Dyslipidemia In Children

Nonpharmacologic approaches for early intervention

By Mallory E. McCord, PA-S, and Laura E. Lee, MHE, PA-C

Learning Objectives
1. Identify abnormal cholesterol levels in the pediatric population.
2. State the risk factors for dyslipidemia in the pediatric population.
3. Summarize the expert nonpharmacologic recommendations for preventing and treating dyslipidemia in the pediatric population.
4. Discuss the role of diet and exercise in children with dyslipidemia.

CARDIOVASCULAR DISEASE (CVD) is the leading cause of morbidity and mortality in the United States. Atherosclerosis begins in childhood and progresses through adulthood. Among the main causes of atherosclerosis and CVD is abnormal cholesterol levels—particularly elevated low-density lipoprotein (LDL) cholesterol, increased triglycerides (TGs) and decreased high-density lipoprotein (HDL) cholesterol. Because these processes begin early in life, it is important to correct abnormal lipid profiles during childhood to reduce the risk of subsequent negative outcomes such as CVD.

Healthcare providers must take special care to monitor risk factors in the U.S. pediatric population because of the ubiquity of unhealthy diets, decreased activity and increased rates of obesity, type 2 diabetes mellitus and metabolic syndrome in children. Although a number of pharmacologic options are available and under development, lifestyle changes such as diet, weight loss and increased physical activity remain the cornerstones of treating and preventing abnormal lipid levels in childhood. This article reviews the specific nonpharmacologic recommendations to prevent and treat dyslipidemia in the pediatric population.

Expert Recommendations
Because children grow rapidly from birth and progress through several developmental changes, childhood cholesterol levels can vary from year to year, unlike the normal adult lipid profile. This progression is important, because healthcare providers must take into account age and development when considering the pediatric lipid profile.

No correlation has been found between abnormal lipid levels in children younger than 2 years and future outcomes of dyslipidemia in adolescence or adulthood. Therefore, assessing lipid profiles before 2 years old is not recommended.

In children older than 2 years, total cholesterol levels peak between ages 9 and 11, decrease during puberty and increase after puberty. Because of these fluctuations, the American Academy of Pediatrics (AAP) has adopted multiple sets of guidelines for the assessment of lipid profiles in children. The National Heart, Lung, and Blood Institute’s National Cholesterol Education Program (NCEP) guidelines use total cholesterol and LDL to classify children between 2 and 18 years into acceptable, borderline or elevated categories.

While the NCEP recommendations do not consider HDL and triglyceride categories, the American Heart Association (AHA) does recommend the inclusion of these two values in the evaluation of children; the AHA considers childhood HDL levels less than 35 mg/dL and LDL levels less than 150 mg/dL to be abnormal.

Table 1 outlines the NCEP and AHA categories.

As a result of the age and developmental variability, the AAP also uses the Lipid Research Clinics Program Prevalence Study guidelines (Table 2) to adjust for

MALLORY E. McCORD will graduate in May from the PA program at Georgia Health Sciences University in Augusta, Ga. LAURA E. LEE is an assistant professor and clinical director at the Georgia Health Sciences University PA program. They have completed a disclosure form and report no relationships related to the content of this article. The ADVANCE for NPs & PAs CME coordinator, John McGinnity, MS, PA-C, discloses receiving honoraria from Boehringer Ingelheim.
lipid changes throughout childhood. According to these guidelines, concentrations between the 90th and 95th percentile should be considered borderline (between the 5th and 10th percentile for HDL levels), while concentrations above the 95th percentile (less than the 5th percentile for HDL levels) should be considered abnormal.

**Two Approaches**

The AAP and the NCEP recommend two approaches for choosing which children to treat: the population approach and the individual approach. The population approach is a recommendation for all U.S. children and adolescents to help prevent CVD and to create a more desirable lipid profile for the entire population. The individual approach is a group of recommendations for high-risk children who are at the greatest risk for atherosclerosis, dyslipidemia or CVD during youth or adulthood. Unlike the recommendations in the population-based approach, these recommendations include more intensive treatments and possible pharmacologic interventions. The individual approach, however, recommends lifestyle changes as the initial therapy before pharmacologic intervention is indicated; therefore, both approaches focus on lifestyle change as the primary initial approach for preventing and reducing dyslipidemia in children and adolescents.

**The Population Approach**

Maintenance of ideal body weight, an active lifestyle and appropriate eating patterns should be recommended to help prevent abnormal lipid levels and cardiovascular disease. Following the population approach, a
healthy diet plan should be recommended for all children and adolescents. It is important to note that the AHA, the NCEP and the AAP do not recommend dietary changes for any child younger than 2 years. The period from birth to 2 years is an important growth and development period that requires an increased intake of fats and nutrition; therefore, dietary interventions should be implemented only in toddlers at 2 or 3 years, as they are transitioning out of this growth period.

For children older than 2 years, the first recommendation is to ensure that daily caloric intake matches energy needs and expenditure for adequate development and to maintain a healthy body weight. Children between 2 and 18 years should limit saturated fat consumption to less than 10% of total daily caloric intake, limit total fat to between 20% and 30% of total daily calories and limit cholesterol to less than 300 mg/day.

A variety of foods should be consumed, including whole grains, fruits and vegetables (five or more a day), low-fat dairy products (1% or skim milk), high-fiber foods, legumes, lean meats and oily fish. Decreasing salt intake to less than 6 g per day and minimizing simple sugar consumption, including fruit juices and other foods and beverages with added sugars, also are recommended. Subsequent to increased attention on the lipid-profile changing effects of trans fatty acids, such as hydrogenated and partially hydrogenated fats, it is now recommended that trans fats be limited to less than 1% of total daily calories in children and adolescents.

Table 1

Lipid Level Categories in Children

The categories for lipid profile levels in pediatric populations as classified by the National Heart, Lung, and Blood Institute’s National Lipid Level Categories in Children

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Cholesterol, mg/dL</th>
<th>Low-Density Lipoprotein Cholesterol, mg/dL</th>
<th>High-Density Lipoprotein Cholesterol, mg/dL</th>
<th>Triglycerides, mg/dL</th>
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<tbody>
<tr>
<td>Acceptable</td>
<td>&lt; 170</td>
<td>&lt; 110</td>
<td>≥ 35</td>
<td>≤ 150</td>
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<tr>
<td>Borderline</td>
<td>170–199</td>
<td>110–129</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Elevated</td>
<td>&gt; 200</td>
<td>&gt; 130</td>
<td>&lt; 35</td>
<td>&gt; 150</td>
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The Individual Approach

The individual approach uses a two-step dietary intervention to treat children who have an abnormal lipid profile. The recommendations for the step 1 guidelines are for children with borderline LDL cholesterol levels (110–129 mg/dL). Step 1 guidelines are the same recommendations as those of the population approach; implementation of these dietary guidelines should be occur for 1 year before lipid profile reassessment. Step 2 guidelines are for children who either are in the borderline lipid profile category and have failed to reach goals after 3 months of step 1 therapy, or are in the abnormal LDL category (130 mg/dL or higher) and have completed 3 months of step 1 therapy.

A dietitian should be consulted and included in the treatment process at this stage if one has not yet been involved. Step 2 guidelines include a diet with less than 7% of calories from saturated fat, less than 200 mg cholesterol per day and an increase in dietary fiber. Calculate recommended daily dietary fiber by taking the child’s age in years and adding 5 to 10 g per day; at age 15 through adulthood, a total of 25 to 35 g per day of fiber should be recommended. The additional step 1 recommendations should be continued through the step 2 phase of treatment.

Questions About Diet Restrictions

Concerns about a restricted diet during pivotal growth periods in children have been countered by studies such as the Dietary Intervention Study in Children, which showed that reducing total fat, saturated fat and cholesterol in children did not result in statistically significant changes in growth, overall nutritional sufficiency, iron stores, sexual maturation, mean BMI and psychological or social assessments. Other studies have shown that children in the active group of dietary intervention studies generally choose healthier food options than do children in the placebo group. Without proper guidance and education, however, children may not receive adequate nutrition, possibly leading to malnutrition, failure to thrive and inadequate growth or development. Further studies are necessary to ensure that these dietary interventions are not leading to unfavorable outcomes in later childhood or adulthood.

A registered dietitian is a key player on the healthcare team when educating and instructing about dietary plans. This nutrition professional can help instruct parents and children on implementing dietary recommendations inside and outside of the home and making healthy choices. If a registered dietitian is unavailable, the primary care provider should fill this role and strive to provide nutritional education at each patient visit. It is essential to make dietary goals realistic and to incorporate the patient’s views and culture, as well as the family’s views, culture and circumstances, to help ensure that they can implement changes effectively.

Exercise Is Key

Regular physical activity is another important recommendation for children with dyslipidemia; assess activity time and level for every child at every visit. Regular physical activity in children can increase HDL levels, decrease TGs and improve LDL levels.
The Centers for Disease Control and Prevention, the AHA and the AAP recommend that children and adolescents older than 2 years should engage in at least 60 minutes of daily moderate to vigorous physical activity. This time recommendation can be continuous or can be broken into increments. Physical activity should include a variety of activities that are enjoyable to the child, that support his or her developmental stage and that are a mix of structured and unstructured activities. Age-appropriate activities can include a group or can be individual, and they can range from walking and running to group sports to household chores.

In children and adolescents 10 years and older, resistance training that uses low weights and high repetitions can be incorporated into daily physical activity if proper technique is followed and proper supervision is available. Heavy weights and lifts with maximum weight can be added when an adolescent has reached Tanner stage 5, given that proper technique is still a focus. Health experts generally recommend that sedentary activities such as watching TV, playing video games and using a computer should be limited to less than 2 hours a day. The AAP recommends that children younger than 2 years be restricted from watching any TV. Other important nonpharmacologic recommendations are weight management and avoidance of smoking tobacco. The primary treatment for any overweight or obese child with dyslipidemia should be weight management and reduction, which should involve dietary changes and increased physical activity. The goal is to maintain a healthy BMI that is below the 95th percentile. Avoidance of smoking and smoke exposure also is necessary to maintain a healthy lipid profile; preventing personal smoking or secondhand smoke exposure should be a primary goal for children with dyslipidemia. Question family members and caregivers about smoking history at every visit; questioning children about personal smoking history should begin at age 10. Provide counseling and resources, if necessary, to decrease all routes of smoke exposure.

### Table 2

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<thead>
<tr>
<th>Category</th>
<th>Males 5–9 y</th>
<th>Males 10–14 y</th>
<th>Males 15–19 y</th>
<th>Females 5–9 y</th>
<th>Females 10–14 y</th>
<th>Females 15–19 y</th>
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<td><strong>Total cholesterol, mg/dL</strong></td>
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<td>50th percentile</td>
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<td>173</td>
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<tr>
<td>90th percentile</td>
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<td>183</td>
<td>191</td>
<td>183</td>
<td>189</td>
<td>191</td>
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<tr>
<td>≥ 95th percentile</td>
<td>Abnormal</td>
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<td>201</td>
<td>191</td>
<td>197</td>
<td>205</td>
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<td><strong>Triglycerides, mg/dL</strong></td>
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<td>50th percentile</td>
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<td>57</td>
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<td>75th percentile</td>
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<td>74</td>
<td>88</td>
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<td>85</td>
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<tr>
<td>90th percentile</td>
<td>Borderline</td>
<td>70</td>
<td>94</td>
<td>125</td>
<td>103</td>
<td>104</td>
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<tr>
<td>≥ 95th percentile</td>
<td>Abnormal</td>
<td>85</td>
<td>111</td>
<td>143</td>
<td>120</td>
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<td><strong>Low-density lipoprotein cholesterol, mg/dL</strong></td>
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<td>75th percentile</td>
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<td>115</td>
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<td>90th percentile</td>
<td>Borderline</td>
<td>117</td>
<td>123</td>
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<td>126</td>
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<tr>
<td>≥ 95th percentile</td>
<td>Abnormal</td>
<td>129</td>
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<td><strong>High-density lipoprotein cholesterol, mg/dL</strong></td>
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<td>38</td>
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<td>10th percentile</td>
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<td>43</td>
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<td>25th percentile</td>
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<td>46</td>
<td>39</td>
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</table>
Clinical Recommendations for Dyslipidemia in Children

Dietary changes

<table>
<thead>
<tr>
<th>Population Approach</th>
<th>Individual Approach</th>
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<tbody>
<tr>
<td>No change for &lt; 2 years old; &gt; 2 years old, match daily caloric intake to energy needs and expenditure</td>
<td>Two-step dietary intervention for children with abnormal lipid profile</td>
</tr>
</tbody>
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Fat consumption (% total caloric intake)

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<thead>
<tr>
<th>Ages 2 to 18:</th>
<th>Step 1, for children with borderline LDL cholesterol readings (110–129 mg/dL): Same as population approach for 1 year</th>
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<tr>
<td>• Saturated fat consumption &lt; 10% of total daily caloric intake</td>
<td>Step 2, for children with borderline lipid profile who do not reach goal after 3 months of step 1 therapy, or LDL &gt; 130 mg/dL after 3 months of step 1 therapy:</td>
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<tr>
<td>• Total fat between 20–30% of total daily caloric intake</td>
<td>• Saturated fat consumption &lt; 7% of total daily caloric intake</td>
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<tr>
<td>• Cholesterol &lt; 300 mg/day</td>
<td>• Cholesterol &lt; 200 mg/day</td>
</tr>
<tr>
<td>• Limit trans fats to &lt; 1% of total daily caloric intake</td>
<td>Increase dietary fiber, calculated by taking the child’s age in years and adding 5–10 g/day; at ages 15 through adult, 25–35 g/day of fiber</td>
</tr>
</tbody>
</table>

Other measures

| • Eat a variety of foods, especially whole grains, fruits and vegetables (5 or more a day), low-fat dairy products (1% or skim milk), high-fiber foods, legumes, lean meats and oily fish | Increase dietary fiber, calculated by taking the child’s age in years and adding 5–10 g/day; at ages 15 through adult, 25–35 g/day of fiber |
| • Decrease salt intake to < 6 g per day | |
| • Minimize simple sugar consumption | |

If nonpharmacologic interventions do not help to achieve lipid profile goals, children older than 8 years with an LDL level greater than 190 mg/dL, an LDL level of 160 mg/dL or greater with other cardiovascular risks present (hypertension, obesity, family history of CVD), or an LDL level of 130 mg/dL or greater with diabetes mellitus present should be considered for pharmacologic therapy.2,5,21

Research is under way to study the effectiveness and safety of using lipid-lowering therapies in children. Nonpharmacologic recommendations, however, always should be first-line therapy and should be continued throughout the course of pharmacotherapy.21

Treating children with dyslipidemia should be a cooperative effort among the child and his or her healthcare provider, caregivers and family members, and other key figures such as dietitians and school personnel. Involving caregivers may help children who depend on them gain better access to physical activity and healthier sources of food and may provide an additional source of encouragement through treatment.3

A school system can help implement changes in the school environment during mealtimes, in health and physical education curriculums and in the general classroom.3

Setting realistic expectations, properly educating all parties involved and deeply investing time into each pediatric patient can help him or her reach cholesterol level goals and decrease the risk of future CVD.3

References

Questions

1. Which one of the following is not an abnormal cholesterol level?
   a. elevated low-density lipoprotein cholesterol
   b. increased triglycerides
   c. decreased triglycerides
   d. decreased high-density lipoprotein cholesterol

2. Which of the following is true of total cholesterol levels in children older than 2 years?
   a. They peak between 2 and 4 years, decrease during puberty and increase after puberty.
   b. They peak during puberty and decrease after puberty.
   c. They peak during puberty and decrease after puberty.
   d. They peak between 2 and 4 years, decrease during puberty and increase after puberty.

3. The National Heart, Lung, and Blood Institute’s National Cholesterol Education Program guidelines use which of the following to classify children between 2 and 18 years into acceptable, borderline or elevated categories?
   a. total cholesterol and HDL
   b. total cholesterol and triglycerides
   c. total cholesterol and LDL
   d. triglycerides and LDL

4. While the NCEP recommendations do not consider HDL and triglyceride categories, the American Heart Association does recommend the inclusion of these values in the evaluation of pediatric populations?
   a. true
   b. false

5. In the population approach to treating pediatric dyslipidemia, children between 2 and 18 years should do which of the following?
   a. limit saturated fat consumption to less than 10% of total daily calories
   b. limit total fat to between 20% and 30% of total daily calories
   c. limit cholesterol to less than 300 mg/day
   d. all of the above

6. In the population approach to treating pediatric dyslipidemia, it is now recommended that trans fats be limited to what percentage of total daily calories in children and adolescents?
   a. less than 10% b. less than 5%
   c. less than 3%
   d. less than 1%

7. In the individual approach to treating pediatric dyslipidemia, which one of the following is not among the step 2 guidelines?
   a. a diet with less than 7% of calories from saturated fat
   b. less than 200 mg cholesterol per day
   c. pharmacologic intervention
   d. an increase in dietary fiber

8. The Dietary Intervention Study in Children showed that reducing total fat, saturated fat and cholesterol in children did not result in statistically significant changes in growth, overall nutritional sufficiency, iron stores, sexual maturation, mean BMI and psychological or social assessments.
   a. true
   b. false

9. Expert groups recommend that children and adolescents older than 2 years should engage in how much daily moderate to vigorous physical activity?
   a. at least 30 minutes
   b. at least 45 minutes
   c. at least 60 minutes
   d. at least 90 minutes

10. If nonpharmacologic interventions do not help to achieve lipid profile goals, children older than 8 years should be considered for pharmacologic therapy under which of the following scenarios?
    a. they have an LDL level greater than 190 mg/dL
    b. they have an LDL level of 160 mg/dL or greater with other cardiovascular risks present
    c. they have an LDL level of 130 mg/dL or greater with diabetes mellitus present
    d. all of the above

Evaluation

1. The content was appropriate for my needs.
   a. strongly disagree
   b. disagree
   c. neutral
   d. agree
   e. strongly agree

2. The educational objectives were achieved.
   a. strongly disagree
   b. disagree
   c. neutral
   d. agree
   e. strongly agree

3. The information provided was practical and can be applied to my professional needs.
   a. strongly disagree
   b. disagree
   c. neutral
   d. agree
   e. strongly agree

4. The information in the article was fair, balanced, free of commercial bias and supported by scientific evidence.
   a. strongly disagree
   b. disagree
   c. neutral
   d. agree
   e. strongly agree

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Dyslipidemia in Children

Test NPPA07

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Evaluation

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