**Case study 1: Disorders of Lipid Metabolism**

JT is a 52-year-old Hispanic man who consults a new physician for a routine physical examination because his employer has recently changed their health insurance plan. He has not seen a physician for the past 3 years.

* **Past Medical History**

JT has no prior history of hospitalizations or chronic illnesses. He is not taking any medications or over-the-counter dietary or herbal supplements, and he has no known food allergies.

* **Family History**

JT’s family history is positive for heart disease. His father had a fatal heart attack at age 54, and his father’s brother had a heart attack at age 55. JT’s uncle is currently being treated for hypercholes- terolemia. There is no family history of hypertension, diabetes, or obesity.

* **Social History**

JT works as an accountant and reports a high stress level both at work and at home. His work commitments do not allow him much free time so he frequently orders lunch in and eats at his desk. After a long day at work and his 45-minute commute home, JT feels too tired to exercise. Over the past 3 years he has experienced a 12-pound weight gain. JT attributes this to his sedentary, high-stress lifestyle, and to dining out with clients on average 2 to 3 nights per week. JT is a non- smoker. He drinks a 20-ounce (600mL) cup of regular coffee every morning and two alcoholic beverages every evening. JT is married and has one daughter who is currently in her junior year of college.

* **Diet History**

Using the 24-hour recall method, JT’s physician obtained the following information about his typical diet.

|  |  |
| --- | --- |
| **Breakfast (office)** | |
| Bagel  Cream cheese  Coffee  Half-and-half | 1 large (4 ounces/113 g)  2 Tbsp.  20 ounces (600 mL)  2 ounces (60 mL) |
| **Lunch (restaurant)** | |
| Pizza with cheese  Soda (cola) | 2 slices  12 ounces (360 mL) |
| **Snack (office)** | |
| Jelly beans | 1 ounce (28 g) |
| **Evening (restaurant)** | |
| Hamburger  Bun  French fries  Vanilla ice cream  Beer | 6 ounces (170 g)  1 large  1 cup  1 cup  24 ounces (720 mL) |

Total calories: 2730 kcal

Protein: 106 g (16% of total calories)

 Fat: 108.5 g (33.5% of total calories)

 Saturated fat: 47 g (15.5% of total calories)

Monounsaturated fat: 36 g (12% of total calories)

Polyunsaturated fat: 10 g (3% of total calories)

*Trans* fat: 6.0 g (2% of total calories)

Cholesterol: 313 mg

 Carbohydrate: 299 g (44% of total calories)

Dietary fiber: 11 g

 Soluble fiber: 5 g

Sodium: 2680 mg

**Physical Examination**

**Vital Signs**

*Temperature:* 98 °F (37 °C)

*Heart Rate:* 76 BPM

*Respiration:* 20 PM

*Blood pressure:* 139/88 mm Hg

*Height:* 5′10′′ (178 cm)

*Current weight*: 212 lb (96 kg)

*BMI:* 30.4 kg/m2

*Weight 2 years ago:* 200 lb (91 kg)

*Waist circumference:* 42 inches (107 cm)

**Laboratory Data**

JT’s lipid profile, after a 12-hour overnight fast, provided the following laboratory values:

|  |  |
| --- | --- |
| **Patient’s Lab Values**  Total cholesterol: 260 mg/dL  HDL-C: 32 mg/dL  LDL-C: 158 mg/dL  Triglycerides: 350 mg/dL  Lp(a): 11 mg/dL  Plasma glucose: 95 mg/dL | **Normal Values**  desirable <200 mg/dL  desirable ≥40 mg/dL  desirable <100 mg/dL  desirable <150 mg/dL  <20 mg/dL  70-99mg/dl |

**JT’s risk factors**

Therefore risk factors present include:

Elevated total cholesterol, LDL-C and triglyceride levels, age (men >45), family history of heart disease, low HDL-C, obesity (BMI ≥30 kg/m2), increased waist circumference (>40 inches), smoking habits. and elevated blood pressure: prehypertension:139/88mmHg,

**Physical examination findings should one look for in a patient suspected of having disorders of lipid metabolism**

* examination of pulses (palpation of all pulses, and auscultation for bruits in the carotid and femoral arteries)
* thyroid palpation (hypothyroidism is a possible secondary cause of hypercholesterolemia),
* an eye examination (If there is a small plaque in the retinal vessels of the back of the eye, it is likely that there are larger plaques in other places of the body. Large plaques increase your risk for heart attack and stroke).

**Based on JT’s medical history, physical examination, and laboratory data, how would you classify and diagnose his lipid disorder?**

This type of lipid disorder is called dyslipidemia since both JT’s total plasma triglycerides and LDL-C concentrations are elevated and HDL-C is low. Although it is likely that a variety of combinations of regulatory defects in lipid metabolism account for a significant number of individuals with this phenotype, familial clustering of dyslipidaemia has been identified in which members of the same family may have both elevated LDL-C and triglycerides, only hypertriglyceridemia, or only elevated LDL-C concentrations.

The type of dyslipidemia that JT has seems to be associated with the secretion of increased numbers of very-low-density lipoprotein (VLDL) particles. Once these individuals assemble and secrete increased numbers of large triglyceride-rich VLDL, their plasma triglyceride concentrations depend on their ability to hydrolyze VLDL triglycerides with lipoprotein lipase and, to a lesser degree, with hepatic lipase.

The ability to hydrolyze VLDL triglycerides also regulates the generation of LDLs in the plasma. Thus subjects with FCHL (familial combined hyperlipidemia) who have very high VLDL triglyc- eride concentrations (and are not able to efficiently catabolize VLDLs) might have normal or reduced numbers of LDL particles in the circulation and thus a normal LDL-C concentration. If these same individuals were able to efficiently catabolize the increased numbers of VLDL particles that were entering the plasma, they would generate increased numbers of LDL particles and have both hypertriglyceridemia and high LDL-C levels. Patients with dyslipidemia who synthesize only normal quantities of triglycerides and secrete increased numbers of VLDLs carrying normal trig- lyceride loads would generate increased numbers of LDL particles and have elevated plasma LDL-C concentrations only.

1. **What is the currently recommended treatment and follow-up for JT’s dyslipidemia?**

Although JT has significant hypertriglyceridemia and low levels of HDL-C, with a high non-HDL- C, the new AHA/ACC guidelines tell us to focus on his LDL-C after assessing his CHD risk. JT does not have an LDL of more than 190, does not have CHD, and is not diabetic, so we need to calculate his 10-year risk. JT’s 10-year risk for CHD (fatal or non-fatal MI, fatal or non-fatal stroke) is 10.4 percent, which is greater than the 7.5 percent level the new guidelines suggest as a cutpoint for initiation of statin treatment. We will discuss medical therapy further in this chapter.

The presence of the metabolic syndrome indicates that intense lifestyle approaches have the potential to benefit him significantly. Particularly, he needs intensification of weight management, and increased physical activity. However, the new guidelines do not provide any goals for either statin or lifestyle therapy; there are clearly no HDL-C or triglyceride targets.

1. **What is the patient’s stage of behavior change? And what would you say to encour- age him? What are some of his barriers to change?**

JT admitted early in his visit that he feels hopeless about his weight. Now he tells the doctor that he knows he has to lose weight and wants to know how much. He also tells his doctor that he needs to get educated on choosing low-fat foods. JT has probably already been thinking about making a change (Contemplation) – and perhaps he is now moving into the Preparation stage (Table 6-6). The role of the clinician is to confirm that weight loss would be slow, provide some guidance on how much weight loss to aim for (e.g., a loss of 10 percent of body weight is often achievable over 6 to 12 months). Barriers to weight loss that JT may encounter:

 • Stress at work. He orders his “usual” high-fat meal without looking for opportunities to find lower fat alternatives.

* There may be social meetings on two to three nights that include excessive eating and  drinking.
* He may be unaware of opportunities for increased daily physical activity at work.
* Heisoverwhelmedwithworkanddoesnotfeelthathecanaddphysicalactivityintohisroutine.
* Hiswifemaynotunderstandtheseriousnessofhishealthandmaynotbesupportivebycooking  healthy meals when he eats at home.

1. **Is JT’s current nutrient intake within the recommended guidelines?**

The key elements of the diet include:

• saturated fat below 5 to 6% of calories; (avoid *trans* fat),

• dietary cholesterol intake below 200 mg/day., • an increase of viscous (soluble) fiber to 10–25 g/day,

 • intake of 2 g/day of plant sterols/stanols daily,

• weight management,

 • increased physical activity.

 JT’s current diet is not within these recommended guidelines. According to the nutritional analysis of his current intake, JT’s saturated fat intake is about 16 percent of his caloric intake (<5 to 6 percent is recommended), *trans* fat intake is 3 percent of calories (needs to be avoided) and cho- lesterol intake is 313mg (<200mg/day is recommended). Significant sources of saturated fat in JT’s diet come from high-fat dairy foods including half and half cream cheese, mozzarella cheese, and ice cream as well as the ground red meat. His caloric intake is approximately 2700 calories per day. This excessive calorie intake combined with his sedentary lifestyle will continue to promote weight gain unless he reduces total calories and routinely participates in some physical activity. In order to lose 1 to 2 pounds of body weight per week (which is the recommended rate of weight loss), JT must reduce his weight maintenance caloric needs by at least 500 calories and increase activity by 250 calories daily. Alternatively, JT may choose to exercise more rather than eat less to achieve the targeted weight loss.

JT’s typical diet is deficient in fruit and vegetables, which are generally low in calories and are nutrient dense. The DASH diet has been found to be very effective in lowering blood pressure and can also be recommended to JT. The DASH diet especially emphasizes greater intake of vegetables, fruits, and whole grains. The DASH diet includes 7 to 8 servings of whole grains; 4 to 5 servings of vegetables; 4 to 5 servings of fruits; 2 to 3 servings of non-fat dairy products; 2 or less servings of meats; 2 to 3 servings of fats/oils on a daily basis. It also limits sodium to less than 3 g/day; and encourages 4 to 5 servings of unsalted nuts/week. JT’s diet contains only 11g of dietary fiber/day

1. **What are the best lifestyle approaches for this patient?**

JT’s modifiable risk factors include obesity, high-saturated fat diet, sedentary lifestyle, and excessive alcohol consumption. Implementing a number of lifestyle and behavioral changes should improve JT’s risk profile significantly.

The first line of therapy for all lipid and non-lipid factors associated with the metabolic syndrome is weight reduction and increased physical activity. Overweight and obesityarerecognized as major underlying risk factors for coronary heart disease. Regular physical activity is a component in the management of dyslipidemia.

In order to make dietary recommendations, it is necessary to first define the desired endpoint or goal for each individual. Is the goal to reduce triglycerides and LDL-C with/without weight reduction? For JT the goal is to lower total cholesterol, LDL-C, and triglycerides, raise HDL-C levels, and reduce weight. He can achieve this by adhering to the DASH diet and reducing his total caloric intake by self-monitoring. Monounsaturated fat and omega-3 fatty acids should be favored in place of both saturated and omega-6 fatty acids, while keeping total fat to a maximum of 35 percent of total calories.

The specific dietary recommendations include reducing total calories and saturated fat intake (less than 6 percent), avoiding *trans* fat, increasing monounsaturated fat (up to 20 percent), and reducing alcohol intake.

1. **How can JT translate the recommended dietary guidelines into food choices?**

A hypocaloric diet, which favors monounsaturated fat, is recommended for JT. Sources of monoun- saturated fats are canola oil, olive oil, pistachios, almonds, hazelnuts, pecans, unsalted peanuts, peanut butter,avocado, and high oleic acid safflower oil and sunflower oils. The main sources of omega-3 fatty acids are fatty fish such as salmon, mackerel, herring, sardines, and plant foods such as flax seeds, chia seedsand walnuts. The main sources of *trans* fat are the French fries and pizza crust made with partially hydrogenated oils. He can substitute with a baked potato or brown rice or barley. JT should eat more vegetables, fruits, whole grains, and beans, only non-fat or very low-fat dairy products, and chicken without skin, fish, or lean meats limited to 5 to 6 ounces per day. If he enjoys eggs, he can include two large egg yolks per week. Egg whites have protein and no fat or cholesterol.

His fiber intake would be significantly increased with the recommended servings of fresh fruits, vegetables, and whole grains containing fiber. Therapeutic options for enhancing LDL-C reduction include increased intake of viscous (soluble) fiber (10 to 25 g/day) from oats, psyllium, dried beans, and fruits such as strawberries, apples, and vegetables such as okra and eggplant. Fat spreads con- taining plant stanol/sterols (2g/day) could be included to further lower LDL-C in place of other spreads the patient may currently be using. Two grams of stanol/sterols can reduce LDL-C by 7 to 15 percent. Plant stanols/sterols containing products are available in the supermarkets, It is impor- tant to note that these products have calories and should replace other fat sources, such as marga- rine or cream cheese. JT will benefit from a reduction in alcohol and sodium intake. Alcohol adds calories to JT’s diet and can raise triglycerides and blood pressure.