importance of nutrition in the schoolgoing years through nutrition networks, and the need to integrate nutrition professionals and enhance their capacities to scale up school meal programmes (Research Consortium, 2024).

Health professional training often falls short (Lepre et al., 2022). In 2016–17, 90% of 156 countries offered training in maternal and child nutrition, but most pre-service programmes allocated less than 20 hours to topics such as malnutrition, breastfeeding counselling and complementary feeding counselling. In 39 countries with detailed data on 5 professional categories (nutritionists, medical doctors, nurses, midwives and community health workers), few countries allocated 40 or more hours in the curricula for any topic (WHO, 2018). In 2022, only 22% of countries reported that at least 75% of caregivers of children under 2 had been counselled on appropriate infant and young child-feeding practices. Only 14% reported that the pre-service curriculum of medical doctors, nurses and midwives and other professionals adequately covered the topic of feeding infants and young children (UNICEF and WHO, 2023).

In the United States, a survey of nutrition education found that 71% of the 121 medical schools failed to provide a recommended minimum of 25 hours of nutrition training in undergraduate medical education, leaving graduates ill-equipped to provide nutritional guidance (Adams et al., 2015). Medical students themselves reported receiving just 1.2 hours of such training per year, with over half receiving no formal nutrition instruction at all (Duggan et al., 2023). A review of 21 studies in 14 countries found that nursing students lacked basic knowledge on food guidelines, food safety and nutrient intake, as well as specific knowledge regarding elderly and chronic patient nutrient needs or healthier lifestyle choices. Lectures that were based on more active teaching approaches were more positively received by nursing students (Mancin et al., 2023).

Community health workers deliver nutrition interventions, particularly in poor countries. The need to train them to deliver nutrition effectively to communities is emphasized in many national policies (Kwansa, 2025). India's national nutrition strategy highlights the need to improve the working conditions, skills, career pathways and motivation of over 3 million community health workers (NITI Aayog, 2017). In Sierra Leone, a strategic priority for implementing malnutrition reduction initiatives is to strengthen community health worker capacity and incentives (Sierra Leone Government, 2018).

A review of community management of acute malnutrition in 16 low- and middle-income countries found that community health workers are important for successful implementation since they are both community members and can be health workers with specialized nutrition knowledge. But they lack adequate investment and support (Beggs et al., 2024). A review of 18 studies found that community health workers require adequate training and supervision to help in the detection and referral of children with severe acute malnutrition (López-Ejeda et al., 2019). A systematic review of studies published from 1997 to 2018 concluded that community health worker home visits increased early initiation of breastfeeding and exclusive breastfeeding, and mother peer groups were effective for improving children's minimum dietary diversity and minimum meal frequency (Janmohamed et al., 2020). In Nepal, capacity-building interventions improved female community health volunteers' skills in identifying malnourished children, underscoring the importance of equipping health workers with the necessary knowledge and tools (Thapa et al., 2024).

Several countries aim to improve nutritional training for health professionals to meet nutrition goals. Cambodia seeks to update and standardize its national pre-service nutrition curriculum for all government health professionals, public health and medical professionals. Egypt's National Nutrition Institute aims to embed life-course nutrition training, with a focus on breastfeeding and child feeding, into medical and nursing curricula. Plans include scaling up training for primary healthcare staff in nutrition screening and counselling using digital tools. In Indonesia, the Ministry of National Development Planning committed to mainstream nutrition in universal health coverage, and aims to equip 83% of primary healthcare facilities with skilled nutritionists and midwives by 2024 (Development Initiatives, 2024).

...TO IMPROVE FOOD PRODUCTIVITY AND SUSTAINABILITY

Educated farmers are better positioned to increase productivity. In Odisha, India, a minimum level of education boosted the adoption of modern paddy varieties and raised farm productivity (Paltasingh and Goyari, 2018). In Sindh, Pakistan, rural households with more formal education were more likely to request agricultural loans (Chandio et al., 2021). In Viet Nam, education improved farmers' ability to optimize the use of inputs and to manage larger farms, enhancing rice output (Ninh, 2021).

Agricultural extension programmes to improve farmers' knowledge can improve farm productivity and practices. On-field sessions, workshops and digital tools complement these efforts (Raji et al., 2024). In northern Ghana, an NGO-led extension programme strengthened value chains and increased farmer income (Danso-Abbeam et al., 2018). Farmer field schools in Kenya, Uganda and the United Republic of Tanzania raised

household income by 61%, particularly benefiting those without formal education (Davis et al., 2012). A review of 65 studies of farmer field schools found positive impacts on critical thinking, experimentation and innovation (van den Berg et al., 2020). In Kenya, farmers reported that they began questioning cultural beliefs and reflecting critically on practices after attending farmer field schools (Friis-Hansen and Duveskog, 2012). A longitudinal analysis of farmer field schools in rural Nepal showed that female participants increased their knowledge and skills and improved their decision making related to cropping patterns and timing of agronomic practices (Westendorp and Visser, 2015). Not all programmes succeed. In Pakistan, extension advisory services implemented between 1952 and 2018 were largely ineffective due to issues of coordination, corruption and lack of participation by local leaders (Ashraf et al., 2019).

Agricultural education must adapt to address evolving nutritional needs and climate challenges. In Upper East Ghana, agricultural extension agents rely on radio and television for climate information but often lack sufficient understanding of climate change and its terminology. They need better technical skills, communication and training in climate-smart agriculture, such as soil moisture conservation and ICT use. Agricultural extension agents found that farmers are sometimes reluctant to adopt new technologies and innovations (Antwi-Agyei and Stringer, 2021). In Nigeria, a study found that training materials for agricultural extension agents rarely included nutrition objectives or related services (Adeyemi et al., 2023a). The Nigeria Agricultural Sector Food Security and Nutrition Strategy (2016–25) proposed nutrition training for sector personnel, but initial assessments revealed significant knowledge and practice gaps (Adeyemi et al., 2023b). In Zambia, analysis of the effectiveness of training sessions on agricultural practices found that targeted interventions aimed at increasing food production and dietary diversity increased productivity, production diversification and dietary intake (Gondwe et al., 2017).

A systematic review of studies from 1999 to 2021 found that education positively influenced the adoption of organic farming, enabling farmers to access information and appreciate the advantages of organic farming (Sapbamrer and Thammachai, 2021). But understanding how farmers learn can help refine training and engagement efforts. For example, peer learning can boost nutrition-sensitive agricultural practices. The Focus on Farmers Project links European farmers with mentors to improve efficiency, profitability and sustainability. Some 4,500 farmers in Germany, Ireland, Italy and the United Kingdom adopted technologies with support from farmer ambassadors and their peers (Elphick, 2020). Some farmers express distrust towards scientific expertise. In Austria and Germany, scientists prioritize research, while farmers prefer information from government and industry sources (Maas et al., 2021). In Ghana, smallholder rural farmers expressed a general lack of confidence in science due to their bad experiences with past climate forecasts (Kabobah et al., 2018). An analysis of farmer learning about sustainable soil innovations in Hungary and the United Kingdom found that they had the highest trust in other farmers and the lowest in traditional experts, such as agricultural researchers from academic and government institutions, who they believed were not empathetic towards farmers' needs (Rust et al., 2022).

Tackling agrobiodiversity and promoting local plants and vegetables also requires capacity building. Mainstreaming agroecology into agricultural training colleges and peer-to-peer exchanges with farmers who are already practising biodiversity-friendly farming can help expand skills (Jones et al., 2024). Agroecology knowledge networks are key to promoting indigenous crops and practices. In Brazil, a network of agronomists, forest engineers, farmer unions and farmers have focused on preserving traditional agrobiodiversity practices and engage with farmers that provide food for school feeding and government programmes (Nimmo et al., 2023).

Expanding home-grown school feeding, i.e. ensuring food is purchased from local smallholder farmers, traders, food processors and farmers, requires training, networking and other capacity-building efforts to expand relevant food production and ensure predictable and adequate access to markets (FAO and WFP, 2018). In India, the integration of locally produced and procured biofortified zinc wheat and iron pearl millet into school meals in six states involved training some 20,000 farmers who live near schools to adopt, grow and market these grains and link them to school food procurement systems (HarvestPlus, 2022). In most contexts, greater efforts are needed to strengthen supplier capacity. In Cambodia, an evaluation of the home-grown school feeding programme found that, while local farmers and suppliers benefited from capacity-strengthening efforts, many suppliers needed more training on procurement and pricing. Only 28% of farmers had received agricultural training (WFP, 2024b).

Public agricultural research and development yields high returns and some nutrition policies emphasize the role of research institutions in improving evidence on nutrition (Kwansa, 2025). Ethiopia aims to improve its research capacities to advance food safety, quality and post-harvest management through nutrition-related research (Ethiopia

Government, 2018). In Jordan, one of the strategic objectives of the national food security strategy is to support agricultural research and knowledge development and transfer (Jordan Government, 2021).

Public research investments are required to make staple and non-staple food crops more productive, climate-resilient and nutritious (Steensland, 2022). However, in most countries, national agricultural research systems are quite small. The Consultative Group on International Agricultural Research, which helps develop agricultural innovations in low- and middle-income countries at 15 centres around the world, spent USD 805 million in 2019, down 30% from its 2014 peak (Alston et al., 2021). Even in high-income countries, such as the United States, public agricultural research and development spending has fallen by one third in the past two decades, just as privately funded research has increased (Nelson and Fuglie, 2022). The expansion in private sector research does not replace the foundational research of the public sector; instead, it primarily focuses on using public research to create marketable products (Ruane and Ramasamy, 2023).

...AND TO TRANSFORM FOOD SYSTEMS

To transform global food systems, research must expand beyond profitable crops to improve crop diversity and dietary quality. Investment is disproportionately low for crops better adapted to future climates, such as sweet potatoes and lentils (Bollington et al., 2021; Manners and van Etten, 2018). In many countries, indigenous crops have been neglected or underutilized, with a predominant focus on major commodity crops, leading to a loss of biodiversity (Lefebvre et al., 2023). In South Africa, some crops may be receiving renewed attention in large-scale agriculture due to their potential for sustainability and climate resilience (Mudau et al., 2022). There is a consistently limited focus on agricultural and food science research from the Global South (Rafols et al., 2023).

Universities can act as sites for food system change (Campbell and Feldpausch, 2023) but need to change pedagogical approaches (Valley et al., 2018). A review of 42 studies of how higher education institutions, predominantly from Northern America, have incorporated sustainable food system issues into their strategies found that they had used pedagogical approaches such as student-centred, experimental learning and collaboration with stakeholders (Salminen et al., 2024). A review of food system education courses in the US states of Oregon, Minnesota and Vermont showed evidence of interdisciplinary approaches, an emphasis on teaching systems thinking, and the addressing of environmental degradation, obesity and food security. Desirable learning activities included experiential learning such as field trips and applied research, system simulations and scenario building, and deductive and open-ended case studies. Desirable pedagogical approaches included collaborative group learning and instructor-modelled co-leading. Experiential learning activities included bringing outside practitioners to share their experiences with students (Brekken et al., 2018).

Transformative food system learning requires students to critically examine power structures, values and norms, focusing on agroecology, food justice and sovereignty (Anderson et al., 2022; Meek and Tarlau, 2016; Ojala, 2022). A review of 171 undergraduate course syllabi from 20 US universities, which are part of the Menus of Change University Research Collaborative, found that most emphasized interdisciplinarity. Nearly all addressed society and culture (96%) but only 71% emphasized equity. Few courses included action-oriented goals: only 19% focused on community engagement, 13% on policy impact and 9% on social movements (Hoffs et al., 2024).

University curricula can be shaped by student-led initiatives. At McGill University, Canada, four student-run projects on food production, distribution and waste provided hands-on experience, fostering awareness of food access issues and solidarity with local vendors. These activities encouraged students to engage in critical learning about food systems (Deskin and Harvey, 2023). The International Federation of Medical Students Association developed a policy document on sustainable and healthy food systems – based on the EAT-Lancet report – which will be used as a reference for integrating sustainable food systems in medical curricula (IFMSA International Secretariat, 2019, 2022) and could impact over 1.3 million medical students.

Grass-roots organizations emphasize preserving indigenous knowledge, seed and soil awareness to foster food justice. Brazil's Landless Workers Movement (MST), founded in 1984, advocates for land redistribution and access to infrastructure, extension programmes and social equity. Since establishing its education sector in 1987 to help transform education, MST has developed pedagogical approaches aligned with its mission, including training movement activists. In the 2000s, as agribusiness expanded, MST emphasized education for rural development through family farming, cooperatives and sustainable agriculture. Its schools promote agroecology, teaching students to integrate nature, social context and

agronomy, and encouraging activities like school gardens and agroecological recipes (Tarlau and Mariano, 2024).

La Via Campesina, a coalition of 182 organizations that, advocates for small farmers' rights in 81 countries, initiated the idea of food sovereignty in 1996. It amplifies grass-roots voices through conferences, events, reports and a training module on peasant seed rights (La Via Campesina, 2023). The Alliance for Food Sovereignty in Africa works on agroecology in climate policy and launched the Agroecology for Climate Action campaign in 2019. South Africa's Surplus People's Project supports agroecological practices, local initiatives and land advocacy through workshops and farmer-led learning spaces. These efforts foster skills through horizontal learning and farmer-to-farmer training (Wach and Hall, 2024). In Zimbabwe, the TSURO Trust trained farmers to enhance seed systems, production and conservation skills (AFSA, 2023).

Nutrition leaders need strategic capacities, such as knowledge, skills and leadership to shape and guide nutrition agendas. A study of 89 leaders in shaping child and maternal undernutrition policy and programming in Bangladesh, Ethiopia, India and Kenya found that more effective leaders were able to translate between sectors and disciplines and had competencies beyond technical skills (Nisbett et al., 2015). Civil society coalitions in Brazil and Peru advocated for nutrition actions that led to pledges to reduce childhood stunting (Acosta and Fanzo, 2012; Acosta and Haddad, 2014). Global initiatives, such as the Scaling Up Nutrition Movement, the European Nutrition Leadership Platform and the African Nutrition Leadership Programme, help develop strategic influence and practical skills such as stakeholder mapping, advocacy, knowledge translation and shaping effective narratives and policy messages (Nisbett et al., 2016). The International Parliamentary Network for Education has created a toolkit to help parliamentarians understand and promote the benefits of school meals (IPNED, 2024). The Milan Urban Food Policy Pact supports municipalities with school meal initiatives to recognize the importance of public food procurement in schools, targeting food system governance officials (MUFPP, 2024).

Tackling food system issues also requires dealing with the food industry that has disproportionate power in promoting unhealthy, profitable food (Lin, 2022). A scoping review of food taxes, labelling and marketing restrictions found that governments and civil society drive their adoption, while corporate political activity and food companies act as barriers (Pereira et al., 2023). In Colombia, analysis showed how the food industry opposed nutrition warning labels, citing trade impacts, high costs and consumer responsibility, by leveraging ties with government officials (Mialon et al., 2021). Agriculture accounts for 70% of child labour worldwide, with 112 million children working in crop production, livestock and fishing, mostly on family microenterprises (ILO and UNICEF, 2021). Despite the 2001 Chocolate Industry Protocol, 1.6 million children aged 10 to 17 were still working in cocoa production in 2018. Yet contrary to independent research findings, industry claims often downplay child labour and try to shape public perceptions (Deam, 2020).

Foundations can play a key role in food industry discussions. In the United Kingdom, the Food Foundation conducts research and offers guidance to tackle food system challenges, such as advising investors on ultra-processed foods (Tobi et al., 2024). The World Resources Institute highlights the role of plant-based foods as critical to helping the planet, introducing the Coolfood concept, and analysing how food providers can boost plant-based food demand. By 2023, 70 food providers joined the Coolfood Pledge, submitting data on animal and plant-based foods (Coolfood Pledge, 2023). A Rockefeller Foundation report helped identify the crops to invest in which could preserve biodiversity (Karl et al., 2024). The Bloomberg Philanthropies' Food Policy Program develops policies to limit children's exposure to unhealthy food marketing. The US-based Legal Defense Fund supports governments to defend food regulations against industry challenges. The Global Center for Legal Innovation on Food Environments at Georgetown Law School's O'Neill Institute is building legal capacity for healthy food laws (Bloomberg Philanthropies, 2024). Yet, despite their increasing influence, few philanthropic foundations aim to radically reform agrifood systems (Kalfagianni, 2023).

REFINEMENTS IN MONITORING SCHOOL MEALS ARE NEEDED TO GUIDE POLICY

Nutrition outcome indicators have been the subject of considerable methodological development, with pioneering methods to develop comparable standards across populations, explore different dimensions of nutrition quality, and use multiple sources of information. The World Health Organization invests in the Global Database on the Implementation of Food and Nutrition Action, an interactive platform for sharing standardized information on food and nutrition policies and actions, and has published two global nutrition policy reviews (WHO, 2024a).

With much attention focused on the early childhood nutrition indicator, one blind spot is middle childhood and adolescence. The absence of a consensus on anthropometric indicators for these age groups obstructs relevant nutrition target setting and data collection (Lelijveld et al., 2022), an issue to which the Global Adolescent Nutrition Network is trying to draw attention (GANN, 2024). The lack of any systematic tracking of mortality, health and nutrition for 5- to 9-year-olds perpetuates the perception that the health and nutrition of these children may be less important than during other life stages, and limits investment in evidence-based interventions targeted at this age group (Voss et al., 2023). The dearth of robust data on student learning for these ages, especially from countries that face major challenges of undernutrition, adds another barrier.

The *Global Nutrition Report*, established at the 2014 Nutrition for Growth Summit, serves as the main accountability mechanism to track commitments by governments, donors and stakeholders for nutrition. The global reports have spotlighted investments in the first 1,000 days; breastfeeding; dietary diversity through policies on processed foods, fortification and healthy dietary habits for adolescent girls; tackling inequality; and food systems – from aligning agriculture with nutrition, to holding the food industry accountable and strengthening policy frameworks to promote healthier diets and planetary sustainability.

The main commitments by stakeholders have remained largely focused on governance and undernutrition, with less attention paid to noncommunicable diseases and food security (Development Initiatives, 2022). Monitoring efforts are most concretely developed in areas of maternal and infant nutrition, with global targets focusing on stunting, anaemia, low birth weight, childhood overweight, breastfeeding and wasting. For example, the Breastfeeding Scorecard has motivated progress on exclusive breastfeeding rates (UNICEF and WHO, 2023). The Scaling Up Nutrition secretariat and its affiliated networks of civil society, donors, businesses and UN agencies support 66 member countries and 4 Indian states (SUN Network, 2023) to meet their commitments (France Ministry for Europe and Foreign Affairs, 2024).

In the intersection between education and nutrition, schools have been highlighted as a key entry point for integrating and influencing relevant outcomes, not only for the two sectors but also for health, water and sanitation, agriculture and food systems (FAO, 2022; Hunter et al., 2020; UNESCO et al., 2023; WFP, 2020a; WHO et al., 2021). School meals are viewed as key to staving off hunger, building healthy lifestyles and improving the sustainability of local food production and planetary well-being. School meal programmes are viewed as 'triple duty' actions, addressing undernutrition, reducing processed food exposure, and supporting farmers, while encouraging attendance and performance (Development Initiatives, 2017).

Efforts to institutionalize data, monitoring and advocacy on school meals have intensified with the School Meals Coalition, which was launched during the UN Food Systems Summit in September 2021 with the goal that 'by 2030, every child receives a healthy, nutritious daily meal in school'. Its Research Consortium for School Health and Nutrition and, notably, its Data and Monitoring Initiative, have helped advance thinking on school feeding monitoring (Research Consortium for School Health and Nutrition, 2025).

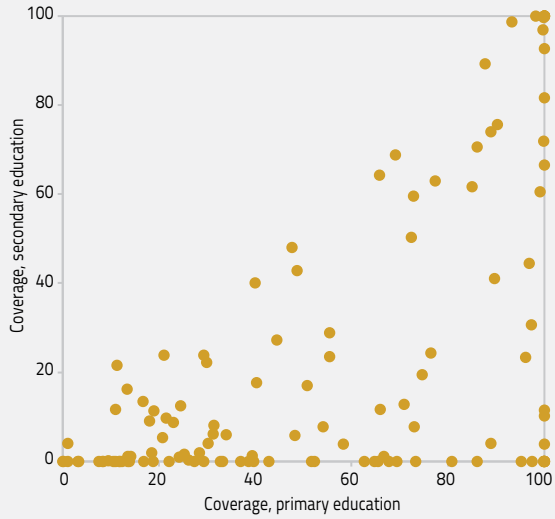
A new SDG 4 thematic indicator linking education with nutrition is the coverage of school meals programmes, in other words, the proportion of children attending school who receive school meals. The World Food Programme (WFP) aims to provide data in its biennial publication, *State of School Feeding Worldwide* (WFP, 2022) drawing primarily on the Global School Feeding Survey run by the Global Child Nutrition Foundation, a non-profit organization which has completed three rounds of data collection (2019, 2021 and 2024). The publication also draws on WFP *Annual Country Reports* and secondary sources, including official reports, publications and case studies (WFP, 2023).

As highlighted earlier (**Box 1**), preliminary data, as part of the preparation of the State of School Feeding Worldwide 2025, show that at least 459 million children, or 47% of primary school students, received school meals in 2024, an increase of 41 million relative to 2022 and of 71 million relative to early 2020, just before the COVID-19 pandemic. Coverage is much higher in primary than in secondary school. Among 123 countries in 2022, the coverage rate was below 10% in 10 countries in primary education and in 70 countries in secondary education (**Figure 5**).

FIGURE 5.

Coverage of school meals is much higher in primary than in secondary education

Percentage of primary and secondary school children receiving school meals, 2020–22



Source: WFP (2023).

However, there are at least three areas where the indicator needs to be improved to be more relevant for policy. First, the policy goal of these programmes is not always sufficiently clear to interpret observed coverage and the effectiveness of targeting efforts. The Gambia, for example, has a targeted school meals programme that provides a hot mid-morning meal to children enrolled in public schools in the country's most vulnerable regions. In 2022, about 180,000 children in primary education were fed, which corresponds to a coverage of 47% of total enrolment at that level. But one third of primary school students are enrolled in private schools, and are therefore not eligible for the school meals programme. If only public school students are considered, the corresponding coverage is 70% (**Figure 6**). School meals programmes are indeed mostly government-led and government-funded and tend only totarget students in public schools (WFP, 2023).

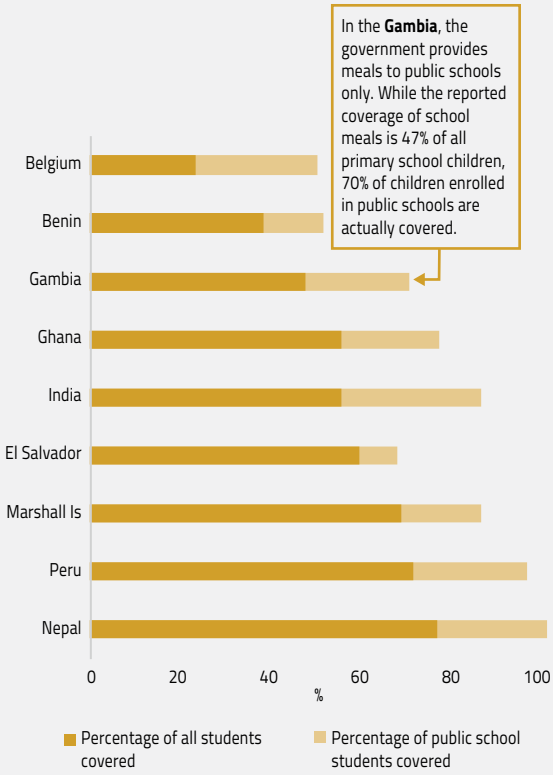
Second, although the Global School Feeding Survey collects information, the indicator does not reveal the type of meal provided, which makes it difficult to compare national efforts. For example, countries may be offering a breakfast or a lunch; a cold meal or a hot meal; a snack or a full meal; a meal in the school or take-home rations; and food of variable nutritional value, including items that are not healthy. Some concerns have also been raised as to whether schools offer meals that end up not being eaten. Not all of these questions can be addressed at a reasonable cost, but there is demand for some refinements to strengthen comparability.

Third, the administration may also need some refinement. Despite the wide coverage, some countries have expressed a preference for the questionnaire to be administered by an intergovernmental organization, such as WFP or UNESCO, instead of a non-governmental organization.

FIGURE 6.

The actual coverage of school meals programmes is higher if private school students are excluded

Primary school children receiving school meals divided by (i) total enrolment in primary and (ii) enrolment in public primary schools only, 2020–22



Notes: In India, PM Poshan, the school meal programme, targets children studying in government, local body and government-aided primary and upper primary schools. Enrolment in government and government-aided primary schools was included in the calculation for the figure, based on the Indian management information system, UDISE+. All other enrolment data are from UIS and refer to public institutions only.

Sources: GEM Report analysis based on WFP (2023), UDISE+ (2022), GCNF (2024) and UIS.

The Food and Agricultural Organization (FAO) has highlighted the importance of education as a system for interventions and as a strategy for improving food security and nutrition outcomes (FAO and European Union, 2019). It advocates for a whole-school approach and deeper investigation into how food and nutrition education are integrated into national curricula. It has developed a White Paper on school-based food and nutrition education for low- and middle-income countries (FAO, 2020) and has conducted surveys and capacity needs assessments. It has also developed curriculum guidelines with an emphasis on experiential learning. Its School Food and Nutrition Global Action Plan 2022–2026 proposes monitoring the uptake of holistic approaches (FAO, 2022). Its School Food Global Hub includes information on the situation of school food nutrition guidelines and standards on food and nutrition education programmes.

FAO has also been working in partnership with the WFP to ensure that the nutrition needs of schoolchildren are prioritized, following school nutrition guidelines and standards for safeguarding children's and adolescents' right to food. Pilot projects have been implemented in Cambodia and Ghana (FAO and WFP, 2022). The capacity assessment tool for school-based food and nutrition education highlights three levels of necessary capacity: individual, organizational and the enabling environment (FAO, 2021a). Home-grown school feeding is also highlighted as an entry point to meet objectives linked to biodiversity and planet-friendly solutions – for instance, by diversifying diets with locally sourced vegetables, improving agrobiodiversity and promoting school garden-based hands-on learning (FAO and WFP, 2018; Pastorino et al., 2024).

Another dimension is nutritional knowledge and attitudes, which may influence dietary practices and nutritional outcomes. International large-scale assessments can offer some insights. The science framework of the 2025 Programme for International Student Assessment includes competency questions on food systems, such as the environmental impacts of eating meat. Nutrition-related knowledge on food consumption and choices will be assessed in the context of science and environmental education (OECD, 2023b). The 2023 Trends in International Mathematics and Science Study life science questions for grade 4 students relate to human health, such as identifying common food sources for a balanced diet and behaviours that promote good health, while grade 8 questions focus on the importance of diet, exercise and other lifestyle choices in maintaining health (Mullis et al., 2021).

RECOMMENDATIONS

Our food systems are under strain, threatening individual and planetary well-being. On the one hand, high levels of hunger, food insecurity and undernutrition are still prevalent. On the other hand, the food landscape is increasingly obesogenic, while food consumption and production practices are environmentally unsustainable. Even if poor and rich countries prioritize different aspects of the nutrition challenge, a more holistic food system transformation approach is needed. Nutrition and food have to be understood in terms of their impacts on health, social inclusion, environmental sustainability and economic prosperity.

Transform nutrition education into a lifelong learning pursuit. From early childhood to adult education, nutrition content should be embedded across the curriculum and into communication campaigns. Formal, non-formal and informal education matter but the channels through which they influence individuals and food systems should be explored further to improve teaching and learning.

- Systematically embed food literacy education, covering nutrition knowledge, practical skills and critical understanding of food in education efforts, in school and beyond.
- Programmes should balance theoretical knowledge with experiential learning, for example through gardening and cooking, to foster healthier, sustainable food habits.
- Integrate nutrition education into mass media and digital platform communications. Design evidence-based campaigns to improve nutrition knowledge and food safety awareness, while ensuring cultural relevance and avoiding messages that are moralizing and stigmatizing.

Place schools at the centre of efforts to influence sustainable nutrition behaviours and outcomes. Apply a whole-school approach that combines school meal provision, nutrition education, physical activity and extracurricular initiatives, to achieve complementary education and nutrition objectives.

- Implement universal and nutritious, locally sourced school meal programmes to ensure equity and maximize learning outcomes – and finance them adequately and sustainably to progressively expand them from primary to secondary schools.
- Integrate nutrition education, developed with adequate nutrition expertise, into school feeding programmes to foster lifelong healthy and environmentally sustainable habits.

- Adopt holistic, systemic approaches to improve food environments, starting at schools. Use creative ways to address the obesogenic and unsustainable food environment by combining education with structural interventions, such as regulating marketing.

Adopt a multisectoral approach to deliver effective nutrition interventions. Just as our relationship with food is multilayered, depending on a range of personal, interpersonal and systemic factors, different sectors, including education, need to collaborate to address nutrition challenges.

- Nutrition, health and agricultural policies should embed education components.
- Accordingly, partnerships across sectors should also focus on the role of education and communication activities to meet nutrition objectives.

Build professional capacity through education and training to deliver on nutrition objectives. Bridging gaps in knowledge and skills at all levels is key to achieving equitable and sustainable nutrition outcomes worldwide.

- Integrate comprehensive nutrition curricula into medical, nursing and community health worker training to address gaps in nutrition knowledge and practice.
- Invest in nutrition expertise for school feeding programmes and ensure that these programmes include trained nutritionists for planning and monitoring.
- Reform agricultural education to integrate climate-smart practices, including indigenous knowledge systems, and nutrition objectives. Offer hands-on training through agricultural extension programmes, farmer field schools and peer-learning initiatives.
- Develop interdisciplinary education frameworks that emphasize nutrition, environmental sustainability and food justice in higher education institutions to develop food system leadership skills to address food system inequities and systemic transformation.

Monitor the relationship between education and nutrition through the life cycle. Strengthen tracking of school meal and related health and nutrition programmes to improve the effectiveness of interventions.

- Improve research on education–nutrition links beyond the first 1,000 days by collecting data nutrition indicators for school-age children linked to learning outcome data.
- Refine the SDG 4 thematic indicator on school meal coverage in terms of alignment with policy targets, comparable quality definitions and the way country surveys are administered.

Education and nutrition
Learn to eat well

Nutrition – whether we eat the right food, and the right amount of it – is a growing concern around the world, in rich countries as in poor. Nutrition matters more than for good health. Eating healthy food fuels our growth, and our learning potential, for infants, children, youth and adults. What we eat also has vast implications for agricultural production and the health of our planet.

This is the second in a series published by the *Global Education Monitoring Report* aimed at advancing research and monitoring of the inter-relationship between education and the other Sustainable Development Goals (SDGs), the first of which looked at climate change. This report is in partnership with the Research Consortium for School Health and Nutrition led by the London School of Hygiene and Tropical Medicine, which is the research initiative of the School Meals Coalition. It emphasizes the often unappreciated role that education plays in building knowledge, awareness and skills and changing attitudes for food system transformation and achieving zero hunger.

The report calls for a whole-school approach, combining school meal provision with nutrition education, physical activity and extracurricular initiatives. It also calls for efforts on food literacy to transform into a lifelong learning pursuit through formal, non-formal and informal learning. It emphasizes the need to build capacity at all levels through education and training across a range of sectors, including health, nutrition, agriculture and food systems. Despite clear interdependencies, the linkages between education and nutrition remain under-researched, including in data collection and monitoring of programmes and outcomes.

This new joint report provides decision-makers with fresh evidence on the multiple benefits of school meals, from education, health to food system transformation. The World Food Programme welcomes the recommendations of the paper to advance holistic approaches to school meals and nutrition education.
World Food Programme

We welcome the evidence and research driven messages and recommendations of this paper. School meals create market opportunities, can increase biodiversity on our farms and our plates, and promote healthier futures.
Alliance of Biodiversity and CIAT

We champion the approach of this report in underscoring the importance of lifelong nutrition learning for pregnant women, children and adolescents, both in schools and community settings.
Partnership for Maternal, Newborn and Child Health, hosted by the World Health Organisation

We need a major improvement in nutritional and education outcomes in African countries. This report uniquely stresses pivotal needs for our continent: school meals adequacy and quality, professional workforce needs in nutrition, and lifelong learning.
Africa Nutrition Society

Governments and parliamentarians are increasingly recognizing the transformative impact of providing children with a free meal at school. This report is adding to that momentum. I really hope that other decision-makers will join the Learn to Eat Well effort and support the movement to give every child a healthy, free meal at school, every day.
International Parliamentary Network for Education

To ensure we Learn To Eat Well, we must engage our young people in understanding about the food they consume, and how it affects them personally, their communities, and the planet. Active global citizens can drive greater collaboration to secure a sustainable future.
Take Action Global

Enabling everyone to enjoy good nutrition involves dialogue and collaboration among sectors responsible for education, health, agriculture, social protection, and more, especially at local level.
4SD Foundation

Nutrition literacy is a critically needed education across humanity. Ensuring nutrition and education for children, adolescents and caregivers is a powerful tool toward disrupting inter-generational cycles of poverty and human capital loss.
World Vision

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