Healthy lifestyles and noncommunicable diseases: Nutrition, the life-course, and health promotion

1 | HEALTHY LIFESTYLES

Consciously living healthier by consuming healthy nutrition and exercising regularly helps to maintain optimal body weight. This is reinforced by high quality and sufficient sleep, destressing to counter anxiety, and limiting the consumption of alcohol and tobacco to shape healthy lifestyles. Cardiovascular disease, cancer, diabetes, and chronic respiratory disease are the most prevalent and prioritized noncommunicable diseases—they are globally pervasive, increasing across regions, and countries irrespective of income, and afflict diverse people over their life-course. Healthy lifestyles, particularly by consuming healthy and balanced diets and exercising regularly at moderate- to-high intensity, can help to prevent noncommunicable diseases and obesity. Obesity is a key driver of noncommunicable diseases, is associated with diabetes, often contributes to cardiovascular disease, and is linked to some cancer types, and, like noncommunicable diseases, is pervasive and increasing globally. Poor nutritional choices such as the overconsumption of calories and nutrients, or deficiencies in macro- (e.g., protein) and micronutrients (e.g., iron) fuel the noncommunicable diseases and obesity epidemics which are further compounded by sedentary lifestyles.

Contextualizing the global obesity and noncommunicable diseases epidemics is important for policy development and refinement. With 38 million overweight/obese children < 5 years; 340 million overweight/obese 5–19-year-old children and adolescents; and 1.9 billion overweight adults ≥ 18 years, of which 650 million are obese; overweight/obesity presents a major global and public health burden that spans the life-course. Further, overweight/obesity is increasing in low- and middle-income countries (LMIC) against a background of infectious diseases and undernutrition, concomitant with increasing noncommunicable diseases, as populations increase in number and advance in age. The noncommunicable disease burden in sub-Saharan Africa (viz., cardiovascular diseases; diabetes; mental disorders; neoplasms; urogenital, blood, and endocrine diseases) has exceeded the global average and is approaching the total burden of infectious diseases, which underlines the urgent need for them to be prioritized and brought to the fore of development agendas. Given the high global prevalence of overweight/obesity and noncommunicable diseases that extend across the life-course, are pervasive, and disproportionately adversely impact poorer people and nations, an LMIC perspective is presented. Noncommunicable diseases in the context of the Sustainable Development Goals (SDGs), in line with LMIC and global development agendas, are overviewed, followed by a focus on nutrition and health promotion.

2 | THE SUSTAINABLE DEVELOPMENT GOALS

In 2012, the United Nations initiated the SDGs in Rio de Janeiro as a global effort, to build on the Millennium Development Goals, to tackle global challenges and advance development. In 2015, the United Nations established the SDGs in the General Assembly that was included in the 2030 Agenda resolution. The ambitious SDGs run from 2015 to 2030 and some targets address poverty, inequality, the health burden, and climate change, all directed towards an improved economy and better planet that is sustainable for the benefit of future generations. The 17 SDGs, with 169 targets, integrate economic, social, and environmental development, in alignment with people, planet, prosperity, peace, and partnerships. These global goals collectively strive to improve national, regional, continental, and global development and are led and adapted at a country level. Nearly 15% (25 targets) of the SDGs contribute to advancing health, with SDG 3 specifically focusing on addressing global health challenges.

SDG 3 endeavors to reduce maternal (SDG 3.1), neonatal and child mortality (SDG 3.2); infectious (SDG 3.3) and noncommunicable diseases (SDG 3.4); substance abuse (SDG 3.5); and road traffic injuries (SDG 3.6); improve access to sexual and reproductive health services (SDG 3.7); implement universal health coverage (SDG 3.8); improve environmental health (SDG 3.9); by reducing mortality from hazardous substances, contamination, and pollution; strengthen tobacco control (SDG 3.a); support medicines and vaccines research and development (R&D) (SDG 3.b); augment health financing and the workforce (SDG 3.c); and strengthen emergency preparedness (SDG 3.d).

SDG 3.4 aims to reduce mortality from noncommunicable diseases by a third through prevention and treatment strategies and the promotion of mental health. Further, SDG 3.4.1 focuses on the mortality rate attributed to cardiovascular disease, cancer, diabetes, and chronic respiratory disease, whereas SDG 3.4.2 focuses on suicide
was less feasible given the high mortality rates from noncommunicable and infectious diseases and injuries\textsuperscript{16} with mortality from noncommunicable diseases highest in LMIC, particularly in sub-Saharan Africa, for men and women.\textsuperscript{11} In most countries, men are more susceptible to succumbing to noncommunicable diseases.\textsuperscript{1} Cancer is expected to lead noncommunicable disease morbidity and mortality as cardiovascular diseases continue to decline globally.\textsuperscript{16}

### 3.1 Noncommunicable diseases and nutrition

Unhealthy diets and physical inactivity are key risks for major noncommunicable diseases.\textsuperscript{17-20} Most populations are affected by the adverse health impact of poor quality diets. Globally, unhealthy nutrition increases the risk for cardiovascular disease, diabetes, and some types of cancer.\textsuperscript{21-23} Diets high in salt and low in whole grains, fresh vegetables, and fruits contribute to approximately half of the mortalities and two-thirds of diet-related disability adjusted life years (years lost due to disability, morbidity, or early mortality).\textsuperscript{19} Additionally, the global production of unhealthy and unsustainable food has transitioned more rapidly in LMIC.\textsuperscript{24} People consume more packaged and processed foods; increasingly laden with sugar, salt, saturated fat, and refined carbohydrates; consume more meals per day; with declining and/or inadequate consumption of healthy foods such as vegetables, fruit, whole grains, and root crops.\textsuperscript{24} Further, in many LMIC, people consume insufficient macronutrients (e.g., low protein intake) and micronutrients (e.g., inadequate vitamin or iron intake) rendering them malnourished. Malnutrition, i.e., under- and overnutrition, fuels stunting and obesity, respectively, and both are risk factors for developing noncommunicable diseases. The increased consumption of ultra-processed foods (e.g., sugary sweetened beverages, cakes, sweets, and breads) was associated with an increased dietary content of nutrients that promote noncommunicable diseases (i.e., free sugars, saturated, trans and total fats) and decreased dietary content of nutrients that help to protect against noncommunicable diseases (i.e., fiber and potassium).\textsuperscript{25}

The World Health Organization (WHO) indicators for addressing unhealthy diets are assessed on whether countries adopt policies to reduce salt consumption; limit saturated fats, and eliminate trans fats; adopt the WHO recommendations on the marketing of food and beverages to children; and implement the International Code of Marketing of Breast Milk Substitutes (that promotes and protects breastfeeding and stipulates no marketing of breast milk substitutes).\textsuperscript{26} Policies that restrict the marketing of foods high in saturated, trans and total fat, free sugars, or salt to children are highly cost-effective government interventions to combat obesity.\textsuperscript{27,28} and noncommunicable diseases.

Healthy nutrition comprises following a nutritious wholesome dietary pattern with energy intake balancing energy expenditure.\textsuperscript{20,29} Total dietary fat intake should be \(\leq 30\%\) (of total caloric intake) to avoid weight gain, concomitant with a shift in fat consumption from saturated fats (ideally \(<10\%\) of total caloric intake) to unsaturated fats, and the elimination of trans fats.\textsuperscript{20,29,30} Healthy nutrition can also be achieved by \(<10\%\) free sugar intake (of total energy) with \(<5\%\) holding greater health benefits.\textsuperscript{20} Salt intake remains high in most countries,
often double the WHO’s maximum recommended maximum levels of 5 g per day.31 The consumption of healthy palatable diets constituted by whole grains, vegetables, fruits, and healthy fats are more feasible for health promotion compared to targeting specific macronutrients.32 However, imbalances (i.e., excesses or deficiencies) in macronutrient intake and specific micronutrients have adverse health effects.

Nutrients derived from plants contain macro- and micronutrients, and highly bioactive compounds that reduce the risk for noncommunicable diseases.33 Phytate (or phytic acid) occurs in plant seeds and store phosphorus. In LMIC, diets are often plant based and phytate rich.34 The highest concentrations of phytate are in legumes, cereals, pseudocereals, nuts, and seeds; and although phytate acts as antioxidants, iron, zinc, calcium, and magnesium are reduced (in phytate-rich diets)33–41 with the absorption of iron and zinc inhibited,38,39,41–43 that, respectively, contribute to iron and zinc deficiencies in people in LMIC.39,44,45 Iron deficiency may lead to anemia, with potentially irreversible impairment in psychomotor and mental development in children.46 Zinc deficiency inhibits growth conferring a higher risk for morbidity and mortality.47 Therefore, some food products are fortified with micronutrients to meet iron and zinc requirements, particularly in complementary foods for infants and young children,34 which improves nutritional levels in LMIC and vulnerable populations.

Some key nutrients are derived from animals to complement plant-sourced nutrients. Nutrients sourced from animals, for example, such as meat, fish, eggs, and dairy, are energy dense with high bioavailability of important micronutrients such as iron, zinc, vitamin A, vitamin B₁₂, choline, and essential fatty acids,48,49 which can help to enrich diets with macro- and micronutrients. This enhances iron and protein intake in LMIC populations, especially in pregravid, pregnant, and lactating women and their offspring. Further, ruminants (cattle) and particularly small ruminants (goats and sheep) are critical for food security in LMIC, especially in sub-Saharan Africa. These vulnerable people depend on the nutrition and income derived from their livestock (e.g., meat, milk, wool, and fertilizer) and poultry (eggs and chicken).30,51

3.2 Noncommunicable diseases and the life-course

Developmental programming refers to a stimulus or insult, during critical developmental transitions (during fetal and early neonatal life), that induce alterations in offspring anatomy, physiology, and metabolism that may be transient, durable, sometimes reversible but often durable.52 Many noncommunicable diseases are avertable through health promotion strategies directed at the maternal and child health lifecycle, by focusing on women of reproductive age (prior to and during pregnancy, and during lactation)4 and during infancy and childhood, and in adolescence that extends over the life-course into adulthood and aging. Some noncommunicable disease risks can be acquired and initiated early in life4 through epigenetic mechanisms even prior to conception, and through developmental programming.

For mothers, healthy nutrition before conception, during gestation (placental maternal-fetal nutrition exchange), and postnatally (breastfeeding of children weaned onto healthy nutritious diets); and for children, the continuation of healthy nutrition coupled to interventions for preventing noncommunicable diseases for their first 1000 days are important to maintain maternal health and imprint healthy outcomes for their children. Adopting a life-course strategy, with focused maternal and child health interventions can therefore avert noncommunicable diseases with global health and socioeconomic benefits.6 This emphasizes the need for targeting women of reproductive age (preconception) to adopt healthy lifestyles and thus confer these benefits to their children.

High-quality diets for women in preconception, pregnancy, and during breastfeeding (lactation) is imperative, as noncommunicable diseases can originate early in life and are chronic. Infants and children, therefore, require healthy nutrition supplemented with the required healthy and nutritious complementary foods.24 Infants should also be breastfed for as long as possible (preferably exclusively for 6 months)53 as they transition to solid foods. Therefore, maternal nutrition, which the growing infant accesses, should be as healthy as is reasonably possible for optimal growth and development of children. Sufficient healthy vegetables, fruit, legumes, nuts, fish, vitamins, and minerals should be consumed as they hold beneficial nutrients, including antioxidants, to meet adequate macro- and micronutrient intakes (i.e., limit nutrient excesses and correct nutrient deficiencies).

The preconception, gestational, and lactational periods are key windows of opportunity for improving and optimizing progeny growth and development for better health outcomes. Therefore, a snapshot of the preconception, gestational, and lactational periods is presented as these early life stages influence noncommunicable diseases and obesity trajectories. In addition, infant and child nutrition is briefly overviewed.

3.2.1 Preconception

Preconception health is associated with pregnancy outcomes and is critical for health across generations.54 Therefore, targeting prospective parents presents an opportunity to improve preconception health, whereas population-level initiatives to mitigate preconception risks (e.g., obesity), irrespective of pregnancy planning, are essential to improve pregnancy54 and offspring health outcomes. Prior to conception, healthy parental lifestyles should be adopted. In men, adverse health and lifestyle factors such as unhealthy nutrition, sedentary lifestyles, obesity, smoking, alcohol and substance abuse, and male reproductive factors (e.g., erectile dysfunction)55,56 need to be addressed. Men should be encouraged to improve their preconception health and visit primary healthcare facilities57 to build towards healthy lifestyles. Therefore, prospective fathers should be as healthy as metabolically possible, for example, eat healthily, exercise regularly, stop smoking and alcohol consumption, and maintain a healthy weight and mental status prior to conception.

Mothers are more influential in shaping their children's health outcomes as their preconception health is a determinant of their children's health and their influence extends as they feed and nurture their children during pregnancy and lactation. Maternal adoption
and adherence to healthier preconception lifestyles lowers their offspring’s risk for obesity. In obese women (who were metabolically healthy), the consumption of noncaloric restricted very low carbohydrate diets was effective for weight loss over 6 months. Preconception body mass index (BMI) and gestational weight gain predict offspring growth. During preconception, maternal obesity is a risk for gestational diabetes, exacerbates insulin resistance, hyperinsulinemia, inflammation, and oxidative stress, and BMI influences placental development, efficiency, and oxygen delivery. Excess maternal weight contributed to childhood respiratory illness with elevated pregravid BMI associated with increased risk for hospitalization.

Folate and iodine are integral for healthy maternal nutrition during preconception. Iron deficiency is a global challenge over the lifetime. In adults, obesity is linked to iron deficiency due to poor diets characterized by increased blood volume and inflammation. Women of reproductive age should ensure adequate intake of bioavailable iron to build reserves in preparation for future pregnancies to sustain fetal growth and development, and to replenish their iron stores. Adequate protein intake is necessary for maternal and child health. In LMIC, balanced protein energy supplementation improves birth weight outcomes in undernourished mothers. Preparing both parents for pregnancy prior to conception is imperative for preserving public health and preventing noncommunicable diseases.

### 3.2.2 Pregnancy

Gestational diabetes affects ~7% of women, with a 1.3–3.8-fold frequency in obese women and is typified by insulin resistance and systemic inflammation. The placenta adapts by altering its structure and function as it senses and responds to fluctuations in the maternal milieu, which may alter blood flow, fetal nutrient supply, and hormone (and other signaling molecules) secretion. Placental weight, which is linked to fetal growth, is altered in response to pregnancy-related conditions, with lower placental weight linked to chronic hypertension/preeclampsia, whereas higher placental weight is linked to maternal anemia, gestational diabetes, and fetal growth restriction. The fetal-to-placental weight ratio is a proxy for fetal growth pathophysiology as it may provide insights on some underlying placental disorders, particularly in growth-restricted fetuses.

Overweight women with gestational diabetes had reduced fetal-to-placental ratios, therefore insulin resistance likely shapes placental development, and there is an association of the fetal-to-placental ratio and glucose concentrations. Obese women had heavier and thicker placentas with reduced fetal-to-placental ratios. Maternal obesity and gestational diabetes adversely impacted placental development and maternal–fetal exchanges which compromised fetal metabolism. Fetuses from obese or gestational diabetic women were hypoxic, thus high preconception BMI alters fetal oxygenation whereas gestational diabetes may contribute to placental dysfunction and impaired fetal oxygenation.

During gestation, maternal weight gain and smoking confer risk for obesity in progeny. Midgestational (15–32 weeks of pregnancy) weight gain influenced children’s growth and abdominal fat accretion, therefore the timing of gestational weight gain influences children’s adiposity. Healthy gestational nutrition and frequent exercise prevent excessive weight gain. Grandchildren of grandmothers who followed healthy lifestyles during gestation (i.e., did not gain additional weight, did not smoke, ingested healthy nutrition, and exercised) had a lower risk for overweight/obesity in young adulthood. Meta-analyses of randomized controlled trials on gestational nutrition and exercise revealed that healthy nutrition and sufficient exercise prevented unnecessary weight gain for better offspring health outcomes. Further, adherence to gestational recommendations for nutrition, exercise, weight gain, and smoking was associated with lower BMI and risk for overweight in grandchildren. Apart from the grandmaternal adherence to healthy lifestyles, maternal BMI, and adherence to healthy lifestyles, the shared environment and behaviors across generations, and the transgenerational effects of healthy lifestyle factors on the fetal ovary contributed to healthy offspring outcomes.

Mothers and their children are especially vulnerable to the adverse effects of iron deficiency. During pregnancy, maternal iron deficiency may predispose infants to iron deficiency leading to irreversible deficits in neurodevelopment, low birth weights, and enduring sequelae and consequences. In pregnant women, iron deficiency is remedied by iron supplementation in combination with folic acid (to prevent neural tube defects in offspring). In women (preconception, pregnant and lactating), iron deficiency increases the risk for anemia, reduces mental capacity, increases the risk for postpartum depression and related mental illnesses, and diminishes the quality of mother–child interactions.

### 3.2.3 Lactation

Lactation presents another window for maintaining healthy nutrition to gear offspring for a better future. Women with small for gestational age (SGA) children had higher blood pressures throughout adulthood, whereas women with large for gestational age (LGA) children had higher adiposity and some glycemic and lipidemic derangements from preconception into menopause. Women who adhere to healthy lifestyles (e.g., adhere to healthy nutrition and regular exercise) may reduce their risk for cardiovascular disease, irrespective of their children’s birth weights. Postpartum, mothers with SGA children will particularly benefit from recommendations on hypertension prevention, whereas mothers with LGA children may benefit more from recommendations on healthy nutrition and regular exercise for weight loss.

With cardiovascular risk factors emerging during preconception, the postpartum (lactational) period presents an opportunity for women who have SGA and LGA children to adopt healthier lifestyles as an early preventive measure that may reduce their and their children’s cardiovascular disease risk. Further, by adopting healthy lifestyles, these women will be better prepared (physiologically and metabolically) for...
future pregnancies, which may protect their future children from cardiovascular and other diseases.

During lactation, exclusive breastfeeding for 6 months is recommended and even some or shorter durations of breastfeeding are beneficial for children. Infants who are breastfed are protected from cardiovascular diseases, diabetes, obesity, asthma, inflammatory bowel disease, necrotizing enterocolitis, and allergies. Further, breastfeeding reduces childhood morbidity and mortality from infectious diseases, for example, respiratory tract infections and diarrhea, especially in LMIC. Maternal preconception and usual nutritional status and infant sex shape human milk composition; therefore, human milk macronutrient and energy content may be determined during gestation and be unique for each mother–infant pair. Barriers to exclusive breastfeeding at childbirth and the initial 24 h postdelivery are cesarean section (strong evidence), early initiation of breastfeeding, the likelihood of practicing exclusive breastfeeding and maternal unemployment (moderate evidence). These breastfeeding barriers should be contextualized relative to broader social and cultural attributes of the maternal environment, and breastfeeding promotion should be sensitized accordingly. For example, rural mothers were expected to undertake various daily tasks, such as, water and wood collection, cooking, and cleaning, that reduced their breastfeeding time. Further, they were expected to express breast milk at every feed, not only to suckle, which increased their burden due to time constraints or fatigue. Breastfeeding counseling and the family and/or community support, with breastfeeding promotion extending to fathers and caregivers, will further promote and enable exclusive breastfeeding. For mothers working in LMIC, paid maternity leave and breastfeeding breaks will support and reinforce legislation and regulations on the marketing of breast milk substitutes.

During pregnancy and lactation, women require higher protein intakes for net tissue deposition and milk production. Human milk micronutrient composition contains nutrients responsive to the maternal diet (intake and status). These micronutrients, that is, vitamins B6 and B12, choline, iodine, and selenium contribute to neurodevelopment and neurophysiology, namely neurogenesis, differentiation, migration, myelination, and neurotransmission. Maternal vitamin B12 depletion, through dietary insufficiency or inhibited absorption, was linked to vitamin B12 deficiency in exclusively breastfed infants. In populations with a high goiter prevalence, human milk with low iodine concentrations was observed with cretin prevalence in 5–15% of the breastfed infants. Further, the reduced bioavailability of specific micronutrients (mainly from plants) may limit their adequacy of the intake. For example, iron is necessary for central nervous system processes that rapidly mature in infancy and early childhood and should therefore be adequately consumed by lactating mothers and children.

3.2.4 Infant and child nutrition

Fetal and neonatal iron deficiency is linked to risks for impaired growth and development, for example, intrauterine growth restriction, pre-mature birth, and maternal diabetes. Adequate protein intake is integral for optimal growth and development of infants, children, and adolescents as these life phases align with rapid growth, development, and functional maturation (e.g., increases in height and weight, and anatomical and physiological development and maturation)—all these growth and developmental processes are sustained by increased protein intake. Infants that grow rapidly, for example, born with low birth weights followed by rapid catch-up growth, are at greater risk for iron deficiency due to their increased demand. At 4–6 months, infants’ iron demands are greater than their iron intake, with stores becoming depleted, rendering them more vulnerable to iron deficiency. Further, in LMIC, complementary foods may be low in iron that compounds the adverse effects of low iron availability for children. Milk is a quality source of protein that enhances the diets of malnourished children.

4 SHIFTING HEALTHCARE PRIORITIES: THE IMPACT OF COVID-19

Health and economic burdens due to health shocks, such as the Covid-19 pandemic and disease outbreaks such as Ebola (aligned with SDG 3.d on emergency preparedness, with SDG 3.b on vaccine R&D prioritized in the global race for Covid-19 vaccines), shift national and global priorities and resources from combating noncommunicable diseases and obesity. Further, in some LMIC, infectious diseases such as HIV/AIDS and TB are prioritized over noncommunicable diseases. In Covid-19 patients, there was a greater prevalence of cardiovascular disease, whereas diabetes patients with Covid-19 were at higher risk for severe infection and death. Further, Covid-19 patients with diabetes often presented with cardiovascular, nervous system, and chronic kidney disease conferring a higher risk for worse prognosis and death. Obese people may often be sedentary, have insulin resistance and gut dysbiosis (altered gut microbiota, i.e., obese dysbiosis), which may exacerbate their proinflammatory response to Covid-19.

In some LMIC, noncommunicable and infectious diseases copresent; and noncommunicable disease patients, such as diabetes patients, are highly susceptible to succumbing to Covid-19 morbidity and mortality and are therefore triaged for testing and treatment. The health impact of the Covid-19 pandemic is the reallocation of resources to test and treat patients, which includes medical personnel, hospital beds, and medical supplies, that overburdens health systems that are already overextended in most LMIC. As Covid-19 patients are triaged, some patients afflicted with other diseases such as noncommunicable diseases may not have their normal access to healthcare and some medical services may be temporarily suspended and delayed. From an economic perspective, the Covid-19 pandemic has resulted in increased unplanned government expenditure on healthcare (e.g., personal protective equipment is requisite and add costs to medical consultations) and several healthcare workers, who are on the frontline to combat the pandemic, become infected with Covid-19, which further strains the health system due to lost productivity. From a patient perspective, limited access to health services, and job losses,
given the contraction of economies due to the temporary collapsing of some sectors, place a high burden of stress on people. Ultimately, it will take time for health systems and economies to rebound and recover from the Covid-19 pandemic, which emphasizes the urgency of noncommunicable diseases and overweight/obese patients to adopt and take ownership of healthier lifestyles.

5 | NONCOMMUNICABLE DISEASE PREVENTION AND HEALTH PROMOTION: CREATING AND SUSTAINING AWARENESS AND ENABLING HEALTHY LIFESTYLES

Over the life-course, unhealthy dietary consumption, physical inactivity, tobacco use, alcohol abuse, and air pollution should be targeted to avert the onset of noncommunicable diseases and preserve mental health. Investments in preventing and controlling noncommunicable diseases to augment health promotion can be economically beneficial through higher productivity and economic activity of healthier people, who manage to prevent noncommunicable diseases by adopting healthy lifestyles. Individual health promotion, government action, private sector responsibility, global initiatives, and partnerships and collaborations to combat and prevent noncommunicable diseases are briefly discussed.

5.1 | Individual health promotion

People should take ownership of their own health. At an individual level, health promotion can be achieved by people committing to maintaining a healthy weight. This can be achieved through healthy nutrition, supported by frequent exercise, to prevent the onset of noncommunicable diseases. In overweight/obese people, weight loss, maintenance, and management are effective strategies to combat noncommunicable diseases and therefore advance SDG 3.4. Overweight/obese adults who did not try to lose weight were less conscious of their weight status. Obese dysbiosis may contribute to diet resistance. Weight loss is challenging physiologically, and there are psychological and behavioral barriers to dietary restriction (low-calorie diets); in obesity, the dysregulated energy balance and metabolic pathways are disrupted by periodic weight fluctuations. The shift from metabolically healthy obesity (obese people with no diseases) to unhealthy obesity (obese people with diseases) should be avoided. Therefore, preventing the onset of obesity for those at risk, and preventing the shift from metabolically healthy obese people to obese people with noncommunicable diseases are key interventions for advancing SDG 3.4.

It is imperative to intervene as early as possible, at the individual level, to combat obesity, which predisposes to noncommunicable diseases, to avert reaching a point where dietary interventions are inefficient. Health promotion targeting individuals is effective. Apart from healthy nutrition, exercise can also help to combat overweight/obesity. Exercise type, frequency, duration, and intensity should be personalized according to individual health needs, capabilities, and preferences. In some individuals, initiating or increasing exercise is more restrictive and displeasurable relative to adopting healthier nutrition. Although calorie-restricted diets coupled to frequent exercise are effective for weight loss, maintenance, and management, exercise is not feasible in all obese people. Further, exercise, without healthy nutrition, is insufficient for weight loss as neurochemical regulation for eating behavior compensates due to the thermic cost of exercise. Weight loss is challenging as endocrine, neurochemical, and thermodynamic systems respond to calorie-restricted diets and other interventions by counteracting their potential benefits. The best strategy to prevent overweight/obesity is for early adoption and maintenance of healthy nutrition to mitigate against excessive weight gain as obesity becomes more irreversible with increasing duration and ageing.

Understanding the global obesity epidemic and how it affects people requires the consideration of multifactorial facets. The global increase in obesity is driven by the food landscape and other factors such as diet, physical activity, the built environment, epi/genetics, pollution, and stress, with the accumulation of factors contributing to increasing overweight/obesity in LMIC. In LMIC, the obesity epidemic is further compounded by a high burden of maternal and child undernutrition and related disorders and infectious diseases. In addition, the global obesity epidemic is associated with shifts in dietary intake and physical activity due to economic development, urbanization, and globalized food systems—globally, diets have become sweeter and saltier with higher fat content, whereas physical activity has declined; thereby contributing to a higher prevalence of obesity. In LMIC, people with low incomes may have greater exposure to overweight/obesity and noncommunicable disease risks, for example, hypercaloric diets coupled to physical inactivity as they transition from subsistence agriculture (primary economy) to manufacturing (secondary economy) or industrialization and services (tertiary economy). Further, lower socioeconomic status and parental obesity are barriers to weight management and associated with higher incidences of overweight/obesity. Working women have less time for food preparation and may therefore prepare quick meals for their children, whereas in lower income households people may not be able to afford healthy food, for example, vegetables and fruit. Also, distances and the ability to travel to food sources may have some influence on food insecurity and obesity.

5.2 | Government action to tackle noncommunicable diseases

At a government (macro) level, taxation supported by policies that increase the price of unhealthy, harmful, nonessential, and non-nutritious nutrients could be more widely adopted and fast-tracked to contribute to population health gains. At a population level, value for money interventions against noncommunicable diseases are prohibitive regulations and taxes on alcohol and tobacco, healthy food
promotion by improving nutritional information and packaging, and revised fiscal strategies. Commercial food products should be reformulated to lessen saturated fat, sugar, and salt content; and health promotion, literacy, and awareness should target vulnerable, high-risk populations; this empowers people to understand the need and importance of adopting healthy nutrition and lifestyles. Governments should promote active living and mobility and provide safe and enabling environments and infrastructure.

Multisectoral action plans are integrated monitoring frameworks with various partners (public, private, and civil society) that address critical issues, for example, advancing health by tackling noncommunicable diseases. For developing multisectoral action plans, following best practice entails identifying and recruiting key sectors, fostering intersectoral collaboration to develop and implement the action plans, and encouraging the public to support the action plans. For benchmarking, national political commitment to noncommunicable diseases, conducting a situational analysis through surveys and capacity building for reliable data collection, stakeholder mapping and recruitment, drafting a blueprint of national noncommunicable disease plans, convening multisectoral meetings, conducting monitoring and evaluation, finalization, and endorsement are necessary. A multisectoral approach will effectively reduce the risk of noncommunicable diseases across the maternal and child life-cycle and encompasses enabling public policies and regulations, better health literacy, and supportive behavioral changes.

The public should collaborate and support governments’ plans that combat unhealthy nutrition, obesity and noncommunicable diseases.

A marked reduction in morbidity and mortality from noncommunicable diseases needs policies to significantly decrease harmful substance use, for example, alcohol and tobacco, and target harmful nutrients that contribute to the onset of noncommunicable diseases (e.g., high salt intake and hypertension); these policies also need to be aligned to enable equitable access to decent preventive and curative healthcare for noncommunicable diseases through universal health coverage. In LMIC, the SDG 3.4 target for noncommunicable diseases can be realized as they can be prevented, treated, and managed; and reinforced with robust noncommunicable disease prevention programs that promote healthy lifestyles, noncommunicable disease morbidity, and mortality will be reduced over time. Adopting a life-course approach will contribute to achieving SDG 3.4 by reducing avoidable mortality by a third. However, with the Covid-19 pandemic, progress in the SDGs has regressed, and colossal efforts are required to realize the health SDGs.

The effectiveness of food policies to help prevent and combat noncommunicable diseases have variable impact. In Afghanistan, Bangladesh, Nepal, Pakistan, Tunisia, and Vietnam, there was a lack of (i) consistent reference to populations potentially at risk or more vulnerable to noncommunicable diseases and (ii) policies protecting vulnerable populations or subsidizing their access to healthier foods (i.e., greater affordability). Fiscal interventions help to promote healthy food consumption and prevent noncommunicable diseases but more evidence is required in LMIC. These fiscal interventions can be categorized according to food price (e.g., taxes, subsidies, and incentives); food promotion (e.g., marketing, advertising, media campaigns, and health promotion); food provision (e.g., in schools, communities, and workplaces); food composition (e.g., nutrient reformulation and elimination); food labeling (e.g., nutrient profiles and calories); and food supply chain, trade and investment (i.e., legislation and regulation focused on food production policies and supply chains). Fiscal interventions that include more than two categories (i.e., multiple fiscal interventions) seemed more effective than single interventions. Fiscal policies likely improve population health and reduce inequalities, but more evidence is required for better estimates of their health impact. Multiple fiscal interventions should also be effective in limiting the dietary intake of salt and trans fats while encouraging more vegetable and fruit consumption, thereby enhancing population health outcomes. In Chile, reducing ultra-processed foods in diets showed potential to limit harmful nutrient intake (implicated in noncommunicable diseases) and to promote healthy eating. Ref ormulation by reducing trans fat intake was effective, but more research on the food supply chain, trade, and investment is necessary to determine policy effectiveness. Food labeling and restrictions on provision or marketing of unhealthy foods were less effective.

The higher price of unhealthy nutrients may be a deterrent for some consumers, but the greater impact will be on food manufacturers, who through meeting compliance requirements and thereby benefiting from reduced taxation, may eventually contribute to healthier food manufacturing to support healthier lifestyles. Part of the taxes on alcohol, tobacco, and unhealthy foods (e.g., sugar, salt, and unhealthy fats) can be redirected to support and supplement noncommunicable disease health promotion and disease prevention to enable the adoption of healthy lifestyles. Further, there should be more subsidization of healthy foods and incentives (e.g., tax rebates) for food manufacturers that supply healthy foods and reduce the harmful or nonbeneficial nutrients in their products.

### 5.3 Private sector responsibility for combatting noncommunicable diseases

Food and beverage (F&B) companies can help in combatting noncommunicable diseases. However, F&B companies have a variable commitment to health and nutrition, competitive positioning on health, and willingness for change. Some large F&B companies may influence and shift policy and public opinion in their favor by employing policy substitution (company policies and codes are developed as alternatives to regulations) and constituency building (foster relations with key influential stakeholders) to delay or prevent regulations from being implemented that may contract their profitability. Benchmarking and accountability initiatives may improve nutrition policies and practices. F&B companies should therefore strive to strengthen and align their nutrition policies and practices with public and global health recommendations.

Weak F&B industry nutrition policies and practices should be benchmarked, and greater accountability will support and enhance government regulations and legislations for nutrition and obesity.
prevention\textsuperscript{135} to help reduce noncommunicable disease morbidity and mortality. Policymakers can help to strengthen F&B industry self-regulation by implementing reporting frameworks, introducing measurable targets that are time bound, and enforcing sanctions for non-compliant F&B companies.\textsuperscript{135} Also, the public is empowered to influence F&B companies’ commitment to healthy nutrition and the prevention of noncommunicable diseases by their purchasing decisions, investments, and decision making.\textsuperscript{135}

Robust and comprehensive food system interventions can help to foster healthy food production, distribution, and consumption, particularly in LMIC.\textsuperscript{19} Governments and global health actors should collaborate to translate global noncommunicable disease prevention goals into clear measurable indicators that address the challenges in creating healthier food environments.\textsuperscript{146} This will guide F&B companies to craft clear and relevant policies, in support of better monitoring, evaluation, and benchmarking.\textsuperscript{146} Further, monitoring the robustness of the food landscape, F&B policy actions, and the strengthening of monitoring are required\textsuperscript{146} for improved compliance and commitment to enable people to adopt healthier nutrition.

5.4 Global initiatives and support for addressing the noncommunicable diseases burden

At a global level, 17 United Nations entities participated, garnered political support, and influenced policy and practice through engagements with governments, non-governmental organizations, academia, and industry that focus on combating noncommunicable diseases.\textsuperscript{147} Priorities to effectively respond to noncommunicable diseases at a national level include (i) the development of national frameworks with an investment case and prioritized costed national plan supported with sustainable financing, maximized domestic resources, and coordinated accountability;\textsuperscript{147} (ii) realization of more robust policy coherence across governments for the delivery of national multisectoral action plans on noncommunicable diseases, for example, improving regulations and legislations to mitigate risk factors, and building enabling environments to encourage health promotion\textsuperscript{5}; (iii) leveraging prohealth partnerships with civil society and the private sector and managing conflicts of interest; and (iv) developing more robust service delivery systems that include community responses, risk communication strategies, and social contracting.\textsuperscript{147}

5.5 Partnerships and collaborations for noncommunicable disease prevention

Although healthier nutrition is promoted in some countries,\textsuperscript{24} few challenge food systems, structures, and manufacturers. Thus, greater unity to address malnutrition is necessary for combatting noncommunicable diseases and to therefore realize SDG 3.4. Greater alignment between the nutrition, noncommunicable diseases, and allied communities is required to focus on providing evidence and advocating for healthier food policies and systems\textsuperscript{24} that promote healthier lifestyles. This change is imperative to attain the health SDGs, particularly SDG 3.4 where progress is lagging in many countries, particularly in LMIC.\textsuperscript{1}

Public–private partnerships can collaborate by creating healthy communities. For public awareness, the messages and benefits of healthy nutrition and regular physical activity should be conveyed, also communicating the developments in these areas. For healthy nutrition, awareness of the adverse effects of increased salt, sugar, and unhealthy fat intake (e.g., nutrition plans) should be disseminated. The importance of adequate macro- and micronutrient intake (without excessive and insufficient consumption of important nutrients), particularly for mothers and children, should be emphasized. For physical activity, knowledge on the benefits of regular physical activity (e.g., exercise plans) and the intensity required per age category, and how to fit physical activity into daily life, should be conveyed, customized at an individual level, and supported by community initiatives. Coordinated programs for noncommunicable disease prevention contribute to improving the quality of life for patients and help to relieve health systems.

National and regional research consortia should lead projects that address their noncommunicable disease priorities that are reinforced with global partnerships in collaboration and funding. The focus should be on tracking the progress of health gains in noncommunicable diseases and remedying health lags. This should feed into national and provincial departments of health, where the health and economic benefits can be monitored and evaluated. Investing in the prevention and control of noncommunicable disease prevention present countries, irrespective of income, the opportunity for greater economic progression.\textsuperscript{2}

6 CONCLUSION

Healthy lifestyles support health promotion and disease prevention, which is cost-effective relative to treatment, particularly for noncommunicable diseases that afflict people for years and decades with compounding costs of treatment, and often progressing to higher severity or co- and multiple morbidities requiring polypharmacy. The high burden of noncommunicable diseases and overweight/obesity globally remains a complex, pervasive, and persistent challenge; therefore, the adoption of healthy lifestyles is critical to slow their onset and exacerbation. Mothers and children should be adequately nourished to preserve maternal health and foster optimal infant and child growth and development. Healthy lifestyles, particularly healthy nutrition over the life-course supported by frequent exercise, can help to advance SDG 3.4 by preventing morbidity and mortality from noncommunicable diseases.

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