United States Department of Agriculture

Economic Research Service

Nutrition and Health Characteristics of Low-Income Populations

Clinic Measures of Iron, Folate, Vitamin B_{12}, Cholesterol, Bone Density, and Lead Poisoning

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As part of the 1988-94 National Health and Nutrition Examination Survey (NHANES-III), respondents completed a physical examination, blood tests, and body measurements in a Mobile Exam Center. Several measures of nutritional biochemistries, bone density, and lead poisoning provide a baseline to monitor the nutrition and health status of the U.S. population. Four subgroups of low-income Americans are the focus of this study: participants in the Food Stamp Program (FSP), participants in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), school-age children, and older adults ages 60 and above. FSP and WIC participants are identified in NHANES. Nonparticipants are separated into income-eligible and higher income groups using the income eligibility cutoff of 130-percent and 185-percent poverty level for FSP and WIC, respectively.

School-age children and older adults ages 60 and above are grouped into three income classes—lowest income (130 percent of poverty level or less), low income (greater than 130 and no more than 185 percent), and higher income (above 185 percent). Additional population groups are created using gender and age. Because of data limitations, the WIC portion of this summary presents findings only for children ages 1-4. This summary focuses on the nutritional biochemistry blood tests and bone density measures that showed differences between income groups.

Iron Deficiency, Anemia, and Iron Deficiency Anemia

The terms "iron deficiency," "iron deficiency anemia," and "anemia" are often used interchangeably, but they are not equivalent. Iron deficiency can contribute to anemia, but anemia also can be caused by other factors, including infection, inflammation, deficiencies of other nutrients, and hereditary anemia. When the prevalence of iron deficiency is high, anemia is a good predictor of iron deficiency. When the prevalence of iron deficiency is low, the majority of anemia cases are due to other causes (U.S. Department of Health and Human Services (HHS), 2000).

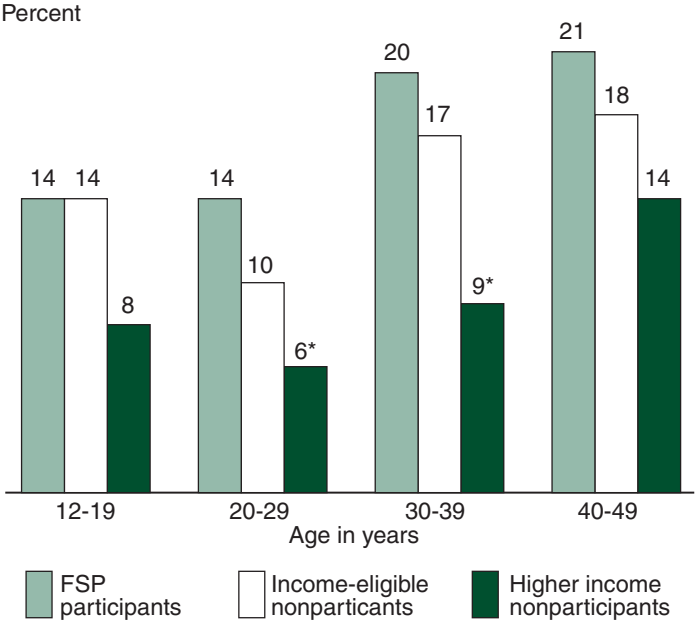
Iron deficiency is the most common form of nutritional deficiency in the United States (Centers for Disease Control and Prevention (CDC, 1997). Iron deficiency can lead to developmental delays, behavioral problems, and decreases in verbal learning and memory. It can also affect immune function, energy metabolism, and work performance (HHS, 2000; CDC, 1998; and Looker et al., 1997). The prevalence of iron deficiency has decreased dramatically over the past 3 decades, in part because of the influence of WIC on increased iron intake among infants and young children (Yip et al., 1987). Nonetheless, iron deficiency remains a problem for young children, particularly low-income children. The prevalence of iron deficiency for the U.S. population was about 6 percent. Prevalence was greatest among 1-year-olds (13 percent), females of childbearing age, ages 12-49 (8-15 percent), and females ages 80 and older (9 percent).

Anemia is defined based on low hemoglobin or hematocrit. The prevalence of anemia was 8 percent for the U.S. population, 8 percent for children ages 1-4, 6 percent among school-age children, and 14 percent among older adults. Iron-deficiency anemia is defined as being iron-deficient and having low hemoglobin. Iron deficiency anemia was observed in about 2 percent of all Americans and 1- to 4-year-old children, in less than 1 percent of school-age children, and in 3 percent of all older adults. The prevalence of iron-deficiency anemia was substantially smaller than the prevalence of the less narrow diagnosis of anemia.

Food Stamp Participants. FSP participants were twice as likely as higher income nonparticipants to be iron deficient (10 percent vs. 5 percent), to have anemia (14 percent vs. 7 percent), and to have iron-deficiency anemia (4 percent vs. 2 percent). Much of these differences were among females of childbearing age (fig. 1).

WIC Children. The overall prevalence of iron deficiency among 1- to 4-year-old children was about 6 percent. Prevalence was greatest among 1-year-olds and was lower for older children. Overall, WIC children were less likely than income-eligible children to be iron deficient (5 percent vs. 10 percent), but more likely than higher

Figure 1
Females of childbearing age with iron deficiency



*Statistically significant difference from FSP participants at the 0.05 level or better.
Source: National Health and Nutrition Examination Survey, 1988-94.

income nonparticipants to have anemia (9 percent vs. 6 percent). WIC children were also more likely than higher income children to have iron-deficiency anemia, although this was a relatively uncommon finding for all children, particularly those older than 2.

School-Age Children. School-age children in the lowest income group were more likely to be iron deficient than school-age children in the higher income group (6 percent vs. 4 percent). This difference was attributable to a difference among females (10 percent vs. 5 percent). Overall, there were no significant differences in the prevalence of anemia or iron deficiency anemia between the three income groups for school-age children.

Older Americans. Among older adults, 6 percent had iron deficiency, 14 percent had anemia, and 3 percent had iron-deficiency anemia. The relatively low prevalence of iron deficiency and iron-deficiency anemia observed in this population suggests that much of the anemia observed in older adults is likely due to causes other than iron deficiency, such as chronic disease, deficiencies of folate and/or vitamin B_{12}, gastrointestinal bleeding, and cancer. Although there were no differences between income groups in the prevalence of iron deficiency or iron deficiency anemia, the prevalence of anemia was greater in the lowest income group than in either of the other income groups (18 percent vs. 12-13 percent).

Low Red Blood Cell (RBC) Folate

Overall, 7 percent of the U.S. population, 6 percent of school-age children, and 5 percent of older adults had low levels of RBC folate, an indicator of long-term folate status. Adequate RBC folate levels are particularly important for women of childbearing age, because inadequate maternal folate has been associated with birth defects. RBC folate was not measured for children younger than 3. FSP participants were more likely than higher income nonparticipants to have low RBC folate (11 percent vs. 6 percent). School-age children in the lowest income group were more likely than children in either the low-income or higher income groups to have low levels of RBC folate (9 percent vs. 4 and 6 percent). The prevalence was greatest among 14- to 18-year-olds, especially females. Similarly, older adults in the lowest income group were more likely to have low levels of RBC folate than their higher income counterpart (9 percent vs. 3 percent).

Low Serum Vitamin B_{12}

Overall, 3 percent of the U.S. population, 1 percent of school-age children, and 5 percent of older adults had low serum vitamin B_{12} (not measured for children younger than 3). Vitamin B_{12} deficiency is observed more often among older adults than among other population groups, due to age-related gastrointestinal changes, including decreased levels of hydrochloric acid, which impede absorption of the vitamin. Low levels of vitamin B_{12} may contribute to anemia.

FSP participants were less likely than higher income nonparticipants to have low levels of serum vitamin B_{12} (2 percent vs. 3 percent). Overall, there were no differences among older adults between income groups in the prevalence of this condition. However, among the two oldest cohorts (ages 80-84 and 85 and above), the problem of low serum vitamin B_{12} was less common in the lowest income group than in the higher income group. These differences were concentrated among females.

Cholesterol

Elevated serum cholesterol levels have been associated with increased risk of coronary heart disease in adults. Further, there is evidence that the process of atherosclerosis, or the buildup of fatty deposits in the arteries, begins early in childhood. For children up to age 19, the National Cholesterol Education Program (NCEP) considers a serum cholesterol level of 200 milligrams per deciliter (mg/dL) or more to be high and levels between 170 mg/dL and 199 mg/dL to be borderline high (National Institutes of Health (NIH), 1991). For adults, serum cholesterol of 240 mg/dL or more is considered high, and levels of 200-239 mg/dL are considered borderline high (NIH, 2001).

Overall, 18 percent of the U.S. population, 10 percent of school-age children, and 33 percent of older adults had high cholesterol levels; 31 percent of the U.S. population, 28 percent of school-age children, and 36 percent of older adults had borderline-high levels of cholesterol.

FSP participants were less likely than income-eligible nonparticipants to have high serum cholesterol (16 percent vs. 19 percent).

Among females, FSP participants were less likely than either group of nonparticipants to have high cholesterol (16 percent vs. 20 percent and 19 percent). There were no differences between FSP participants and either group of nonparticipants in the prevalence of borderline-high cholesterol levels. There were few differences among children by income on blood cholesterol levels. Among older adults, neither the prevalence of high or borderline-high serum cholesterol varied by income.

Bone Density

A reduction in bone mass or bone density can lead to deteriorated or fragile bones (HHS, 2000). Reduced bone density, or osteopenia, has been defined as bone density that is 1 to 2.5 standard deviations below the mean for non-Hispanic White women between ages 20-29, as measured in the 1988-94 NHANES (National Center for Health Statistics (NCHS), 1999). Severely reduced bone mass, or osteoporosis, is defined as bone density more than 2.5 standard deviations below this norm. In NHANES-III, bone density was not measured for those younger than 20.

Male FSP participants ages 20-29 and 40-49 were less likely than their income-eligible or higher income counterparts to have reduced or severely reduced bone density. However, among those most at risk of osteoporosis—adults 80 and over—FSP participants were more likely than higher income nonparticipants to have severely reduced bone density (42 percent vs. 24 percent) (fig. 2).

Overall, 50 percent of adults 60 years of age and older had reduced or severely reduced bone density. Older adults in the lowest income group were more likely than those in the other income groups to have reduced or severely reduced bone density (58 percent vs. 48-50 percent). Older adults in the lowest income group were also more likely than other older adults to have severely reduced bone density—osteoporosis (21 percent vs. 14 percent).

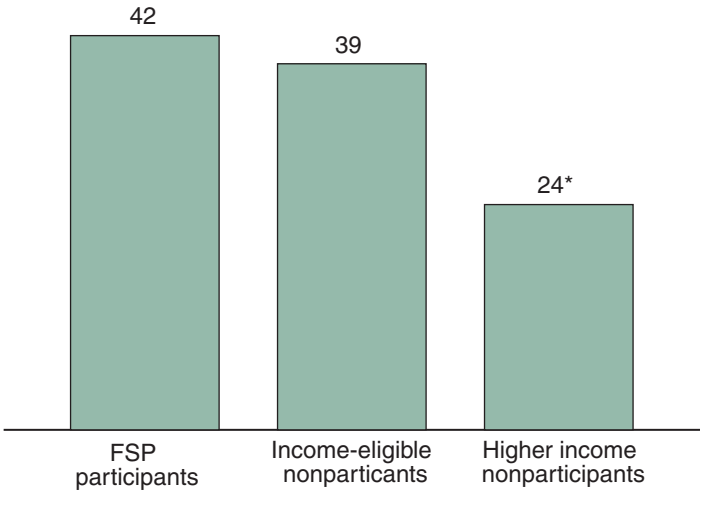
Lead Poisoning

The prevalence of lead poisoning has been declining sharply in recent years, from 77.8 percent in 1976-80 to 4.4 percent in 1988-91 (CDC, 1997). Based on 1988-94 NHANES laboratory tests and CDC-defined standards for elevated levels of blood lead, 3 percent of children ages 1-16 were found to have high levels of blood lead, indicative of lead poisoning. Prevalence was highest among the youngest age groups.

FSP children were more likely than children in either of the nonparticipant groups to have high levels of blood lead (fig. 3). Seventeen percent of 1- to 2-year-old FSP participants and 13 percent of 3- to 5-year-old FSP participants had abnormally high levels of lead in their blood, compared with 6 percent and 4 percent, respectively, for income-eligible nonparticipants, and 5 percent and 2 percent, respectively, for higher income nonparticipants.

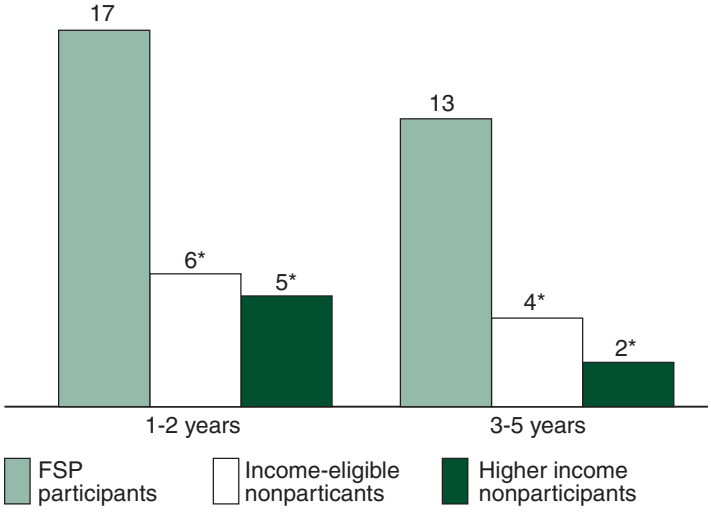
Similarly, the prevalence of high blood lead levels was greater for WIC children than for income-eligible or higher income nonparticipating children. Fourteen percent of WIC children had abnormally high blood lead levels, compared with 8 percent for income-eligible children and 3 percent for higher income children. Lead poisoning was being used as a nutritional risk criteria for WIC when 1988-94 NHANES was conducted.

Figure 2
Adults 80 and older with severely reduced bone density
Percent



*Statistically significant difference from FSP participants at the 0.05 level or better.
Source: National Health and Nutrition Examination Survey, 1988-94.

Figure 3
Children with high blood lead levels
Percent



*Statistically significant difference from FSP participants at the 0.05 level or better.
Source: National Health and Nutrition Examination Survey, 1988-94.

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For more information, see www.ers.usda.gov/publications/efan04014-1, 04014-2, 04014-3, 04014-4/.

NOTE: These studies were not designed to assess program impacts. Do not interpret any reported differences between program participants and nonparticipants as impacts of food assistance programs.