

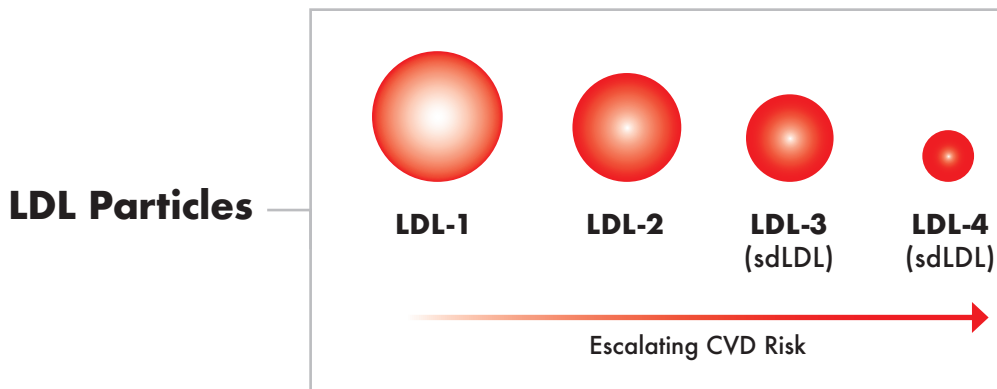


# A CLOSER LOOK AT CHOLESTEROL AND CARBOHYDRATES

Meaningful subtleties in LDL cholesterol are beginning to challenge approaches to cardiovascular disease (CVD) treatment and prevention.

## LDL SIZE AND DENSITY SIGNAL CVD RISK

LDL particles vary in size and density, ranging from “large and light” to “small and dense,” and are further divided into subclasses according to density: large (LDL-1), intermediate (LDL-2), small (LDL-3), and very small (LDL-4).<sup>1, 2</sup> Together, LDL-3 and LDL-4 are referred to as small dense LDL (sdLDL).



**Small dense LDL particles are significantly and independently associated with increased CVD risk<sup>3-8</sup>** and they are believed to be more atherogenic than larger LDL molecules for several reasons:<sup>9</sup>

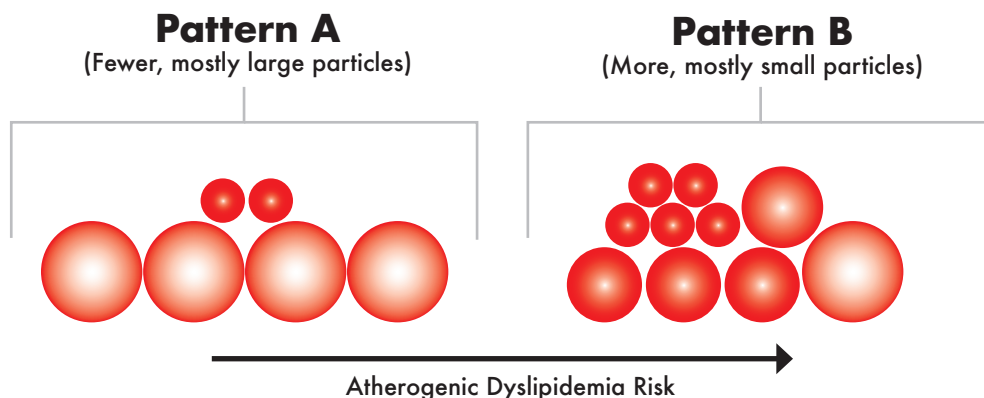
- **Smaller particle size:** facilitates greater arterial wall penetration
- **Longer circulation time:** increases the likelihood of atherogenic modifications
- **Lower antioxidant levels:** increases susceptibility to oxidation

## PATTERN B LDL POINTS TO ATHEROGENIC DYSLIPIDEMIA

Everyone has a different mix of LDL subclasses, arising in two distinct patterns:

- **Pattern A:** fewer and larger LDL particles; less atherogenic
- **Pattern B:** predominantly sdLDL particles; a categorical marker of atherogenic dyslipidemia; associated with 3x greater CVD risk than pattern A

Assessing sdLDL measurements in addition to traditional lipid measures should be considered.

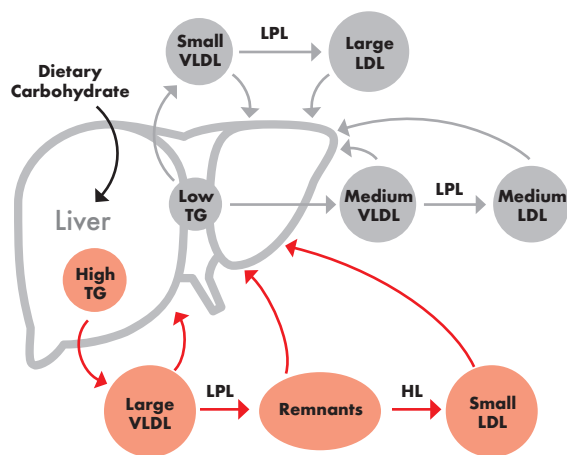


## DIET MAY AFFECT LDL STATUS IN 4 SURPRISING WAYS

1. Saturated fatty acids (SFAs) appear to preferentially increase plasma concentrations of larger LDL particles.<sup>13, 14</sup>
2. Replacing SFAs with carbohydrates has been associated with no improvement, or even worsening, of CVD risk.<sup>15, 16</sup>
3. Carbohydrate intake is linearly and positively associated with prevalence of LDL pattern B.<sup>3</sup>
4. Limiting dietary carbohydrate as a total percent of energy is shown to reduce levels of sdLDL.<sup>17</sup>

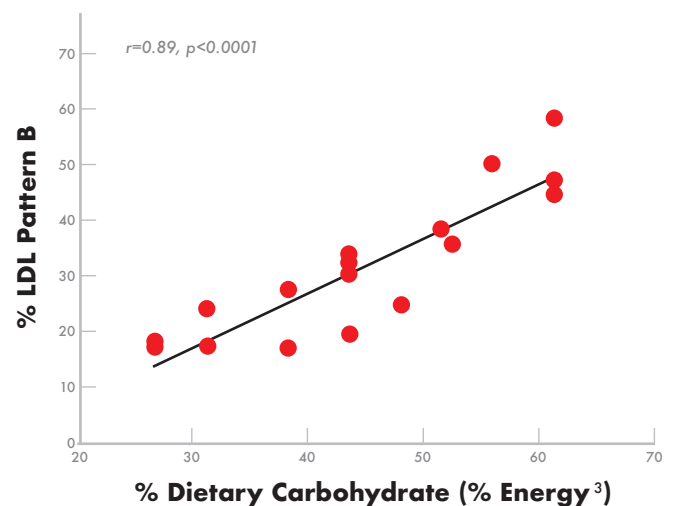
### Carbohydrates Promote sdLDL Cholesterol

Carbohydrate intake initiates a cascade of metabolic processes, including increasing hepatic triglycerides (TG), which leads to the secretion of large, TG-enriched VLDLs. Lipoprotein lipase (LPL) breaks down VLDLs into remnant lipoproteins, which are then catabolized by hepatic lipase to produce sdLDLs.<sup>3</sup>



### Increasing Carbohydrate Intake is Associated with Increasing Prevalence of Pattern B

Variation in carbohydrate consumption is correlated with the prevalence of pattern B LDL in metabolic feeding studies. Each data point below is the summation of the response of at least 40 individuals to a dietary regimen that controlled for dietary carbohydrate and lasted three to six weeks.<sup>3</sup>



## RETHINKING NUTRITION INTERVENTIONS

Science continues to support the widespread health benefits of low-carbohydrate diets — including their capacity to promote cardiovascular health, improve insulin resistance, stimulate weight loss and reduce inflammation.<sup>18-24</sup>

### WHAT YOU NEED TO KNOW

**Patients presenting with CVD or CVD risk factors may benefit most from low-carbohydrate diets.**

Nutrition education messages should focus on:

- Consuming nutrient-dense foods containing healthy fats
- Reducing overall carbohydrate intake
- Choosing heart-healthy carbohydrates in moderation



Visit [Atkins-HCP.com](https://www.atkins-hcp.com) and see the [Atkins meal plans](#) to learn more.

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