

# ADEQUATE NUTRIENT INTAKE CAN REDUCE CARDIOVASCULAR DISEASE RISK IN AFRICAN AMERICANS

Molly E. Reusser, BA, Douglas B. DiRienzo, PhD, FACN,  
Gregory D. Miller, PhD, FACN, and David A. McCarron, MD, FACP  
Portland, Oregon

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Cardiovascular disease kills nearly as many Americans each year as the next seven leading causes of death combined. The prevalence of cardiovascular disease and most of its associated risk factors is markedly higher and increasing more rapidly among African Americans than in any other racial or ethnic group. Improving these statistics may be simply a matter of improving diet quality. In recent years, a substantial and growing body of evidence has revealed that dietary patterns complete in all food groups, including nutrient-rich dairy products, are essential for preventing and reducing cardiovascular disease and the conditions that contribute to it. Several cardiovascular risk factors, including hypertension, insulin resistance syndrome, and obesity, have been shown to be positively influenced by dietary patterns that include adequate intake of dairy products. The benefits of nutrient-rich dietary patterns have been specifically tested in randomized, controlled trials emphasizing African American populations. These studies demonstrated proportionally greater benefits for African Americans without evidence of adverse effects such as symptoms of lactose intolerance. As currently promoted for the prevention of certain cancers and osteoporosis, regular consumption of diets that meet recommended nutrient intake levels might also be the most effective approach for reducing cardiovascular disease risk in African Americans. (*J Natl Med Assoc.* 2003;95:188-195.)

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Cardiovascular disease (CVD) is the leading cause of death among adult African Americans. Thirty-seven percent of all deaths in this population are attributable to CVD annually, and more

than 40% of African Americans have some form of the disease.<sup>1</sup> The prevalence of medical conditions known to increase the risk of developing CVD is staggering. National health agencies estimate that among adult African Americans, 36% have high blood pressure, nearly 12% of women and 9% of men have diabetes, and more than 60% are overweight, with 21% of men and 38% of women meeting the criteria for obesity.<sup>1, 2</sup> Obviously, the importance of identifying and implementing effective means for decreasing these conditions, along with their attendant and escalating personal and economic costs, cannot be overemphasized.

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© 2003. From the Academic Network, Portland, Oregon. Direct correspondence to: David A. McCarron, MD, Academic Network, 1221 SW Yamhill Street, Suite.303, Portland, OR 97205-2110; Telephone (503) 228 3217; fax: (503) 273 8778; or direct e-mail to dmccarron@academicnetwork.com.

Each of these risk factors for CVD is known to be modifiable by improvements in lifestyle and/or controllable with pharmaceutical agents.<sup>1-3</sup> However, their continuing high prevalence indicates that these approaches, as well as widespread campaigns promoting awareness, prevention, and treatment, are not attenuating the magnitude of the problem of CVD and its risk factors, particularly among African Americans.<sup>1,3</sup> To be successful, a CVD risk reduction strategy must be clearly proven effective. It must then be simple, convenient, affordable, and have few if any adverse effects. Finally, because CVD risk factors often cluster in an individual,<sup>4,5</sup> a successful strategy must be able to improve multiple conditions simultaneously.

Daunting though it may sound, such a strategy presently exists. As this paper will demonstrate, the means for preventing and managing CVD and many of its antecedent conditions is the regular consumption of a nutritionally replete diet, rich in dairy products, fruits, vegetables, and grains. Current data, combined with evidence from several decades of nutritional research, demonstrate that a high quality diet pattern, of which dairy foods are an essential component, can significantly diminish a number of known risk factors for CVD, as well several other increasingly prevalent medical conditions. Improving the diet offers the simplest and yet one of the most effective means of improving CVD risk and the general health of African Americans, as well as the entire US population.

## BACKGROUND

There has long been general agreement that a healthy diet is one that is high in fruits, vegetables, grain products, lean meats, and fiber, and low in fat.<sup>6,7</sup> Dairy products, however, have often been overlooked in dietary recommendations for various reasons. In efforts to reduce the content of fat in the diet, nutritional guidelines have suggested limiting intake of dairy products on the assumption that because many dairy foods contain dietary fat, they contribute to heart disease and obesity. Although this remains unproven, it has commonly been included in the nutritional advice of many

health organizations, and thus, has become entrenched in the practices of healthcare providers and the general public. On the basis of more recent data, however, many public and private health agencies are revising dietary recommendations to include dairy products as an important element of a health-promoting diet.<sup>3,6,8,9</sup>

In the past, emphasis on the "health value" of dairy foods was generally limited to the well-established role of calcium in the growth and maintenance of bone.<sup>10,11</sup> Since the early 1980s, when it was first reported that dietary calcium was inversely related to blood pressure levels,<sup>12,13</sup> calcium and/or dairy products have been shown to be associated with a variety of medical conditions, many of which are risk factors for CVD. Of these, the calcium-blood pressure connection has been the most extensively studied.<sup>14-20</sup> Today there is clear evidence of a relationship between low dairy product intake and elevated blood pressure levels in individuals and in populations at increased risk of hypertension.<sup>14-19</sup> It also has been shown that inadequate intake of multiple minerals, including calcium, potassium, and magnesium, rather than excess intake of any single nutrient, is most clearly associated with high blood pressure.<sup>18,19,21</sup>

## FROM SINGLE NUTRIENTS TO THE OVERALL DIET

As is commonly the case in dietary intervention studies, however, while many studies provided evidence that calcium intake influences blood pressure, others were unable to demonstrate a consistent effect, leaving in question calcium's role in hypertension management. Heterogeneous blood pressure responses are intrinsic to single-nutrient interventions: while many individuals may exhibit a favorable blood pressure response with a specific treatment (e.g., increased calcium, reduced sodium), others may respond negatively, and still others, not at all. Heterogeneity has been observed repeatedly in nutrient intervention studies, and has been a major factor in the inconsistent and often contradictory results of clinical trials examining blood pressure effects of individ-

ual dietary components.<sup>22, 23</sup>

The variations commonly seen both within and between nutrient studies have several possible explanations.<sup>24</sup> Observational surveys are limited by design to assess only certain nutrients, which may not necessarily include the one(s) having the primary effect. Because the effects of single nutrients are likely to be small, only large-scale clinical trials may be able to detect them. Supplemental forms of nutrients are commonly used in intervention trials and usually do not have the same physiologic effects as nutrients from food, which has been shown to be the case with calcium.<sup>17</sup> While these explanations each contribute to some degree to the inconsistencies in nutrient studies, of greater impact and importance may be the synergistic relationships of dietary components, which can enhance and also obscure their individual effects.<sup>22-25</sup>

The concept that it is the adequate intake of multiple nutrients in combination, rather than any single nutrient, that most directly influences a given condition exists throughout nutrition literature. In 1984, based on analysis of diet and blood pressure from the first National Health and Nutrition Examination Survey,<sup>13</sup> we concluded that the use of diet for the management of hypertension should emphasize "consumption of a diet balanced in all the essential nutrients." Reed et al.<sup>23</sup> suggested in 1985 that multicollinearity due to the interactions between nutrients makes it inherently difficult to isolate the effects of a single nutrient from those consumed concurrently. They concluded that: "If recommendations are to be made concerning nutritional prevention of hypertension, these data suggest that the focus be on a mixture of nutrients rather than on a specific item."

As a result of increasing numbers of investigations pointing in this same direction and expansion of our knowledge of nutrient actions, the approach in nutrition research in recent years has shifted from assessing a specific nutrient's effect to that of examining the effects of the total diet.<sup>24, 26-29</sup> Dietary nutrients are not ingested in isolation, but as combined constituents of a complete diet. Recognizing that nutrients express their physio-

logic actions through integrated pathways, it is unrealistic to expect a uniform benefit by modifying the intake of a single nutrient. The recent redirection of investigative efforts to the effect of the overall diet on various medical conditions is addressing many of the unresolved issues in this field of study, and enabling development of uniform and definitive dietary recommendations for cardiovascular health.<sup>27</sup>

## HYPERTENSION

The Dietary Approaches to Stop Hypertension (DASH) study, sponsored by the US National Heart, Lung, and Blood Institute, assessed the effects of the total diet, or dietary pattern, on blood pressure in persons with high-normal and mildly elevated blood pressure.<sup>24, 26</sup> Three diets were tested in DASH: a typical American diet (low in fruits, vegetables, and dairy and high in fat); a "fruits and vegetables" diet that included 8-10 servings of these foods daily; and a combination diet, known as the DASH diet, which also was rich in fruits and vegetables and included ~3 daily servings of dairy products. Sodium intake and weight, factors commonly associated with blood pressure changes, were maintained at constant (and in the case of sodium, equivalent) levels in all three diet groups during the eight-week intervention.

In the total DASH cohort, highly significant blood pressure reductions were achieved with the DASH diet compared with the typical American (control) diet. Systolic pressure was reduced by 5 mm Hg and diastolic by 3.0 mm Hg with DASH relative to the control diet. With the fruits and vegetables diet, blood pressure reductions, although significant, were only about half those achieved with the DASH diet. Among the participants with established hypertension, blood pressure reductions were even more dramatic. On the DASH diet compared to the control, systolic blood pressure decreased by 11.4 mm Hg and diastolic by 5 mm Hg.

Due to the disproportionately higher burden of hypertension and resultant CVD in African Americans,<sup>3</sup> the DASH study cohort was designed to comprise two-thirds minority participants (60%

African American, 6% who identified themselves as other than white or African American).<sup>30</sup> On the fruits and vegetables diet compared to the control, blood pressure reductions among the entire African American group were 3.5 mm Hg systolic and 1.4 mm Hg diastolic; with the DASH diet, containing dairy products, blood pressures were reduced by 6.9 and 3.7 mm Hg respectively. Among hypertensive African Americans, the fruits and vegetables diet reduced systolic and diastolic blood pressures by 8.0 and 3.4 mm Hg, whereas the DASH diet lowered pressures by 13.2 and 6.1 mm Hg, respectively.<sup>30</sup> Thus, the addition of dairy products to the diet pattern contributed to blood pressure reductions roughly double those achieved without dairy.

A second DASH study, DASH-Sodium, was done to examine the blood pressure effects of the DASH diet in combination with reduced sodium intake.<sup>29</sup> Again, minority and hypertensive participants were intentionally over-represented (60% and 41% respectively). In this study, persons who regularly consumed diets of poor nutritional quality experienced blood pressure reductions with lowered sodium intakes that were similar to those seen with the combination diet in the first DASH study. However, once participants were consuming the nutritionally replete DASH diet, restricting dietary sodium levels had little or no effect on blood pressure. With the exception of older persons with established hypertension, for the majority of participants, consuming the DASH diet alone provided the most significant blood pressure benefits.

The DASH-Sodium study confirmed the results of the first DASH study, demonstrating that the intake of a diet that meets currently recommended nutrient levels is the most effective nutritional approach for managing blood pressure. This DASH study also provided evidence that salt sensitivity, i.e. the tendency, particularly common among African Americans, to exhibit blood pressure increases with high sodium intakes, is not the immutable condition it was once believed to be, but it is actually modifiable by diet.<sup>31</sup> A diet containing the full complement of nutrients, including the min-

eral profile available primarily through dairy products (calcium, potassium, magnesium, phosphorus) can mitigate the negative effects of high salt intake on blood pressure in persons who are salt-sensitive

## **CORONARY HEART DISEASE AND STROKE**

Coronary heart disease is the single largest killer of American adults. Stroke, considered separately from other cardiovascular diseases, is the third leading cause of death in this country, behind heart diseases and cancer.<sup>1</sup> For coronary heart disease and stroke, incidence and death rates are both significantly higher in African Americans than in other ethnic groups for women and for men. Hypertension, which is also highly more prevalent among African Americans, is a primary risk factor for each of these conditions.<sup>1,3</sup> Based on the blood pressure reductions observed in the first DASH trial, it was estimated that population-wide adoption of the DASH diet could reduce coronary heart disease and stroke incidence by 15% and 27% respectively.<sup>26</sup>

Support for these potential improvements comes from the findings of Kant et al.<sup>28</sup> in their prospective study of the relationship between diet quality and mortality. They classified the dietary patterns of more than 42,000 women on the basis of intake levels of recommended foods, including fruits, vegetables, low-fat dairy, whole grains, and lean meats. Comparing the highest intake levels with the lowest, they found that in the high quality diet group, coronary heart disease risk was 30% lower, stroke risk was 40% lower, and all-cause mortality was 30% lower. In a cohort study of older men (50-70 yr.), dietary pattern meeting current recommendations was associated with 13% lower all-cause mortality than a low quality diet, and the authors concluded that "the dietary pattern as a whole is more important than specific dietary components with respect to survival among older people."<sup>32</sup>

## **INSULIN RESISTANCE SYNDROME**

The American Association of Clinical Endocrinologists recently reported that the preva-

lence of insulin resistance syndrome (IRS), also known as metabolic syndrome or syndrome X, has risen more than 60% in the past 10 years, and now afflicts as many as one in every three Americans.<sup>33</sup> IRS includes hypertension, abnormal glucose homeostasis, obesity, and dyslipidemia, all of which are contributing factors for type 2 diabetes and CVD. In their report on the effect of dairy intake on IRS, Pereira and colleagues<sup>34</sup> speculate that the marked increase in the prevalence of this combination of conditions may explain, at least in part, why CVD rates have stopped declining in recent years.

In addition to its favorable effects on individual conditions, adequate dairy intake has been shown to similarly and simultaneously influence those coexisting in IRS.<sup>34,35</sup> Mennen et al.<sup>35</sup> assessed the dietary intakes of nearly 5000 women and men to determine whether specific foods are associated with this syndrome. They found that in men, though not women, who regularly consumed dairy products ( $\geq 1$  serving/day) or bread ( $\geq 50$  g/day), there was a 40% lower prevalence of the metabolic syndrome than in those who did not. In a recently published population-based study designed to specifically examine associations between dairy food intake and IRS incidence, a strong inverse association between these factors among overweight adults was observed.<sup>34</sup>

The prospective Coronary Artery Risk Development in Young Adults (CARDIA) study<sup>34</sup> examined the independent effects of dairy product consumption on the development of IRS in more than 3000 black and white men and women between 18 and 30 years of age. CARDIA found that dairy intake was inversely related to the incidence of all of the components of IRS among overweight participants (BMI  $> 25$  kg/m<sup>2</sup>), but not among their leaner counterparts. In the former, the incidence of IRS decreased by more than 50% from the lowest category of dairy intake ( $< 10$  times/week) to the highest category ( $\geq 35$  times/week). Adjusted odds of developing IRS were more than 70% lower in those in highest category of dairy consumption compared to those in the lowest. The association between dairy intake

and IRS incidence was similar for African Americans and whites, and for men and women. CARDIA findings clearly link inadequate dairy intake to this constellation of risk factors known to dramatically increase cardiovascular disease risk.

## OVERWEIGHT AND OBESITY

In the past decade, the prevalence of excess body weight has reached epidemic levels throughout the US population, with the most rapidly increasing prevalence being seen in minority groups. Based on CDC statistics, between 1991 and 2000, the prevalence of obesity, defined as BMI  $\geq 30$ , among African Americans rose by nearly 50%, increasing from 19.3% of this population group to 29.3%.<sup>36,37</sup> Overweight and obesity are associated with 300,000 deaths each year in this country, and are directly linked to CVD, type 2 diabetes, IRS, certain types of cancer, and stroke, as well as a variety of respiratory, skeletal, and psychological disorders.<sup>37, 38</sup>

Observational and clinical studies have suggested that dairy product consumption favorably affects weight loss and/or maintenance.<sup>39-42</sup> Investigating the antihypertensive effect of calcium by increasing its intake from approximately 400 mg to 1000 mg/day with the addition of yogurt to the diets of obese African Americans, Zemel et al.<sup>39</sup> observed a 4.9 kg reduction in body fat. In a later analysis of the NHANES III database, these investigators found "a profound reduction in the odds of being in the highest quartile of adiposity associated with increases in calcium and dairy product intake."<sup>39</sup> A prospective study of dairy calcium intake and changes in body weight with a two-year exercise intervention by Lin and colleagues<sup>40</sup> found that participants with high dairy calcium intake (but not non-dairy) gained less weight and body fat over the duration of the study, regardless of exercise level. In a recent assessment of calcium intake in African American women with lactose maldigestion or intolerance, those who consumed higher amounts of dairy calcium weighed less and had lower BMI compared to the low calcium group.<sup>41</sup>

In an analysis of data accumulated from five calcium intake studies of various designs, Davies et al.<sup>42</sup> observed consistently negative associations between calcium and body weight; they estimated that a 1000-mg difference in calcium intake is associated with an 8-kg difference in mean body weight. The CARDIA trial<sup>34</sup> provides strong direct evidence of the benefit of increased dairy food intake on obesity incidence over a 10-year period, documenting a 30% reduction in the emergence of obesity in young adults who were overweight at initiation of the study. Collectively, these findings document the beneficial impact of increasing dairy food intake on the emergence of obesity.

## LACTOSE INTOLERANCE

Dairy products are clearly a critical component of a health-promoting diet, serving as the predominant food source of naturally occurring calcium and the mineral combination (calcium, potassium, magnesium) known to beneficially influence multiple CVD risk factors.<sup>25,43</sup> Achieving increased dairy food intake can be hindered by the common perception that many African Americans are unable to readily digest the lactose these products contain. Lactose maldigestion or intolerance is more prevalent among selected ethnic populations; some experts have estimated that it affects up to 75% of African Americans. Extensive investigative efforts have been undertaken to characterize true extent and the multiple causes of lactose maldigestion and to identify means to overcome its symptoms.<sup>44-46</sup> These studies have consistently shown that the effects of these conditions can be minimized, and in some cases eliminated, when a variety of dairy products are used and when they are consumed as part of complete meals.<sup>46-49</sup>

This is borne out by the evidence from the DASH study wherein three daily servings of dairy products, sufficient to provide recommended intake levels, were included in the combination DASH diet.<sup>26</sup> The dairy products used in this study were varied in type (milk, yogurt, cheese) and consumed as components of full meals. As noted above, the majority of DASH participants were African American, and with the higher inci-

dence of lactose maldigestion in this population, an increase in the symptoms of the condition would be expected in participants who were assigned to the dairy-rich DASH diet. Just the reverse was observed. The only adverse effect frequently reported in this study was constipation, which was reported least often with the DASH diet compared to the other two test diets. As noted by the DASH investigators, occurrence of any other gastrointestinal symptoms was infrequent and similar among all three diets.

## CONCLUSION

Recently available data confirm several decades of investigative efforts targeted at characterizing the association between cardiovascular health and nutrient intake. It is clear that a balanced diet that provides the full complement of dietary nutrients at currently recommended intake levels is essential for optimal health. We now know that in addition to their established roles in bone health and hypertension, dairy foods as part of a high quality diet afford protective benefits against a rapidly growing list of conditions, including the CVD risk factors discussed here, some forms of cancer, kidney stones, premenstrual syndrome, and hypertensive disorders of pregnancy.<sup>50</sup> Clearly, the primary dietary goal of all members of our society should be the regular consumption of a nutritionally complete diet. Dairy products are an essential component of such a diet and have been shown to be well tolerated and clinically beneficial in African Americans.

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