# The role of dairy food intake for improving health among black Americans across the life continuum: A summary of the evidence

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*Abstract:* Decades of health data show major health disparities occurring at every life stage between Black and White Americans. These disparities include greater mortality rates among Black mothers and their offspring, higher levels of malnutrition and obesity among Black children and adolescents, and a higher burden of chronic disease and lower life expectancy for Black adults. Although nutrition is only one of many factors that influence human health and well-being across the life continuum, a growing body of research continues to demonstrate that consuming a healthy dietary pattern is one of the most dominant factors associated with increased longevity, improved mental health, improved immunity, and decreased risk for obesity and chronic disease. Unfortunately, large percentages of Black Americans tend to consume inadequate amounts of several essential nutrients such as vitamin A, vitamin D, calcium, and magnesium; and simultaneously consume excessive amounts of fast foods and sugar-sweetened beverages to a greater degree than other racial/ethnic groups. Therefore, strategies that can help improve dietary patterns for Black Americans could make up a major public health opportunity for reducing nutrition-related diseases and health disparities across the life course. A key intervention strategy to improve diet quality among Black Americans is to focus on increasing the intake of nutrient-rich dairy foods, which are significantly underconsumed by most Black Americans. Compared to other food group, dairy foods are some of the most accessible and affordable sources of essential nutrients like vitamin A, D, and B12, calcium, magnesium, potassium, selenium, and zinc in the food supply, as well as being some of the primary sources of several health-promoting bioactive compounds, including polar lipids, bioactive proteins and peptides, oligosaccharides, and live and active cultures in fermented products. Given the complex relationships that many Black Americans have with dairy foods, due to issues with lactose intolerance, and/or negative perceptions about the health effects of dairy foods, there is still a need to examine the role that dairy foods play in the health and well-being of Black Americans of all ages and life stages. Therefore, the National Medical Association and its partners have produced multiple reports on the value of including adequate dairy in the diet of Black Americans. This present summary paper and its associated series of evidence reviews provide an examination of an immense amount of research focused on dairy intake and health outcomes, with an emphasis on evidence-based strategies for improving the health of Black Americans. Overall, the findings and conclusions from this body of research continue to indicate that higher dairy intake is associated with reduced risk for many of the most commonly occurring deficiencies and diseases impacting each life stage, and that Black Americans would receive significantly greater health benefits by increasing their daily dairy intake levels to meet the national recommendations than they would from continuing to fall short of these recommendations. However, these recommendations must be considered with appropriate context and nuance as the intake of different dairy products can have different impacts on health outcomes. For instance, vitamin D fortified dairy products and fermented dairy products like yogurt - which are low in lactose and rich in live and active cultures - tend to show the greatest benefits for improved health. Importantly, there are significant limitations to these research findings for Black Americans, especially as they relate to reproductive and child health, since most of the research on dairy intake and health has failed to include adequate representation of Black populations or to sufficiently address the role of dairy intake during the most vulnerable life stages, such as pregancy, lactation, fetal development, early childhood, and older age. This population and these life stages require considerably more research and policy attention if health equity is ever to be achieved for Black Americans. Sharing and applying the learnings from this summary paper and its associated series of evidence reviews will help inform and empower nutrition and health practitioners to provide more evidence-based dietary recommendations for improving the health and well-being of Black Americans across the life course.

**Keywords:** Black ■ African American ■ Dairy intake ■ Lactose intolerance ■ Health equity ■ Chronic disease ■ Life stage

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## INTRODUCTION

Recent census data show that there are over 40 million Black Americans currently living in the United States (US), making up approximately 13.6% of the US population.[1] This population has diverse origins, arising from more than 50 different countries, and encompassing a mix of ancestries, traditions, and life histories. Despite these differences, Black Americans share greater burdens of discrimination, socioeconomic inequities, and health disparities than any other racial/ethnic group in the US, resulting in Black Americans being the least healthy racial/ethnic group in the US.[2] Many of these health disparities have remained constant or continued to

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increase. For example, in recent years, the median household income for Black households has been approximately 60% of White households, while the poverty and unemployment rates were more than double that for White Americans.[3] Food insecurity also impacts Black populations at more than twice the rate as the national average (21.7%, vs. 10.5%, respectively).[4] The average life span for Black Americans is nearly 6 years shorter than for White Americans (70.8 years vs. 76.4 years, respectively).[5] This difference in life span can be directly attributed to higher death rates among Black Americans for heart disease, stroke, hypertension, cancer, type 2 diabetes (T2D), kidney disease, cerebrovascular disease, influenza, pneumonia, HIV/AIDS, septicemia, homicide, and conditions related to pregnancy and childbirth.[6,7] During the COVID-19 pandemic, health disparities for Black populations also rose more significantly than for White populations, and overall mortality rates reached nearly twice the level of White populations.[8] Taken together, these statistics indicate a much higher prevalence of several chronic and debilitating health conditions among Black populations throughout their life course,[7] many of which arise earlier in life, occur with a greater number of comorbidities, and result in a larger proportion of life spent with life-threatening diseases and/or life-altering disabilities.[9–11]

From a healthcare perspective, it is imperative that we address the core elements of these health disparities to improve both overall health and health equity for Black Americans. These core elements include factors such as systemic racism, low socioeconomic status, food insecurity, poor access to healthcare, and unhealthy dietary habits. These disparities are non-trivial, putting the health and longevity of certain Black communities on par with those of populations from much lower-income countries.[11] While most of these issues and inequities need to be addressed at the state and national levels, there are certain behavior changes (a.k.a. modifiable risk factors) that can be made at the individual, family, and community levels, which hold massive potential for improving health and well-being across the life course. Improving these types of behaviors, such as following healthier dietary patterns, could significantly reduce the burden of disease, disability, and death, among Black populations of all ages. There is no greater preventative measure for reducing deficiency disorders, reproductive disparities, obesity, and chronic disease risk than improving dietary patterns. Therefore, we find that the greater prevalence of unhealthy dietary behaviors among Black Americans, such as the chronic overconsumption of fast foods and sugar-sweetened beverages; and lower consumption of nutrient-dense foods such as fruits, vegetables, whole grains, and dairy foods is one of the greatest concerns impacting health equity, and in need of further educational outreach, policy attention, and public health action.

## THE ROLE OF THE NATIONAL MEDICAL ASSOCIATION IN IMPROVING HEALTH EQUITY THROUGH NUTRITION EDUCATION

Established in 1895, the National Medical Association (NMA) is the oldest and largest organization representing Black physicians in the US.[12] This organization, which is comprised of more than 30,000 physicians, has a long history of developing and promoting health policies that benefit its patients and the general public. Given the complex relationships that many Black individuals have with dairy foods, due to issues with lactose intolerance or other cultural factors, the NMA has made considerable efforts to examine the role that dairy foods play in the health and well-being of Black Americans. Over the last two decades, the NMA and its partners have produced multiple reports on the value of including adequate dairy foods in the diet of Black Americans.[12–15] These publications have primarily focused on nutrient intake, highlighting the impacts that inadequate intake of dairy foods and dairy nutrients have on chronic disease risk. Additionally, these publications have also provided evidence-based recommendations for the management of lactose intolerance and its symptoms.

In 2013, the NMA and its partners released a consensus statement report regarding dairy intake, lactose intolerance, and health disparities in Black and Hispanic American populations.[15] One of the major findings from that report was that higher intake of dairy products was associated with reduced risk for several chronic diseases, including cardiovascular disease (CVD), metabolic syndrome (METS), T2D, and osteoporosis. Since the publication of that report, the body of research on dairy intake and disease has been expanded considerably, and dozens of new systematic reviews and/or meta-analyses on dairy intake now cover a much larger spectrum of health and disease-related research. While most of this research has been conducted in White populations, many of the findings from this body of literature are still likely applicable to other racial/ethnic groups and are therefore worth examining and feasibly extrapolating to Black Americans.

This new NMA summary report and its associated series of evidence reviews provide updates to these earlier publications, while expanding beyond the lens of nutrient intake, obesity, and cardiometabolic disease, to a much broader focus. This work relies heavily on the extensive

body of scientific evidence published over the last decade which has investigated the relationships between dairy intake, disparities, and disease outcomes. This examination attempts to find middle-ground between national-level dietary guidance put forth by the 2020–2025 Dietary Guidelines for Americans (DGA)[16] and a medically-relevant perspective that can assist health professionals and their patients with diet-related advice for disease prevention and management. This work follows a similar format as the DGA by utilizing a life stage approach comprised of five distinct stages: 1) pregnancy, fetal development, and lactation, 2) infants, toddlers, and young children; birth to 4 years, 3) older children and adolescents: 5 to 17 years, 4) adults; 18 to 59 years, and 5) geriatrics; 60 years and over. This work also includes a novel effort to summarize the evidence for the most prominent health and disease outcomes for Black populations at each life stage, and where possible, it attempts to convey the research findings focused on different dairy food types (e.g., milk, yogurt, cheese) and subtypes (e.g., low-fat, fermented, vitamin D fortified) that are most highly associated with reduced disease risk at each life stage.

## THE ROLE OF DAIRY FOODS IN HEALTHY EATING PATTERNS

Dairy foods have been considered a foundational component of dietary guidance in the US for nearly 130 years, dating back to the nation's first nutrition and health promotions in the late 1800s.[17,18] Over the last 30 years, DGA recommendations have promoted the dairy food group's ability to contribute roughly a dozen essential nutrients (protein, calcium, magnesium, phosphorus, potassium, zinc, selenium, vitamin A, riboflavin, vitamin B12, pantothenic acid, and vitamin D in fortified products) to healthy dietary patterns.[19,20] Overall, dairy foods such as milk, yogurt and cheese contribute ~14% of the energy in the diets of children and adolescents, while at the same time this food group provides more than 20% of at least 9 different nutrients. For adults, dairy foods contribute to ~10% of energy, and more than 15% of at least 8 different nutrients (Table 1).[21] Recent DGA's have also put additional emphasis on the importance of achieving adequate dairy food intake to meet the recommended intake levels for vitamin D, calcium, and potassium - which are classified as nutrients of public health concern for underconsumption by the US population.[22] Dairy foods are one of the largest contributors to the intake of these nutrients in the US food supply, providing approximately 66% of vitamin D, 62% of calcium, and 23% of potassium for children and adolescents; and 46% of vitamin D, 50% of calcium, and 12% of potassium for adults (Table 1).

Dairy products tend to provide more nutrition per unit of energy than any other food group,[23] and they generally provide these nutrients at lower costs than other foods.[24] Dairy foods also contribute an array of additional health-promoting bioactive compounds (i.e., non-nutritional or extra-nutritional compounds with health-promoting properties)[25–27] that are not generally captured in nutrition or economic metrics, but may provide incalculable benefits to human health and well-being.

## DAIRY FOODS AND DAIRY NUTRIENTS ARE INADEQUATELY CONSUMED BY MOST AMERICANS – WITH THE LOWEST INTAKE LEVELS AMONG BLACK AMERICANS

The 2020–2025 DGA aims to provide evidence-based dietary recommendations for optimal health based on life stage, gender, energy needs, and dietary preferences. However, approximately 90% of the US population does not meet the DGA recommended intake levels of dairy foods listed at 2.5 servings/day for most children and 3 servings/day for adolescents and adults.[16] So while most Americans are falling short of dairy food recommendations, Black Americans tend to have the lowest average intake of dairy foods among all sampled racial/ethnic groups, with the largest disparities occurring between Black and White populations (Table 2).[28] Overall, Black Americans also tend to follow fewer DGA recommendations than other racial/ethnic group in the US,[16,29] and when compared to White Americans, the diets of Black Americans are usually higher in foods that contain excessive energy, sugars, and sodium, and at the same time are lower in protein and nutrient-rich foods.[29–31] Black Americans also tend to consume less vitamin A, riboflavin, vitamin D, calcium, magnesium, phosphorus, and zinc when compared to White Americans,[32,33] since it is more difficult to achieve adequacy of these nutrients when not meeting dairy intake recommendations (Table 3).[34] For example, nearly 100% of Black Americans who are not meeting dairy intake recommendations are also not meeting vitamin D recommendations, while 60% or more of Black Americans who are not meeting dairy intake recommendations are also not meeting vitamin A, calcium, or magnesium recommendations (Table 3).

Dairy foods are the main dietary sources of calcium and vitamin D in the US, and inadequate intake of these nutrients is associated with negative health outcomes that disproportionately impact Black Americans, ranging from poor maternal health and birth outcomes to increased risk for chronic diseases and reduced life span.[15,16,36] Emerg-

**Table 1.** %Contributions of recommended dairy foods to energy and nutrient intakes in us dietary patterns.

| | Children and Adolescents (2–18 years) Dairy Contributions to Dietary Patterns | Adults and Geriatrics (19+ years) Dairy Contribution to Dietary Patterns |
|---|---|---|
| Energy | 14.2% | 9.7% |
| Protein | 23.7% | 15.7% |
| Fat | 19.0% | 14.2% |
| Vitamin A | 38.5% | 26.6% |
| Riboflavin | 31.1% | 18.6% |
| Vitamin B12 | 38.3% | 24.9% |
| Vitamin D | 65.8% | 45.9% |
| Calcium | 61.8% | 49.5% |
| Magnesium | 18.1% | 9.4% |
| Phosphorus | 36.3% | 25.0% |
| Potassium | 22.8% | 11.6% |
| Sodium | 13.9% | 10.1% |
| Zinc | 22.7% | 15.5% |

*Source of information: Cifelli 2021 et al.[21] Data from National Health and Nutrition Examination Survey (NHANES) 2015–2016 and 2017–2018 for milk, yogurt, and cheese on a disaggregated basis.*

**Table 2.** Recommended dairy intake vs. actual average intake for racial/ethnic groups.

| Age | Recommended Dairy Intake Servings/Day | White Americans Servings/Day | Hispanic Americans Servings/Day | Asian Americans Servings/Day | Black Americans Servings/Day |
|---|---|---|---|---|---|
| 2–8 years | 2 – 2.5 | 2 | 1.97 | 1.93 | 1.55 |
| 9–18 years | 3 | 1.87 | 1.86 | 1.71 | 1.47 |
| 19–50 years | 3 | 1.70 | 1.47 | 1.23 | 1.21 |
| 51–70 years | 3 | 1.55 | 1.22 | 0.86 | 0.88 |
| 71+ years | 3 | 1.46 | 1.05 | 0.88 | 0.69 |

*Source of information: Hess 2020, et al.[28] Cifelli, et al.[35]*

ing evidence indicates that deficiencies in calcium and/or vitamin D are associated with higher risk for hypertension, CVD, T2D, METS, cancer, rheumatoid arthritis, osteoporosis, and sarcopenia.[37,38] To this point, the 2020–2025 DGA emphasizes adequate intake of calcium and vitamin D more often than any other micronutrient besides iron, drawing focus to the importance of dairy foods for achieving health at every life stage.[16]

**Table 3.** Dairy nutrients – recommended vs actual average intake levels. Percentage of Black Americans and White Americans (2+ years of age) who are consuming less than 3 servings of dairy per day and falling short of nutrient Estimated Average Requirements (EAR).

| Select Dairy Nutrients | %Black Americans falling short of dairy and nutrient intake recommendations | %White Americans falling short of dairy and nutrient intake recommendations |
|---|---|---|
| Vitamin A | 59 ± 2 | 47 ± 2 |
| Riboflavin | 7 ± 1 | 2 ± 0 |
| Vitamin B12 | 5 ± 1 | 5 ± 1 |
| Vitamin D | 100 ± 0 | 98 ± 0 |
| Calcium | 74 ± 2 | 62 ± 1 |
| Magnesium | 67 ± 1 | 58 ± 2 |
| Phosphorus | 10 ± 1 | 6 ± 1 |
| Selenium | 1 ± 0 | 1 ± 0 |
| Zinc | 28 ± 2 | 22 ± 2 |

*Source of information: Hess 2020, et al.*[34]

## CONFLICTING RESEARCH ON THE ROLE OF DAIRY FATS IN HEALTHY EATING PATTERNS

Dairy foods are a major contributor to dietary fats, including saturated fats and other essential lipids in US diets. Historically, higher saturated fat intake has been linked to several negative health outcomes, however, the scientific merit of these findings has been contested for more than half a century.[39] Much of the research on saturated fat has failed to consider or convey that different sources (and types) of saturated fats can have very different effects on health. For example, the health impacts of saturated fats from sources as diverse as meat, milk, and coconut can differ considerably since these foods all contain different types (i.e., short chain vs. medium chain vs. long chain fatty acids) and combinations of saturated fatty acids and their associated lipid-soluble compounds. The food matrices in which saturated fats are part and parcel are also important to the health properties of these fats, as is the process of fermentation through which certain microbes can alter the saturated fatty acid profile of foods such as by increasing levels of health-promoting short-chain fatty acids.[40–43] A growing body of research indicates that the unique profile of fats from dairy foods, which include short-chain saturated fatty acids, medium-chain saturated fatty acids, long-chain saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, branched-chain fatty acids, odd-chain fatty acids, and conjugated-linoleic acid,[44] appears to have neutral to mildly beneficial effects on overall health.[39,45–50] Although dietary guidelines continue to recommend low-fat dairy over whole-fat options, there has been a growing consensus that the unique array of fats in dairy foods, especially in fermented dairy foods, are not harmful to overall health and instead provide numerous benefits for neurocognitive health and protections against chronic disease development.[51] Furthermore, whole-fat dairy foods are better able to assist with the absorption of fat-soluble vitamins such as vitamin A and vitamin D,[52] which are both inadequately consumed by the general population, and even more so by Black American populations.[32]

Several randomized controlled trials (RCTs) and mechanistic studies also indicate that higher intake of whole-fat dairy foods, within the context of a healthy eating pattern, are generally associated with neutral to mildly beneficial impacts on cardiometabolic, inflammatory, gastrointestinal, and neurocognitive health outcomes.[51,53] These beneficial impacts are usually attributed to the lipid profiles of whole-fat dairy products, which, in addition to their unique fatty acid profiles also contain several additional types of bioactive lipid compounds such as phospholipids and sphingolipids that are known to benefit human health and are not commonly found in other food groups.[51,53,54] Taken together, these findings indicate that there are potential trade-offs to consider between the health impacts of regularly consuming whole-fat dairy products vs. low-fat products. On one hand, the higher fat content in whole-fat

dairy products provides more energy and sometimes less protein than low-fat products. On the other hand, whole-fat dairy products contain higher levels of numerous health-promoting lipid compounds and contribute to enhanced absorption of multiple fat-soluble vitamins that are important for optimal mental and physical health. For these reasons, the intake of whole-fat dairy foods may hold greater potential for being able to help ensure proper growth, development, reproductive health, lactation, and neurocognitive function across the most vulnerable life stages when compared to low-fat dairy products.

## CONTRIBUTIONS OF FERMENTED DAIRY FOODS AND DAIRY PROBIOTICS TO HEALTH AND REDUCED RISK FOR CHRONIC DISEASE

Humans have been benefitting from the consumption of fermented dairy foods for more than 10,000 years, however, researchers only began to study and appreciate the multitude of health benefits delivered by this microbe-driven food transformation process over the last 100 years.[55] The fermentation of milk by specialized microbes, such as lactic acid bacteria and bifidobacteria, into products such as yogurt, kefir, cheese, buttermilk, and sour cream, not only improve the safety and shelf-life of these foods by preventing their colonization and contamination with pathogenic microorganisms, but also improve milk's health value by increasing the bioactivity and/or bioavailability of several micronutrients. In effect, the fermentation process enriches the food with numerous health-promoting bioactive compounds and simultaneously reducing its lactose content and allergenic potential.[56–58]

A recent systematic review of research on fermented dairy foods and health, which included over 100 studies and spanned nearly 40 years of research, found that 70% of studies showed favorable impacts of fermented dairy foods on health, whereas another 26% found neutral or non-significant impacts.[59] The most prominent benefits of fermented dairy food intake were improved weight maintenance, and reduced risk for CVD, T2D, osteoporosis, gastrointestinal disorders, colorectal cancer, and breast cancer. In essence, the fermentation of milk into higher-value dairy products allows for the delivery of nutrients and health-promoting bioactive compounds beyond what unfermented milk is able to provide.[59] Therefore, future dietary guidelines should consider further emphasizing and encouraging higher intake of fermented dairy foods such as yogurt, kefir, and cheese for improving overall health.[59] Importantly, an emerging body of evidence shows that the particular species and strains of bacteria used in the fermentation process, as well as those which are added after initial fermentation, can all impact the nutrition and health properties of the finished product, making the selection of specific starter cultures and supplemental probiotics much more important than previously thought.[60] Further research comparing the nutrition and health properties of fermented dairy foods to fermented plant-based foods may also be warranted, as several of the most popular types of bacteria used in the fermentation of plant-based yogurts and other dairy alternatives have evolved to preferentially consume lactose and hydrolyze milk proteins into specific bioactive peptides, and may likely produce very different metabolites with very different health effects when non-dairy substrates are fermented.

## CONTRIBUTIONS OF FORTIFIED AND FUNCTIONAL DAIRY FOODS TO HEALTH

Vitamin D fortified milk, whey protein beverages, and probiotic yogurt, are all considered "functional" dairy foods, meaning that they have additional quantities of nutrients and/or bioactive compounds added to improve their health-value.[61] These "functional" compounds may already be found in milk and are concentrated to reach higher levels, or they may be added from non-dairy sources to increase levels of compounds such as vitamin D, probiotics, and omega-3 fatty acids.[61] Dairy foods may also be fortified with plant-based compounds like prebiotics, soluble or insoluble fibers, or phytosterols that are meant to improve the foods' health value. Most of the milk produced in the US is fortified with additional vitamins and minerals, such as vitamins A and D. The addition of these vitamins has been shown to contribute substantially to improved nutrient status and reductions in vitamin inadequacies among populations who regularly consume milk.[62,63] A 2018 systematic review and meta-analysis of 36 RCTs, which focused on the role of dairy components on nutrition and fitness, found that higher intake of vitamin D was associated with better physical performance in older adults.[64] A recent systematic review of 41 studies, which investigated the effects of functional dairy products on cardiometabolic health, found that adding phytosterols or omega-3 fatty acids to milk improved cardiometabolic risk factors such as reducing LDL cholesterol.[65] A separate systematic review of 88 studies on a variety of functional foods reported that low-fat dairy products could be considered functional foods as they could help regulate inflammation.[66] Additionally, several other publications have reported on the abilities of probiotic dairy foods and beverages to improve milk's digestibility, improve gut health, improve immune function, and reduce chronic disease risk.[67–70]

## DIETARY RECOMMENDATIONS AND NUTRIENT REQUIREMENTS DIFFER BY LIFE STAGE

Although nutrition is only one of many factors that influence health and well-being, a growing body of research continues to show that a healthy dietary pattern is one of the most dominant factors associated with increased longevity, improved mental health and immunity, body weight regulation, and decreased risk for chronic disease.[16,71–74] The basic components of a healthy dietary pattern are fairly consistent over the life course, however, certain dietary needs shift over time, especially throughout the childhood and adolescent stages of development, and also during pregnancy, lactation, and the transition to older adulthood.[16] Therefore, the 2020–2025 DGA recommendations differ by life stage, with populations being provided with dietary recommendations depending on age, gender, reproductive status, energy needs, and dietary pattern preferences (e.g., US-Style, Vegetarian, and Mediterranean-Style Dietary Patterns). Specific DGA recommendations are provided for dairy intake frequency (i.e., daily number of servings) and amount (i.e., number cup equivalents per day), as well as for dairy food type (e.g., milk, cheese, yogurt) and subtype (e.g., low-fat, fortified) for each life stage.[16] However, only infants, toddlers, and very young children are regularly meeting these recommendations, while the average intake across all other life stages progressively declines with advancing age.[16]

While the DGA recognizes that certain racial/ethnic groups have higher risk for obesity and chronic diseases, race/ethnicity is not currently an element of DGA recommendations.[16] From a medical perspective, dietary needs may also change considerably based on disease status, hence, prescriptive dietary recommendations are often made based on treatment or management plans that may not align with DGA recommendations. Research also indicates that subclinical factors such as increased stress and inflammation levels may alter dietary needs,[75,76] and this line of research requires further investigation for its potential impacts on health across the life course. For example, an emerging body of evidence suggests that Black Americans tend to have greater levels of stress and allostatic load across the life course than White Americans,[10,96] which can lead to physiological dysregulation that impairs gut and immune function and may thereby alter nutrient needs.[77–79] This type of research implies that the life experiences of certain racial/ethnic groups may, in fact, impact dietary requirements, with more cumulative impacts occurring in the later life stages. These findings require further attention for older Black Americans since nutrient inadequacies also tend to increase with advancing age,[80] meaning that due to aspects of their life histories many older Black Americans may have higher nutrient needs than age-matched White Americans, and at the same time are taking in fewer nutrients than their younger selves who were already not meeting their nutrient requirements. While the health of individuals at any life stage can benefit by improving diet quality, it appears that health of older Black Americans may benefit more than most.

## THE ROLE OF DAIRY INTAKE ACROSS THE LIFE COURSE

The transition from one life stage to the next comes with changing nutritional needs. Milk and dairy products can help meet many of these nutritional needs by providing a wide range of essential nutrients and bioactive compounds that are required for optimal health across the life course - especially nutrients that are difficult to get from non-dairy foods sources.[81] The clinical implications of dairy intake encompass reproductive health, early life growth and development, and the maintenance of gut, immune, neurocognitive, musculoskeletal, and cardiometabolic health. There is also increasing evidence that dairy intake in early life can impact disease risk in later life,[82–84] as well as evidence that dairy intake during pregnancy and lactation can impact the health of the offspring.[85–87] Hence, the health value of dairy products is relevant across all life stages, impacting health and well-being throughout one's life course, as well as from one generation to the next.

The current NMA summary paper and associated series of evidence reviews include summary and analysis of an extensive amount of evidence produced over the last decade that has focused on dairy intake and health across the life course. Below are several key take-a-aways from NMA's series of evidence reviews that are focused on recommendations for improving the health and well-being of Black Americans. Ten of these "Evidence-Based Recommendations" are applicable to the entire life course, with five additional points provided for each of the major life stages: 1) pregnancy, fetal development, and lactation, 2) infants, toddlers, and young children (birth to 4 years), 3) school-age children and adolescents (5 to 17 years), 4) adults (18 to 59 years), and 5) geriatrics (60+ years). More information on the complex relationships between dairy intake and health at each life stage is provided in much greater depth in each of the associated series of evidence reviews.

**EVIDENCE-BASED RECOMMENDATIONS FOR IMPROVING PATIENT HEALTH: Entire Life Continuum**

- Meeting national dairy intake recommendations (2 to 2.5 servings/day for young children, 3 serving/day for older children, adolescents, adults, and geriatrics) contributes to better nutrition and health outcomes for Black Americans across all life stages.
- Higher dairy intake (≥3 servings/day) coupled with an energy-restricted diet has been shown to help facilitate weight loss and improve body composition when compared to lower dairy intake (<2 servings/day).
- Dairy avoidance due to misinformation/disinformation about dairy foods, or due to incorrect self-diagnosis of lactose intolerance, may put Black populations at higher risk for inadequate intake of multiple micronutrients and several preventable diseases. Fortunately, there are many accessible options for individuals with lactose intolerance to meet intake recommendations for nutrient-rich dairy foods, such as by selecting lactose-free products and fermented dairy products, and/or by taking probiotic or enzymatic supplements.
- Dairy consumption may be an economical and accessible intervention strategy to improve gut and immune health among Black populations, as several compounds found in dairy foods have shown promise for favorably modulating the gut microbiome and immune function.
- The nutritional quality of plant-based alternatives is typically regarded as inferior to dairy foods. Exclusive intake of plant-based alternatives instead of nutrient-rich dairy foods may carry serious health risks, especially for pediatric populations, pregnant and lactating women, geriatric populations, and populations such as Black Americans with chronically low intake of dairy nutrients, including calcium and vitamin D.
- Higher daily intake of dairy products, especially those that have been fermented and fortified with vitamin D, has been shown to reduce the risk for developing chronic diseases across the lifespan.
- Regular intake of fermented dairy products, especially yogurt, appears to have the most protective effects against disease risk. Fermented dairy foods also contain an array of bioactive compounds that can beneficially impact gut microflora, immune function, lipid storage, blood pressure, and glucose regulation.

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- The fortification of dairy products with vitamin D, probiotics, additional protein, or bioactive peptides, may improve the efficacy of these foods for functions such as body weight regulation, reducing chronic disease risk, and enhancing mental and physical performance.
- Dairy fats may be beneficial for overall health when consumed as part of an energy-restricted diet, given they contain several health-promoting compounds, including short-chain fatty acids, medium-chain fatty acids, conjugated linolenic acid, branched-chain fatty acids, odd-chain fatty acids, and polar lipids, and help facilitate the absorption of fat-soluble vitamins like vitamin A and D.
- It is recommended that Black Americans of all life stages meet the DGA-recommended intake levels for dairy foods to reduce health disparities and improve health equity. Black populations with elevated stress and inflammation, geriatric populations, and/or individuals with multiple comorbidities, may benefit from higher than DGA-recommended intake of dairy foods to help offset the negative biological impacts of these risk factors on health.

## PREGNANCY, FETAL DEVELOPMENT, AND LACTATION

Pregnancy and lactation are special life stages, marked by the creation and nourishment of one or more offspring. These life stages both require additional energy intake (~300–500 kcal/day depending on trimester and lactation status) and higher intake of vitamin B12, vitamin D, iodine, and choline to support maternal health as well as fetal growth and development.[88] Vitamin B12 and vitamin D intake are of particular concern for birth outcomes such as spontaneous pregnancy loss and preterm birth,[89–91] whereas suboptimal iodine and choline intake among women of childbearing age has been linked to reduced cognitive development in the offspring.[84,92] Current DGA guidance recommends that pregnant and lactating women in the US consume 3 servings of dairy per day.[16] However, on average, pregnant and lactating women consume fewer than 2 servings per day, putting them at risk for inadequate intake of multiple nutrients that are necessary for optimal maternal and offspring health. When compared to the national average, Black mothers, generally have lower dairy intake,[93] and higher risk for birth-related complications, including preeclampsia, abnormal

fetal growth, spontaneous abortion, and preterm birth.[94–96] Additionally, Black mothers tend to have much lower rates of breastfeeding initiation and duration compared to White mothers.[97]

Given these disparities, the health of Black mothers and their offspring could greatly benefit from nutrition interventions that improve maternal diet quality during these vulnerable stages of life. Higher maternal intake of dairy foods is associated with higher intake of several critical nutrients, including vitamin A, vitamin D, vitamin B12, iodine, and choline, that are required for maternal and fetal health during pregnancy and lactation.[16] Furthermore, higher dairy intake is associated with lower blood pressure during pregnancy, which is important for prevention of preeclampsia and other pregnancy-related complications.[98]

**EVIDENCE-BASED RECOMMENDATIONS FOR IMPROVING PATIENT HEALTH – For Pregnancy, Fetal Development, and Lactation**

- Black mothers have some of the highest rates of health disparities and mortality rates, and some of the lowest intakes of dairy foods and dairy nutrients of all racial/ethnic groups in the US. It is recommended that Black mothers consume 3 servings of dairy products per day to help reduce the number of health disparities and mortality rates attributed to poor nutrition.
- Regular intake of dairy nutrients such as vitamin B6, vitamin B12, vitamin D, calcium, selenium, magnesium, and zinc may improve fertility and help reduce the risk for pregnancy-related complications.
- Dairy foods provide vitamin A, vitamin D, vitamin B12, choline, and iodine – making them an ideal food source for mothers to support brain health and neurocognitive development of their children.
- Dairy foods provide mothers with multiple bioactive compounds, such as phospholipids, sialic acid, cholesterol, and gangliosides, which are known to support maternal health, and fetal growth and development.
- Black females of child-bearing age have the lowest average intake of dairy foods compared to other racial/ethnic groups, while their intake of lower-nutrient plant-based alternatives is increasing. Exclusive intake of nutrient-poor plant-based alternatives may carry serious nutrition and health risks to both mothers and their children.

## INFANTS, TODDLERS, AND YOUNG CHILDREN (BIRTH TO 4 YEARS)

The life stages following birth and lasting through infancy, toddlerhood, and early childhood mark several phases of rapid growth, where adequate nutrition and bioactive compound intake are essential for proper health and development. For the first 6 months of life, current DGA guidance recommends that infants exclusively consume breastmilk and are supplemented with vitamin D.[16] This combination provides all of the nutrients and bioactive components necessary to promote growth and development and protect against disease in the first 6 months of life. For infants who do not breastfeed, dairy-based formulas that have been fortified with iron are considered the most nutritionally appropriate substitute for breastmilk. While fermented dairy foods such as yogurt and cheese are suitable complementary foods starting around 6 months of age, cow's milk is not recommended until around 1-year of age due to its high nutrient density (which may be difficult for the infant digestive tract to handle) and its potential for allergenicity.[16] Flavored milk and plant-based milk alternatives are also not recommended during the first year of life due to their nutrient content (too high for flavored cow's milk and too low for most plant-based alternatives) and general presence of added sugars.[16] Upon weaning and introduction to complementary foods, dairy foods become some of the most important contributors to a range of key nutrients and bioactive compounds that are particularly important for musculoskeletal, immunological, gastrointestinal, and neurocognitive health and development for toddlers and young children.[16,84]

To support proper growth and development, current DGA guidance recommends that toddlers (12 to 23 months) consume between 1.67 to 2 servings of dairy per day, and young children (2 to 4 years) consume between 2 and 2.5 servings per day depending on their age and energy needs. On average, US toddlers of all racial/ethnic groups are meeting or exceeding the dairy recommendations with actual average intakes of 2.6 servings/day for White toddlers and 1.8 servings/day for Black toddlers.[99] However, only young White children (2 to 4 years) are meeting their dairy recommendations, while young Black children are falling short (2.2 servings/day vs 1.6 servings/day, respectively). Young Black children are also falling shorter than White children in both calcium and vitamin D intake, with approximately 26% not receiving enough calcium, and nearly 95% not receiving enough vitamin D.[99] Further compounding these disparities is that Black Americans are twice as likely to be born prematurely than White Americans,[94] making the adequate intake of dairy foods even more of a priority for providing the necessary nutrients and

bioactive compounds to support 'catch up' growth among these vulnerable children.

**EVIDENCE-BASED RECOMMENDATIONS FOR IMPROVING PATIENT HEALTH – For Infants, Toddlers, and Young Children (Birth to 4 years)**

- Breastfeeding is recommended as the primary source of nutrition in the first 6 months of life, and as complementary nutrition up to 2 years of age or beyond. For infants who are not breastfed, dairy-based infant formulas provide adequate nutrition for maintaining growth and development, but they are limited in their ability to provide similar immunological benefits as breastfeeding.
- Dairy foods, including cheese and yogurt, can be introduced as complementary foods starting at 6 months. However, it is recommended to wait until after the first year of life to introduce cow's milk due to its high nutrient density (which may be difficult for the infant digestive tract to handle) and potential for allergenicity. After the first year of life, cow's milk is an ideal substitute when breastfeeding is not possible, as it is more similar in nutrient and bioactive composition to human milk than any other food source.
- Adequate prenatal and early-life intake of vitamin A, vitamin D, vitamin B12, choline, and iodine – nutrients found in dairy foods – are associated with brain health and cognitive development. Dairy foods are an affordable and accessible dietary strategy to support this population in meeting their nutrient needs to improve birth outcomes and offspring neurodevelopment.
- Dairy foods provide multiple bioactive compounds, such as phospholipids, sialic acid, cholesterol, and gangliosides, that may support both physical growth and neurocognitive development in pediatric populations.
- Black children consume the least amounts of milk and the most sugar-sweetened beverages compared to other racial/ethnic groups in the US. Intake of lower-nutrient plant-based alternatives is also on the rise in this population. Selecting nutrient-rich dairy foods and beverages over nutritionally inferior alternatives could provide the nutrients and bioactive compounds for better musculoskeletal, immunological, gastrointestinal, and neurocognitive health and development.

## CHILDREN AND ADOLESCENTS (5 TO 17 YEARS)

The life stages encompassing childhood through adolescence are marked by immense physical, emotional, and reproductive maturation. Adequate nutritional intake is critical during this period of rapid growth to help ensure lifelong musculoskeletal, metabolic, and immune health. To support proper health and development in school-age children and adolescents, current DGA guidance recommends that children (aged 5 to 8 years) consume 2.5 servings of dairy per day depending on age and energy needs, while older children and adolescents (ages 9 to 17 years) consume 3 servings per day.[16] Yet, the older portion of this population is consistently falling short of these recommendations, with intake levels dipping rather than rising through adolescence. This trend is worse for adolescent females compared to males,[84] and for Black youth compared to White youth in the US. In addition to underconsuming dairy foods, Black youth are also underconsuming calcium and vitamin D, while simultaneously overconsuming sweetened beverages, added sugars, and calories.[16,100,101]

In the US, over 40% percent of children and adolescents are overweight or obese, and the prevalence is higher among Black youth than for White youth. Overweight and obese youth are at increased risks for developing chronic diseases – and these risks often remain elevated throughout their lifetime.[16] Meeting dairy intake recommendations could be an effective strategy for mitigating multiple health disparities and helping to improve health equity in vulnerable children and adolescents. The body of evidence on dairy intake and health outcomes in these populations shows that regular intake, especially of fermented and vitamin D fortified products, is associated with better outcomes related to bone health, body composition, and oral health, and may also have promising benefits for mental health.[102–106] The research on higher intake of dairy products on skin health is mixed, with the findings appearing to differ based on the type of dairy product consumed.[107–110] Further research is also warranted on dairy fat intake and health outcomes for children and adolescents since a growing body of research shows little to no differences between whole-fat and low-fat dairy intake on body composition and cardiometabolic health in this population.[111,112]

**EVIDENCE-BASED RECOMMENDATIONS FOR IMPROVING PATIENT HEALTH – For Children and Adolescents (5 to17 years)**

- Meeting national dairy intake recommendations (2.5 servings per day for 5 to 8 years, and 3 servings per day for 9 to 17 years) can support proper bone development, bone mass, and bone density in children and adolescents.
- Although fat-free and low-fat dairy foods are primarily recommended in dietary guidelines, research indicates that whole-fat dairy foods do not appear to promote obesity in pediatric populations. Most studies demonstrate neutral or mildly protective effects of whole-fat dairy intake on obesity, especially when whole-fat dairy replaces the consumption of energy-dense and nutrient-poor options, such as convenience foods and sugar-sweetened beverages.
- Research on the impacts of dairy foods on various mental health parameters is limited, and more research is needed. Some research suggests a role for dairy foods in improving mental health outcomes related to depression and anxiety.
- Research on the impacts of dairy foods on skin health is limited. At present, the findings appear to differ based on the population studied and type of dairy product consumed. Further research is necessary to understand these relationships.
- Limited research exists on the topic of dairy foods and oral health; however, the dairy nutrients calcium, vitamin D, and iodine, as well as probiotics in functional dairy foods, may offer protection against dental caries and periodontitis. Plant-based dairy alternatives provide less nutrition than dairy products and may contain significant amounts of cariogenic sugars. These products should be consumed sparingly as replacements for dairy foods.

## ADULTHOOD (18 TO 59 YEARS)

Adulthood is a life stage that encompasses a range of new experiences, opportunities, and responsibilities that impact health and well-being. For many individuals, the beginning of this life stage marks the first time that they are the primary decision makers regarding their dietary patterns. Unfortunately, the majority of US adults are not meeting one or more of their nutritional requirements,[16] while also having overweight or obesity and one or more chronic diseases.[113,114] Historically, chronic diseases were thought to begin in adolescence or early adulthood and take decades to develop, with symptoms generally not occurring until older age. However, many types of chronic diseases are now impacting the health and longevity of young and middle-aged adults, with significantly higher rates of obesity and chronic diseases impacting Black Americans compared to White Americans.[3,115–117] Black Americans also have a greater number of nutritional inadequacies, comorbidities, earlier chronic disease onset, worse treatment outcomes, and nearly twice the mortality rates as White Americans.[31,117–119]

To meet nutrient needs, and reduce the risk for obesity and chronic disease, current DGA guidance recommends that adults consume 3 servings of dairy per day, regardless of age, ethnicity, or energy requirements.[16] Of the major food groups recommended by the 2020–2025 DGA, dairy foods have a nutrient profile that most closely matches the nutrients that Black Americans are commonly underconsuming. However, in part, due to lactose intolerance and other cultural factors, Black adults tend to consume only half of the recommended daily servings of dairy foods. Strategies that target misconceptions around lactose intolerance and help improve dairy intake among Black adults remain critical for helping to reduce chronic disease risk in this population.

In the last decade, several systematic reviews and meta-analyses have attempted to summarize the extensive body of research focused on dairy food intake and risks for major disease outcomes. The basic findings from these reports, which have largely focused on chronic diseases in adult populations, indicate that higher intake of nutrient-rich dairy foods (≥3 servings per day) is likely to be more beneficial for overall health and well-being than lower dairy intake (<2 servings per day). Two separate umbrella reviews, which summarized the findings from dozens of systematic reviews and/or meta-analyses on dairy intake and health outcomes found beneficial associations between higher dairy intake and decreased risk of obesity, osteoporosis, hypertension, stroke, CVD, METS, T2D, colorectal cancer, breast cancer, and Alzheimer's Disease.[120,121] These umbrella reviews also found that higher dairy intake could slightly increase the risk for developing prostate cancer and Parkinson's Disease.[121] In addition, a recent journal supplement published in the journal *Advances in Nutrition*, which consisted of several systematic reviews that were focused on dairy intake and chronic disease, found similar associations as the umbrella reviews, except they found neutral associations for higher dairy intake and prostate cancer, positive associations for higher dairy intake during pregnancy on infant and child health outcomes, and beneficial

effects of higher dairy intake on muscle health in older populations.[19]

**EVIDENCE-BASED RECOMMENDATIONS FOR IMPROVING PATIENT HEALTH – For Adults (18 to 59 years)**

- Individuals with lactose intolerance, which includes a large percentage of Black Americans, tend to have lower intake of dairy foods compared to other racial/ethnic groups. Achieving adequate intake of dairy foods and dairy nutrients, including calcium, magnesium, vitamin A, and vitamin D, is linked with lower rates of obesity and most chronic diseases.
- Yogurt and lactose-free milk and cheeses are excellent options for Black Americans, and/or individuals with lactose intolerance, and can help them meet the 3 recommended servings of dairy foods per day.
- Regular intake of fermented dairy products, like yogurt, appears to have the most protective effects against chronic disease risk. These foods also contain an array of nutrients and bioactive compounds that can beneficially impact health and well-being.
- Nearly all Black Americans are not meeting vitamin D intake recommendations. Fortified dairy foods are one of the primary sources of vitamin D in the food supply, and dairy fats can help facilitate the absorption of fat-soluble vitamins such as vitamin D. Higher intake of whole dairy foods may support an improvement in vitamin D status in Black Americans.
- Regular intake of "Functional Dairy Products," such as those that have been fortified with additional health-promoting nutrients, including high-quality protein, vitamin A, vitamin D, and/or bioactive compounds, like probiotics, bioactive peptides, and antioxidants, may improve the efficacy of these foods for body weight regulation, physical performance, and reducing disease risk.

## OLDER ADULTHOOD (60+ YEARS)

The transition to older adulthood is generally marked by progressive alterations in energy and nutrient needs, and detrimental changes in body composition, metabolism, cognitive function, and immunity.[122] These changes are among the most impactful age-related factors associated with declining health and the development of chronic disease.[122] In the US, the prevalence and severity of age-related chronic disease is significantly higher in older Black Americans than in White Americans.[9] Early-life exposures to racial/ethnic and socioeconomic stressors appear to have lasting effects and do not 'reset,'[123] even if an individual is able to attain higher socioeconomic status or higher diet quality later in life. Rather the negative biological burden (i.e., allostatic load) of one's early- and mid-life history tends to continuously impact their health and well-being throughout their later life stages.[124] For Black Americans, this often shows up in the form of an accelerated aging process that impacts both body and brain.[10] Therefore, not only do Black Americans tend to have higher rates of most common chronic diseases, but they also tend to develop them earlier in life compared to White Americans - meaning that when Black Americans transition to older adulthood they have already been living with certain diseases and their complications for much longer.[9] Additionally, as the US population ages and becomes more diverse, the burdens of age-related chronic disease are expected to disproportionately impact minority groups such as Black Americans in both prevalence and severity.[1]

Current DGA guidance recommends that older adults consume 3 servings of dairy per day, regardless of age or energy requirements, to meet their dietary needs which include lower calorie requirements along with higher demand for protein, calcium, potassium, vitamin B12, and vitamin D.[16] Dairy foods are recognized as supplying several of the nutrients that are most commonly inadequately consumed by older Black Americans, with more liquid forms of dairy foods such as milk also being listed as ideal options for improving hydration status in geriatric populations.[16] Whey protein supplements and other dairy-protein based functional beverages have been shown to be particularly effective for reducing age-related muscle loss and improving nutrient status.[84] When compared to other protein- and nutrient-rich foods such as meat, seafood, and eggs, dairy foods tend to be more cost-effective and require less preparation (i.e., cooking, seasoning, cleaning), making them both affordable and practical options for helping older adults meet their dietary needs.[125,126]

Due to their higher nutritional needs, older Black populations that limit or avoid dairy food intake due to lactose intolerance, restrictive dietary patterns, low-appetite, or for other reasons, are likely underconsuming multiple essential nutrients that support healthy aging. Fermented dairy products which are generally nutrient-rich and low in lactose are also an optimal delivery system for certain live and active cultures like lactic acid bacteria and bifidobacteria that can benefit both physical and mental health, indicating that the daily intake of fermented dairy foods pro-

vides an ideal foundation for dietary patterns aimed at healthy aging.[67,127–129] Overall, the evidence reported in multiple systematic reviews and/or meta-analyses shows that higher dairy intake among older adults is associated with better musculoskeletal health[23,71,125,130–132] - especially when consumed in conjunction with beneficial lifestyle practices, such as habitual exercise.[133] The limited body of evidence on higher dairy intake and neurocognitive or immune outcomes is less clear, but does show promise for benefitting aging populations, especially when fermented and fortified dairy products are regularly consumed as part of an anti-inflammatory dietary pattern.

**EVIDENCE-BASED RECOMMENDATIONS FOR IMPROVING PATIENT HEALTH – For Geriatrics (≥60 Years)**

- Most older Black Americans are underconsuming dairy foods and dairy nutrients. Regular daily intake of dairy foods as part of a healthy diet throughout the life course is associated with slower physical decline in geriatric populations. The impact of higher dairy intake on geriatric health appears greatest in populations with chronically low-calcium intake and vitamin D intake.
- Dairy foods, especially fermented and/or fortified products, contain several nutrients and bioactive compounds that are associated with better musculoskeletal health in geriatrics. Yet, older Black Americans tend to have lower dairy intake and higher bone and muscle mass than other racial/ethnic groups. More research is needed to better understand the relationship between diet, genetics, and musculoskeletal health in this population.
- Higher dairy intake is associated with lower risk for several factors, including nutrient deficiencies, inflammation, and hypertension, which have been associated with cognitive decline. Fermented dairy foods likely have additional benefits on brain health due to the neuroprotective effects of live and active cultures on the gut microbiome and gut-brain axis. Future research is needed to understand the impact of different dairy foods or dairy amounts on neurocognitive health among older Black Americans.
- Dairy foods, especially fermented and/or fortified products, are recommended sources of several immune-modulating micronutrients and bioactive compounds that have shown promise for supporting immunity in older adults. More research is needed to confirm the impact of different dairy foods or dairy amounts on immune function among older Black Americans.

(*continued on next page*)

- Liquid dairy products such as milk and supplemental dairy-based nutritional shakes (e.g., Ensure®, Boost®, Glucerna®) can help older Black Americans who struggle to meet their hydration and nutritional needs from diet alone.

## MANAGEMENT OPTIONS FOR LACTOSE INTOLERANCE

Lactose is a disaccharide in milk that cannot be absorbed intact and must either be broken down in the small intestine by the lactase enzyme to its constituent monosaccharides (glucose and galactose) or broken down in the colon by lactase-producing bacteria. The genetic ability to produce adequate lactase in the small intestine after childhood is called "lactase persistence," whereas the inability to do so is called "lactase non-persistence." Importantly, a deficiency in lactase production, (i.e., lactase non-persistence), may occur due to reasons other than genetics. Dietary factors, environmental factors, and/or disease states that result in small intestinal damage to the tissues that produce lactase may cause a "secondary lactose intolerance," which is often a temporary form of lactase-non persistence that goes away after the intestinal damage has been resolved.[134]

In clinical practice, not all individuals with lactase non-persistence are lactose intolerant, and there is substantial variation among lactose intolerant individuals in how much lactose they can comfortably consume as well as in the type, extent, and severity of symptoms they may experience. Some individuals with lactase non-persistence are able consume milk and dairy foods without developing symptoms whereas others require lactose restriction.[135] Approximately 70–75% of Black Americans are lactase non-persistent and a large percentage of this population avoids dairy products because they have either been diagnosed with lactose intolerance by a medical professional or they perceive themselves to be lactose intolerant without obtaining a valid medical confirmation.[29] These distinctions are important as perceived lactose intolerance is often due to other dietary or medical factors besides lactase non-persistence. Due to the nutrition and health benefits associated with regular intake of dairy foods, the National Institutes of Health (NIH) has recognized that dairy avoidance due to self-diagnosis of lactose intolerance is a public health problem.[136] The issue of unnecessary dairy avoidance is a critical issue for the health and well-being of Black Americans since the vast majority of this population is chronically underconsuming multiple nutrients of

public health concern that are most prominently found in dairy foods.[28,37]

Research studies show that many individuals with lactase non-persistence may still be able to consume ~12–25 g of lactose (1–2 servings of milk) at a time without having any noticeable symptoms.[29,137] These findings indicate that an individual's ability to digest lactose depends on more than their ability to produce lactase in their small intestine, and also likely depends on factors such as their gut microbiome's ability to produce lactase in the colon, the specific type or subtype of dairy product(s) being consumed, and the other foods that are consumed around the same time that lactose is consumed.[137] Thus, the idea that individuals with lactase non-persistence cannot digest lactose is more of a cultural myth than medical dogma, as the ability to digest lactose and avoid symptoms of lactose intolerance differs between individuals and is based on many more factors than lactase persistence genetics.[137] Overall, from a medical perspective, the consequences of underconsuming or avoiding dairy foods far outweigh the benefits and could have serious negative health impacts across the life course.[138,139]

While lactose intolerance is a complex health issue, it is relatively easy to manage through dietary modifications and/or supplementation.[14] These management options include 1) consistently consuming dairy foods over time to allow for colonic microbial adaptation by lactose-digesting bacteria, 2) replacing lactose-containing products with lactose-reduced dairy products in the diet, 3) consuming higher levels of fermented dairy foods which are low in lactose and rich in live and active cultures, 4) reducing the intake of other dietary components such as gluten that may negatively impact intestinal lactase production, 5) consuming lactose-containing products with other foods or within the context of meals, 6) only consuming small to moderate amounts of lactose at time, 7) regularly taking probiotic supplements that contain lactose-digesting bacteria, and/or 8) taking lactase enzyme supplements before consuming lactose-containing foods.[134,140]

## COLONIC MICROBIAL ADAPTATION

While the regular intake of lactose-containing foods over time does not appear to induce changes in expression of the lactase enzyme in the small intestine, it may lead to adaptation of lactose-digesting bacteria in the colon.[141,142] In lactase non-persistent individuals, lactose will pass through the small intestine to the colon, where it often causes gastrointestinal distress. However, when lactose-containing foods are consumed on a regular basis, the colonic microflora that breakdown lactose can adapt to the higher lactose content, and may thereby help minimize lactose intolerance symptoms.[142] In this sense, lactose that ends up intact in the colon can serve as a selective prebiotic that may improve the composition of the microbiome and contribute potential health benefits.[143] The scientific literature on the ability of the colonic microbiome to adapt to regular lactose intake suggests that many lactase-deficient individuals may be able to consume a serving of milk (~12 g of lactose) or more with few to no noticeable symptoms, and that consuming lactose-containing foods with a meal may reduce symptoms even more as it slows the movement of lactose through the intestinal tract.[29,137,144]

## LACTOSE-FREE DAIRY PRODUCTS

There are several lactose-free and low-lactose dairy products available on the market that contain an otherwise full spectrum of dairy nutrients and bioactive compounds. These options include lactose-free milk, yogurts, kefirs, and most cheeses. Lactose-free milk generally has the lactose removed by processing techniques that filter out the lactose and/or add lactase enzymes to breakdown the lactose into glucose and galactose.[29,145] These lactose-free dairy products are well-tolerated by individuals with lactose intolerance. Lactose-free milk-based infant formulas also exist to cater to infants and toddlers with lactose intolerance, and a large percentage of dairy-based dietary supplements such as whey protein powders and ready-to-drink nutritional beverages also come in lactose-free varieties.

## FERMENTED/PROBIOTIC DAIRY PRODUCTS

Dairy products such as yogurt, kefir, and cheese are low in lactose because they have undergone fermentation by bacteria (as well as yeast in the case of kefir) that are able to consume lactose, and at the same time are able to produce an array of new bioactive metabolites that can promote human health.[146,147] Many fermented dairy products also provide beneficial live and active cultures that can survive digestion and alter the human gut microbiome composition towards microbes that preferentially consume lactose, thereby minimizing the amount of lactose in the colon that can cause intolerance symptoms. In addition to centuries of anecdotal evidence suggesting that fermented dairy products could improve the storage capacity, safety level, and health profile of dairy foods,[148] a growing body of research on fermented dairy foods and lactose intolerance dating back to the 1970s shows that regular intake of these foods are well tolerated by nearly all individuals with lactose intolerance,[149–151] and can substantially help reduce symptoms of lactose intolerance.[138] The impacts of regular yogurt intake on reducing lactose intolerance

symptoms and reducing hydrogen in the breath may even be seen at levels as low as one serving of probiotic yogurt per day, and as soon as one week after daily intake commences.[152] The specific types of probiotic strains used in yogurt production can have different impacts on lactose levels and gut health, with lactic acid bacteria and bifidobacteria showing some of the most promising effects for reducing lactose intolerance symptoms.[146]

## OTHER DIETARY MODIFICATIONS

In addition to allowing for colonic microbial adaptation or consuming lactose-free and fermented dairy foods, there are several other dietary modifications that can help reduce or eliminate the symptoms of lactose intolerance. These options include: 1) limiting or removing certain non-dairy foods from the diet that may cause sensitivity reactions that negatively impact intestinal health and lead to "secondary lactose intolerance", 2) making sure to consume lactose-containing products with other foods or within the context of meals, and 3) only consuming small to moderate amounts of lactose at time.

There are several disease states such as gastroenteritis, celiac disease, and Crohn's disease which impact, and are impacted by diet. These diseases can create inflammatory reactions in the small intestinal tissues that impair the production or release of the lactase enzyme and result in a temporary form of lactose intolerance known as "secondary lactose intolerance." This form of lactose intolerance can often be resolved with dietary modifications such as removing the offending food or ingredient, but may require medical attention to adequately manage or treat the underlying condition.[153] Similarly, sensitivities to different dietary components (e.g., gluten, fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAPs)) may also cause damage to the lactase-producing small intestinal tissues and result in a secondary lactose intolerance. In these cases, lactose intolerance can be greatly reduced when those dietary components are removed from the diet.[154]

Research has also shown that symptoms of lactose intolerance can be limited by consuming milk with meals because the other foods in the meal can slow down stomach emptying and the intestinal transit time of lactose.[29] In these types of controlled studies, nearly all participants who initially reported having lactose intolerance, many of which were Black Americans, were able to consume at least one glass of milk within the context of a meal with no noticeable symptoms. These results were found to extend to multiple meals in a single day even for individuals who reported having severe lactose intolerance.[155]

Another simple dietary modification that can improve lactose intolerance symptoms is to consume small amounts of lactose-containing foods throughout the day which contain lactose levels below the threshold that induces intolerance symptoms.

## PROBIOTIC SUPPLEMENTS

The effects of consuming probiotic bacteria to improve lactose digestion have been studied for the last four decades,[156] with certain probiotic strains demonstrating greater ability to digest lactose and reduce lactose intolerance symptoms than others.[157] Systematic reviews published in 2019 (15 RCTs)[158] and 2020 (9 RCTs)[138] that were focused on the effects of probiotic supplementation on lactose intolerance both reported overall benefits of supplementation on intolerance symptoms with varying degrees of efficacy from different probiotic strains and doses. The most promising probiotic strains researched to date for reducing symptoms of lactose intolerance are members of the genus *Bifidobacterium and Lactobacillus*. Outcomes reported from higher intake of these probiotics included reductions in exhaled hydrogen, bloating, flatulence, cramping, diarrhea, and vomiting. Additional research has also shown that the addition of vitamin B6 to *Bifidobacterium and Lactobacillus* supplements may improve their ability to improve gut dysbiosis and alleviate persistent symptoms of lactose intolerance.[159]

## LACTASE SUPPLEMENTS

The enzyme lactase is also available to be taken as a dietary supplement 5 to 30 min before meals which can help breakdown the lactose in dairy products after consumption. Clinical research shows that when compared to a placebo, the use of lactase tablets before a 25 g to 50 g lactose challenge test (equivalent to the lactose in 2 to 4 glasses of milk), resulted in 40% to 55% lower cumulative breath hydrogen levels and 45% to 88% reductions in symptoms of bloating, abdominal pain, flatulence, and diarrhea over the course several hours.[160-164] Lactase enzymes are also available in supplements that contain additional digestive enzymes and/or probiotics, and may therefore be even more effective for improving diet-related gut dysbiosis than lactase alone.[165] The combination of supplemental lactase enzymes along with probiotic supplements could provide dual-action benefits since the target of lactase supplements is to breakdown lactose in the small intestine, while probiotic supplements may improve the profile of lactase-producing bacteria in the colon.

## MILK SUBSTITUTES/DAIRY ALTERNATIVES

The replacement of dairy products with plant-based alternatives such as soy, rice, almonds, coconuts, hemp, and oats is another management option for individuals with lactose intolerance. However, this option should be approached with caution to avoid nutrient imbalances commonly associated with removing nutrient-dense animal-sourced foods from the diet.[166] While higher intake of minimally processed plant-based foods such as fruits, vegetables, whole grains, legumes, nuts, and seeds are associated with reductions in the risk for several chronic diseases and provide complementary nutrition to animal-sourced foods,[25] the health benefits of many plant-based dairy alternatives are not as clear. Plant-based foods and beverages which are meant to mimic the flavors and textures of dairy foods (but not the nutritional value) undergo various forms of food processing that dramatically alter their food matrices and negatively skew their nutrient profiles compared to their whole food forms. For instance, plant-based dairy substitutes tend to have lower nutrient-density, higher sugar content, and lower fiber compared to the foods they were derived from.[19] They also tend to contain several added ingredients such as sweeteners, stabilizers, and flavors that are included for improving consistency, palatability, and shelf-life and may negatively impact health.[167] There is major variability among the hundreds of plant-based alternative milks, yogurts, and cheeses available today, and when compared to dairy foods, these alternatives also tend to contain lower levels of protein, calcium, iodine, zinc, vitamin B12, and vitamin D,[168–170] and at the same time have higher levels of antinutrients such as oxalates, phytates, and tannins that can negatively impact nutrient absorption.[168,171] Moreover, the forms of protein and calcium in plant-based alternatives are thought to be inferior to those found in dairy foods.[172] Although calcium fortified soy beverages have been included in the 2020–2025 DGA as the only plant-based option that comes close to the nutritional contributions of dairy foods, this distinction is based on a small subset of nutrients, namely protein, calcium, vitamin A, vitamin D,[16] and may be misleading to those who are attempting to replace dairy foods with foods that are both nutritionally and bioactively equivalent. Several researchers have also reported that severe nutritional deficiencies and negative health outcomes can occur when inappropriately substituting nutrient-poor plant-based alternatives in place of nutrient-rich dairy products.[171,173,174]

From a health perspective, dairy products and their plant-based alternatives are nutritionally and bioactively very different foods, and should be considered more so as complementary foods rather than as equivalent or interchangeable dietary options.[25] In sum, the currently established dietary guidance showing regular daily intake of dairy foods as part of healthy dietary patterns should not be extrapolated to plant-based alternatives, and much more research is necessary to better understand the health impacts of the various dairy food alternatives available for humans consumption.[19,172]

**EVIDENCE-BASED RECOMMENDATIONS FOR IMPROVING PATIENT HEALTH: LACTOSE INTOLERANCE – MANAGEMENT OPTIONS**

- **Consume lactose-free dairy products:** These products, which have had the lactose filtered out, and/or have been treated with lactase enzymes, contain all the nutrients of regular dairy products, except for lactose.
- **Consume fermented products such as yogurt, kefir, and cheese:** Due to the fermentation process, these products are generally low in lactose and contain live and active cultures and other health-promoting bioactive compounds.
- **Increase and maintain frequency of consumption of lactose-containing dairy products over time to improve colonic microbial adaptation**: Tolerance to lactose is improved with repeated exposures that allow for the microbes in the colon to adapt and produce additional lactase that allow them to better digest lactose and reduce intolerance symptoms.
- **Consume lactose-containing dairy products with meals**: The co-consumption of other foods with lactose-containing dairy foods can slow the transit of lactose through the gastrointestinal tract, giving it more time to be digested and thereby reducing the symptoms of lactose intolerance.
- **Consume lactose-containing dairy products in small doses**: Most individuals with lactose intolerance can consume ~12 g of lactose (1 glass of milk) or more at a time without symptoms. However, if this amount is not tolerable, it is recommended to consume smaller doses more often to still meet nutrient intake recommendations.
- **Take probiotic supplements**: Regular intake of certain probiotic supplements, which contain strains of lactic acid bacteria and/or bifidobacteria, can alter the gut microbiota and improve the digestion of lactose that arrives in the colon.
- **Take lactase supplements prior to meals with lactose-containing dairy products**: The intake of lactase-containing supplements 5 to 30 min prior to a meal can assist in the breakdown of lactose in meals and significantly reduce lactose intolerance symptoms.

## GAPS, LIMITATIONS, AND OPPORTUNITIES

The relationships between diet and disease have been investigated by researchers for centuries,[175] yet there are still many unknowns concerning food and health to still be discovered, including the roles of genetics and epigenetics, the effects of food matrices and food processing, the impacts of bioactive food compounds, and the bidirectional influences of the gut microbiome and immune system. There are also several factors impacting these diet-disease relationships which have often been overlooked or ignored in mainstream research such as the role of systemic racism, socioeconomic stressors, adverse life events, and other racial/ethnic disparities. Understanding the roles that these factors play in mediating and moderating the relationships between diet, life stage, and disease will be invaluable for improving overall health and health equity across the life continuum.

US dietary guidance that supports the inclusion of dairy intake for human health has been around for more than a century.[17] The majority of the research that supports this guidance has overwhelmingly been focused on White populations and has failed to include adequate representation of racial/ethnic minorities.[176] Therefore, many of the present research findings on dairy intake and health must be extrapolated from White to Black populations, which may dilute some of their accuracy. Furthermore, while there is a massive body of scientific literature available on dairy intake and health outcomes in adult populations, the research is limited regarding more vulnerable life stages such pregnancy, lactation, fetal development, infancy, childhood, and adolescence. Although the reproductive life stages of pregnancy and lactation are the briefest life stages, they each encompass critical windows of time in which adequate nutrition is imperative for the health of both the mother and offspring. During these developmental windows, breastmilk, dairy-based infant formulas, and dairy foods can all play vital roles in protecting and promoting health from one generation to the next and in helping to set the stage for a more equitable future. These reproductive and early developmental life stages deserve considerably more research, medical, and policy attention – as do the formative years during the childhood and adolescent life stages, which lay the foundation for long-term health and reproductive success. If health equity is to be achieved for Black Americans and other racial/ethnic minorities in the US, research and education efforts must specifically target the nutrition and health of the most vulnerable members of these populations during their most vulnerable life stages.

For health professionals, there are several key opportunities to help Black patients, families, and communities improve their nutrition and health. Many of these opportunities revolve around improved education of both physicians and patients, as well as improved networking and information sharing.

**FOR HEALTH PROFESSIONALS: OPPORTUNITIES AND KEY MESSAGING TO HELP IMPROVE NUTRITION AND HEALTH EQUITY**

- Discuss the importance of a medically accurate diagnosis of lactose intolerance since incorrect self-diagnosis may lead to the unnecessary exclusion of dairy products from the diet and result in inadequate intake of essential nutrients.
- Provide information on the numerous management options allowing individuals with lactose intolerance to be able to consume adequate dairy nutrition with minimal or no symptoms (e.g., consuming lactose free dairy foods, consuming fermented dairy foods like yogurt, consuming milk with meals, taking lactase and/or probiotic supplements).
- Provide recommendations for the most appropriate dairy types (milk, yogurt, cheese), subtypes (fermented, vitamin D fortified), and number of daily servings for optimal dairy intake at different life stages.
- Discuss the potential nutritional dangers of improperly substituting nutrient-rich milk and dairy foods for nutritionally inferior alternatives.
- Recommend community and government food and nutrition programs (e.g., WIC, SNAP) that are designed to help improve diet-quality for vulnerable populations such as racial/ethnic minorities, mothers, children, and individuals or families with low-incomes.
- Seek out additional training that focuses on the critical issues for Black populations surrounding dairy foods, cultural barriers, and health disparities.
- Keep up to date on research focused on improving the nutrition and health of Black Americans. For example, review and share findings from major research studies on Black American health such as the Jackson Heart Study, Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) Study, REasons for Geographic And Racial Differences in Stroke (REGARDS) Study, and Black Women's Health Study (BWHS).

(*continued on next page*)

- Join or build networks of healthcare professionals, community organizations, government organizations, researchers, and educators to work together on strategies to promote the role of healthy dietary patterns and nutrient-rich dairy foods in supporting health equity.

There are still many opportunities for improving nutrition and health research, education, and public health policy to better achieve health equity. One major opportunity to reduce health disparities for Black populations is to promote dietary interventions and other strategies to improve diet quality, especially for increasing intake of nutrient-rich dairy foods that have been fermented and/or fortified with additional probiotics, vitamin D, and other health-promoting bioactive compounds. In recent years, a growing number of special interest groups have suggested that the DGA lower its recommendations for dairy foods and instead provide greater promotion of plant-based alternatives. These suggestions often cite a racial/ethnic bias associated with dairy food recommendations since most racial/ethnic minorities in the US have significantly higher rates of lactase non-persistence than White Americans.[29] However, lactose intolerance is a manageable condition, and does not require dairy food avoidance. Rather, dairy avoidance is considered a poor management option for lactose intolerance since avoiding dairy foods is associated with multiple nutrient inadequacies that negatively impact health.

## CONCLUSIONS

Major health disparities exist between Black and White Americans at all life stages: starting with greater maternal and infant mortality rates and culminating in a lowered life expectancy for Black populations.[177,178] The risks for diet-related diseases such as nutrient deficiencies, obesity, cardiometabolic disease, and certain cancers are also elevated in many Black populations. The underlying causes of these health disparities are attributed to multiple factors, including systemic racism, genetic polymorphisms, lower socioeconomic status, and personal health behaviors such as unhealthy dietary patterns. Of the multiple risk factors associated with poor health in Black Americans, improving diet quality is one of the most readily modifiable and most effective methods for improving health across the lifespan, and across generations - as is the case for pregnant and lactating mothers whose diets impact both the short-term and long-term health of their offspring.

Important dietary modifications for Black Americans, such as improving adherence to DGA recommendations for food group and nutrient intakes, limiting intake of fast foods and sugar-sweetened beverages, and properly diagnosing and managing lactose intolerance, can all help reduce health disparities and lead to improvements in health span and life span. Despite the best of intentions, following this dietary advice may be challenging for many Black Americans who have misconceptions regarding the health impacts of dairy foods or dairy alternatives.[12,136] Therefore, evidence-based and culturally appropriate strategies for addressing barriers to healthy eating are needed to improve health equity, especially for dairy foods, which are the main contributors to several of the nutrients that are inadequately consumed by Black populations and associated with impacting chronic disease risk.[34,179]

Although lactose intolerance is a major barrier to adequate dairy intake for Black Americans, many individuals with lactose intolerance can tolerate the lactose in one glass of milk (~12 g lactose) or more, multiple times per day with minor symptoms or no symptoms at all.[29,137,144] For individuals who do have symptoms, there are several simple, affordable, and accessible options for managing lactose intolerance. The most ideal lactose management option is to regularly consume fermented dairy products (yogurt, kefir, cheese) that are low in lactose and able to provide the full range of dairy-derived nutrients as well as additional bioactives compounds that can improve health. Other excellent options for avoiding the symptoms of lactose intolerance include the regular daily intake of lactose-free dairy products, the regular intake of lactase-promoting probiotics, the intake of lactase enzyme supplements before meals, and/or the intake of milk and other lactose-containing dairy foods with meals. The exclusion of dairy products in favor of nutritionally inferior dairy alternatives is considered a poor management option for lactose intolerance as this could result in multiple nutrient inadequacies and unintended negative health outcomes.[180,181]

Research findings from the largest analyses on dairy intake and health outcomes (i.e., publications that aggregate the results from multiple systematic reviews and/or meta-analyses) consistently show that higher intake of nutrient-rich dairy products is associated with reduced risk for many of the most common chronic diseases affecting Americans of all racial/ethnic groups.[120,121] A recent umbrella review which assessed the data from 41 meta-analyses found that consuming just one additional cup of milk per day was associated with reduced risk for obesity, METS, CVD, osteoporosis, and colorectal cancer.[121] Other large evidence reviews also report that there are important health trade-offs to consider with higher dairy intake, such as a potential for slightly increased risks for Parkinson's disease and prostate cancer.[120,121] Nevertheless, the many potential benefits of higher dairy intake are thought to clearly outweigh these limited risks, especially when

intake of fermented and vitamin D fortified dairy products are prioritized in dietary patterns. Furthermore, the burgeoning research on dairy foods that have been fortified with additional dairy proteins, oligosaccharides, probiotics, phytochemicals, and/or omega-3 fatty acids suggest that these functional foods could provide additional dietary strategies for improving health across the life continuum.

Overall, the conclusions from the largest umbrella reviews, systematic reviews, and meta-analyses in recent years confirm the findings from those published a decade prior, indicating that higher total dairy intake, and especially higher fermented and fortified dairy intake, is consistently associated with reduced risk for the most prominent chronic diseases that impact Americans – as well as those that disproportionally impact Black Americans. Given that Black Americans tend to carry a higher allostatic load and chronic disease burden than White Americans, especially in the later life stages, this population may benefit even more from higher intake of dairy foods than populations that do not have to contend with a lifetime of systemic racism and other stressors that negatively impact health. In sum, our series of evidence reviews strongly indicates that Black Americans would receive significantly greater nutrition and health benefits by meeting DGA recommendations or daily dairy intake than they would from continuing to fall short of these recommendations.

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