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THE EFFECTS OF DIET ON MODULATING THE SUSCEPTIBILITY OF LOW DENSITY LIPOPROTEIN TO OXIDATIVE MODIFICATION

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ABSTRACT

Oxidative modification of low density lipoprotein is thought to play an important role in the development of atherosclerosis. Three experiments were conducted that addressed different questions about the effects of diet on oxidative stress. Different population groups were studied using study-specific methodologies appropriate for each study to address research questions about the effects of diet on oxidative stress. In the first study, the combined effects of dietary fat and iron status on low-density lipoprotein (LDL) oxidation were assessed using a pharmacologic dose of an iron supplement in women with low iron status (n=26). The experimental diets were an average American diet (AAD) [36% of energy as fat; 15% saturated fatty acids (SFA)], and a Step 2 diet (26% fat; 7% SFA). Subjects consumed each diet for three weeks before crossing over to the other diet. In addition, subjects received either a supplement containing 160 mg of ferrous sulfate (50 mg elemental iron) or a placebo twice daily [supplement group received a total of 320 mg ferrous sulfate (100 mg elemental iron) daily]. Subjects consumed the iron supplement or placebo throughout both diet periods. After supplementation, serum ferritin increased in the supplement group compared to the placebo group ($p = 0.008$). Although iron status was improved by the high-dose iron supplement, LDL oxidative susceptibility was not affected. However, measures of LDL oxidation were affected by diet. As expected, lag time was increased after the women consumed the low fat, low SFA diet ($p < 0.0001$). Rate of oxidation and total dienes were not affected by diet. Therefore, the results indicate that although the low fat, low SFA diet significantly increased lag time, the addition of a therapeutic dose of iron did not affect all measures of oxidative stress measured despite improved iron status in subjects

receiving the supplement. Although supplemental iron did not act as an oxidant in this study, we conclude that a blood cholesterol lowering diet can be recommended for individuals treated with supplemental iron for poor iron status to decrease cardiovascular disease risk.

The second study was designed to examine the effects of different dietary fatty acid profiles in subjects with moderately elevated total cholesterol levels (n=12 M, n=19 F) on plasma lipids and lipoproteins and oxidative stress. Two experimental diets were studied that provided 30% calories from fat (either olive oil or NuSun™ sunflower oil contributed one half of the total fat), 8.3% vs. 7.9% SFA, 17.2% vs.14.2% MUFA and 4.3% vs. 7.7% PUFA (olive oil and NuSun™ sunflower oil, respectively), and 294 mg/day of cholesterol. The olive oil and NuSun™ sunflower oil diets were designed to provide similar amounts of SFA whereas MUFA and PUFA levels varied, in a manner that reflected the fatty acid composition of the oils used in the respective diets. The control diet was an average American diet (34% fat, 11.2% SFA, 14.9% MUFA, 7.8% PUFA). Subjects consumed each diet for 4 weeks with a two-week compliance break before crossing over to the other diets. The NuSun™ sunflower oil diet significantly reduced total and LDL cholesterol compared to the AAD ($p<0.0001$ and $p=0.0006$, respectively) and the olive oil diet ($p=0.005$ and $p=0.008$, respectively). In contrast, there was no effect of the olive oil diet compared to the AAD on plasma lipids and lipoproteins. Although the experimental diets were lower in total fat, plasma triglycerides did not differ among the three diets. No significant differences were observed due to diet for rate of oxidation, total dienes, lipid hydroperoxides or alpha-tocopherol. However, lag time increased following the olive oil diet as compared to the

NuSun™ sunflower oil diet (p=0.01). The greater total and LDL cholesterol lowering of NuSun™ sunflower oil diet could be explained by its higher PUFA content compared to the olive oil diet. However, the increase in PUFA may also explain the reduction in lag time observed in response to the NuSun™ sunflower oil diet suggestive of increased oxidative susceptibility. Despite increased oxidative susceptibility with the NuSun™ sunflower oil diet as measured by lag time, no differences in the resulting oxidation products (total dienes and lipid hydroperoxides) were observed suggesting no adverse effects of the NuSun™ sunflower oil diet on LDL oxidation. Thus, since PUFA are important for cholesterol-lowering, foods that replace SFA should include a balance of unsaturated fatty acids, and not be disproportionally enriched in MUFA.

The last study is an analysis of data collected from a clinical nutrition study conducted at Pennington Biomedical Research Center. The objective was to evaluate the effects of two cholesterol-lowering, test diets on markers of LDL oxidation in individuals with different LDL phenotypes. Previous studies have shown that a low fat diet may be preferable for individuals expressing LDL phenotype B and contraindicated for some persons with LDL phenotype A because they may convert to LDL phenotype B, the atherogenic LDL phenotype. In this study, 87 normocholesterolemic men consumed an AAD that provided 37% of calories from total fat and 14% SFA; a Step 1 diet that provided 28% total fat and 9% SFA and a Step 2 diet that provided 24% total fat and 6% SFA. Subjects consumed each diet for six weeks in a randomized crossover design.

Ten subjects converted from LDL phenotype A to LDL phenotype B during the study. The analysis included subjects who remained LDL phenotype A on all three diets (Stable A; n=55), those that remained LDL phenotype B on all three diets (Stable B;

n=22), and a “change” group (n=10) which converted from LDL phenotype A to LDL phenotype B in response to reductions in total and saturated fat. Greater reductions in LDL size following the Step 2 diet were observed in the “change” group compared to both the Stable A group ($p=0.0002$) and the Stable B group ($p=0.0003$). At screening, both the Stable B group and the “change” group had higher triglycerides ($p<0.01$) and lower HDL cholesterol ($p<0.05$) compared to the Stable A group.

Reductions in apolipoprotein A1 were observed in the Stable A and Stable B subjects following both the Step 1 and Step 2 diets compared to the AAD ($p<0.0001$). The Stable A subjects had a further reduction in apo A1 following the Step 2 diet compared to the Step 1 diet ($p=0.0006$). In addition, the “change” group did not have a reduction in apo A1 but did have an increase in HDL_{3b} on the Step 2 diet compared to the AAD ($p=0.02$) indicative of a shift to a more dense HDL particle.

Lag time, total dienes and paraoxonase activity were not different between test diets. While no differences between groups was observed for lag time or paraoxonase activity, rate of oxidation and total dienes were increased in the “change” group across all diets compared to the Stable A group ($p=0.03$ and $p=0.02$, respectively) and the Stable B group ($p=0.06$ and $p=0.06$, respectively).

Together, the results of the third study suggest that with reductions in dietary fat typical of those that can be achieved in a clinical setting, a diet lower in total and saturated fat is not necessarily beneficial, nor is it detrimental for persons with LDL phenotype B. Although a dietary reduction in total and saturated fat may induce some individuals with LDL phenotype A to switch to the more atherogenic LDL phenotype B, these individuals are not at increased risk in terms of lipid response. However, reductions

in LDL size and a shift to a more dense HDL particle are observed in these individuals as well as increases in rate of oxidation and total dienes. Compared to those who remain LDL phenotype A or B with dietary intervention, there appear to be metabolic differences in individuals who change LDL phenotype in response to changing diet. Therefore, individuals who change LDL phenotype in response to diet appear to be at increased risk in terms of their overall lipid profile, LDL and HDL size and susceptibility of LDL to oxidation.

Collectively, the results of these three studies show that different dietary interventions did not have substantive effects on measures of LDL oxidation in any of the population groups studied. There were subtle effects noted on some measures of oxidative susceptibility that appeared to be due to varying the type and amount of dietary fat. Decreasing total fat may favorably affect lag time and decreased rate of oxidation in individuals who convert from phenotype A to B in response to a Step 1 diet. Altering type of fat also may have subtle effects on measures of oxidative susceptibility. For example, a diet enriched in olive oil favorably affects lag time compared with mid-oleic sunflower oil. It will be important in future studies to evaluate whether subtle changes in measures of oxidative susceptibility are of any clinical importance.

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LIST OF ABBREVIATIONS

AAD	average American diet
Apo	apolipoprotein
ARIC	Atherosclerosis Risk in Communities
BMI	body mass index
CHD	coronary heart disease
CHO	carbohydrate
CVD	cardiovascular disease
DHA	docosahexaenoic acid
ECG	electrocardiogram
EPA	eicosapentaenoic acid
FCHL	familial combined hypercholesterolemia
HDL	high density lipoprotein
LDL	low density lipoprotein
MI	myocardial infarction
MUFA	monounsaturated fatty acids
NHANES	National Health and Nutrition Examination Survey
PON	paraoxonase
PUFA	polyunsaturated fatty acids
SFA	saturated fatty acids
TFA	trans fatty acids
TG	triglycerides
TIBC	total iron binding capacity

Chapter 1

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death in the United States accounting for more deaths than all other causes combined. Numerous risk factors for CVD have been identified, many of which are modifiable by diet and lifestyle practices. Major modifiable risk factors include cigarette smoking, elevated total and low density lipoprotein (LDL-) cholesterol levels, overweight and obesity, hypertension, diabetes mellitus, and a sedentary lifestyle. Other important risk factors that are modifiable by diet are a low level of high density lipoprotein (HDL-) cholesterol, elevated levels of triglycerides (TG), and small, dense LDL particles.

Diet continues to be an important cornerstone in the prevention and treatment of CVD. Current recommendations are to reduce saturated fatty acids (SFA) and trans fatty acids (TFA) by decreasing total fat and replacing SFA calories with carbohydrate (CHO) resulting in a lower-fat, higher-CHO diet with protein held constant. An alternative approach is to replace SFA calories with monounsaturated fatty acids (MUFA) resulting in a moderate fat diet. Polyunsaturated fatty acids (PUFA), and omega-3 fatty acids, in particular, have been a focus of attention recently because of their marked beneficial effects on CVD risk. The rapid increase in our understanding of fatty acid biology has clearly established the remarkable diversity of the effects of fatty acids on CVD risk factors. Moreover, this information has led to different diet options for reducing CVD risk. For example, the American Heart Association has issued dietary recommendations for fish consumption (1). Specifically, 1 g per day of eicosapentaenoic acid (EPA) + docosahexaenoic acid (DHA) is recommended for patients with CVD, whereas 2 servings

of fish (preferably fatty) per week are recommended for the population at large (1-2). It is becoming clear that diets that vary in total and unsaturated fatty acids benefit CVD risk markers in individuals with certain clinical profiles. For example, a moderate fat diet is recommended for individuals with metabolic syndrome who present with hypertriglyceridemia and low HDL cholesterol levels (3).

Oxidative modification of LDL is thought to play an important role in the development of CVD. The progression of disease could potentially be delayed by dietary manipulations that increase LDL resistance to oxidation. Decreased susceptibility of LDL to oxidation has been observed with a reduction in dietary total and saturated fat (4). In addition, diets enriched in MUFA have been shown to reduce susceptibility of LDL to oxidative modification compared to diets high in PUFA (5-7).

Certain population groups have also shown differences in LDL oxidative susceptibility. For example, individuals with small, dense LDL appear to be more susceptible to oxidation whereas those with large, buoyant LDL are more resistant (8-10). Individuals with increased iron stores have been associated with increased CVD risk (11-14). This association has been proposed to be due to iron catalyzing the reactions produced by free radicals. However, while the literature has been mixed in terms of whether a relationship between iron stores and CVD exist, most of the studies reported to date have been epidemiologic. Thus, controlled clinical studies and trials are necessary to further examine this relationship.

Knowledge of how diet affects LDL oxidation will provide important information about interventions that can be implemented to decrease CVD risk factors beyond lipids and lipoproteins. Dietary interventions that target multiple CVD risk factors could

significantly decrease CVD risk. Thus, gaining a better understanding of diet effects on LDL oxidation may result in strategies that will reduce CVD morbidity and mortality.

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Chapter 2

REVIEW OF THE LITERATURE

Cardiovascular disease (CVD) is the leading cause of death in the United States. Numerous risk factors for CVD have been identified, many of which are modifiable by diet and lifestyle practices. Major modifiable risk factors include cigarette smoking, elevated total and LDL cholesterol levels, overweight and obesity, hypertension, diabetes mellitus and physical inactivity. The major non-modifiable risk factors are age, male sex and family history of CVD. A large body of evidence from clinical and intervention trials support that LDL cholesterol is a major risk factor for CVD and that reductions in LDL cholesterol reduces the risk of CVD. HDL cholesterol has been shown to be a negative CVD risk factor. Diet continues to be an important cornerstone in the prevention and treatment of CVD. Numerous studies have shown that LDL cholesterol can be affected by the type of fat in the diet along with dietary cholesterol, viscous fiber, plant stanols and sterols. Decreasing SFA is an absolute requisite for reducing LDL cholesterol, whereas maintaining or even increasing intake of other fatty acid classes also is important for modifying LDL cholesterol in order to reduce CVD risk. With respect to LDL cholesterol, other factors may be important such as size of the LDL particle and susceptibility of LDL to oxidative modification both which can be affected by diet. Diet also affects HDL cholesterol which may play a role in protecting LDL from oxidation by the HDL-associated enzyme paraoxonase. The purpose of this literature review is to discuss the role of diet on LDL oxidation susceptibility as well as lipids and lipoproteins, LDL size and HDL subpopulations.

Effects of Dietary Fatty Acids on Lipids and Lipoproteins

The initial studies assessing the effects of different fats on blood cholesterol levels were published in the 1950's (1-4). When vegetable oils high in PUFA replaced fats high in saturated fat, blood cholesterol concentrations were markedly decreased. In 1965, Keys et al. (5) and Hegsted et al. (6) developed blood cholesterol predictive equations using regression analyses of data that were collected from several feeding studies. These equations demonstrated a cholesterol-lowering response of PUFA that is approximately half the cholesterol-raising response of saturated fatty acids. MUFA have been shown to either be neutral (6-7) or slightly hypocholesterolemic (8-9).

While the earlier predictive equations estimated changes in blood cholesterol levels in response to dietary fatty acid classes, the effects are quite different when comparisons are made between individual fatty acids. While lauric (C12:0), myristic (C14:0) and palmitic (C16:0) acids all are hypercholesterolemic, myristic acid has been shown to be twice as potent as lauric acid in raising total and LDL cholesterol (5, 9-10) and lauric may be less hypercholesterolemic than palmitic (11). Myristic acid has been shown to have both a hypercholesterolemic effect (12) and a similar cholesterolemic effect as palmitic acid (13). However, stearic acid (C18:0) is uniquely different from the other saturated fatty acids in that it does not increase blood cholesterol levels and has either a neutral or moderate cholesterol-lowering effect (5, 9-10).

In most studies in which oleic acid (18:1) is substituted for SFA (12:0-16:0), total and LDL cholesterol-lowering is observed (reviewed by Kris-Etherton and Yu; 10). A

diet high in MUFA has been shown to have similar total and LDL cholesterol-lowering effects as a high carbohydrate, low-fat diet. However, compared to a high carbohydrate, low fat diet, studies have shown increases in HDL cholesterol (6-22%) and reductions in triglycerides (2-24%) with a high MUFA diet (10). While some studies suggest a neutral effect of MUFA (6-7), meta-analyses by Mensink and Katan and Yu et al. (8-9) have shown total and LDL cholesterol-lowering effects of MUFA as well as increases in HDL cholesterol.

Linoleic acid (18:2) has been shown to reduce total and LDL cholesterol and raise HDL cholesterol compared with stearic acid (18:0) (10,14). A greater total cholesterol-lowering effect of linoleic acid compared with oleic acid has been observed in some studies (15-16) whereas another study observed similar effects on total cholesterol (17). PUFA significantly decreased total and LDL cholesterol when substituted for carbohydrate suggesting and independent cholesterol-lowering effect of PUFA (18). Despite the reduction of total and LDL cholesterol when PUFA is substituted for carbohydrate, results from both meta-analyses and clinical studies show that PUFA do not reduce HDL cholesterol (7-10). Some studies have reported a reduction in HDL cholesterol however, large amounts of PUFA were consumed in those studies (19-22). The effects of dietary fats high in PUFA compared with MUFA on lipids and lipoproteins were reported in a meta-analysis of 14 studies conducted by Gardner and Kraemer (23). The results indicated similar total, LDL and HDL cholesterol responses to diets high in MUFA or PUFA. However, triglyceride levels were consistently lower on the diets high in PUFA versus high in MUFA. These results reported by Gardner and Kraemer suggest a comparable blood cholesterol-lowering response when oils high in PUFA versus

MUFA are substituted for fat sources high in SFA. Other studies, however, have shown a greater cholesterol lowering effect of PUFA compared with MUFA (8-10).

The research summarized underscores the importance of the relative amounts of individual fatty acids that have opposing effects on blood cholesterol levels. It is evident that the changes in the proportion of each result in interactive effects that enhance or attenuate the blood cholesterol response. Collectively, fatty acid profiles of different diets can be changed in a myriad of ways with a potentially different consequent effect on blood cholesterol levels.

LDL Oxidation

Oxidative modification of low-density lipoprotein is thought to play an important role in the development of atherosclerosis (24-27). When LDL becomes modified by oxidation, the resulting oxidized LDL becomes exceedingly atherogenic. Oxidized LDL is the key step in the formation of foam cells because it induces cholesterol accumulation in macrophages (24-27). Both native and oxidized LDL can be taken up by monocytes and macrophages via LDL receptors and scavenger receptors. However, LDL receptors are down-regulated with increasing intracellular cholesterol levels (28) whereas scavenger receptors on macrophages are not down-regulated by intracellular cholesterol content (29). This difference was explained by Brown and Goldstein who suggested that since macrophages act to scavenge damaged material, lipoproteins might somehow need to become modified in order to be taken up by these cells. They observed that LDL modified by acetylation was taken up rapidly by a novel macrophage acceptor, referred to

as the scavenger receptor. Scavenger receptor expression is not down-regulated by an increase in intracellular LDL content (30). Thus, these receptors will continue to take up modified LDL particles regardless how much cholesterol accumulates in the cell. The accumulation of lipids in macrophages can lead to a conversion of macrophages to foam cells. Foam cells are the typical constituent of the fatty streak and atherosclerotic plaque.

LDL oxidation occurs in three phases. The first phase (lag time) proceeds slowly initially until the antioxidant content within the LDL particle is depleted. Oxidation begins on the LDL surface, where there is a sequential loss of α-tocopherol, γ-tocopherol, lycopene and β-carotene (31). The propagation phase (rate of oxidation) begins following the depletion of antioxidants from LDL in which LDL polyunsaturated fatty acids are rapidly oxidized to lipid hydroperoxides. During the final decomposition phase (formation of total dienes), the lipid hydroperoxides are converted to aldehydes, including malondialdehyde, hexanal and 4-hydroxynonenal (32) which may act with lysine residues in apolipoprotein B (apo B), modifying apo B so that it is recognized by the macrophage scavenger receptor (33) thus resulting in the accumulation of lipids in macrophages.

Oxidized LDL have chemotactic activity for circulating mononocytes (33-34) and stimulate the secretion of adhesion molecules from endothelial cells (35-37). Adhesion molecules increase monocyte adhesion and facilitate their differentiation into tissue macrophages (38) thus aiding in the development of the fatty streak. Oxidized LDL can stimulate monocytes to secrete interleukin-1 and endothelial cells to secrete basic fibroblast growth factor which stimulates smooth muscle cell proliferation (39). Smooth muscle cell and macrophage proliferation and accumulation of foam cells causes

thickening of the intimal layer of the artery wall. This thickening results in reduction of the diameter of the lumen of the artery and impairment of the normal vasodilatory capacity of the arterial wall. Although the precise mechanisms of atherosclerosis are still being elucidated, oxidation of LDL enhances the formation of the fatty streak and eventually the accumulation of plaque within the artery wall.

LDL Oxidation and Dietary Fat

Diet has been shown to modulate the susceptibility of LDL to oxidative modification. Therefore, dietary manipulations that increase LDL oxidative resistance could potentially delay the progression of CVD. One of the first studies to examine the effects of different types of fat on LDL oxidative susceptibility showed that LDL isolated from rabbits fed a diet rich in oleic acid were more resistant to oxidation than those fed a diet rich in linoleic acid (40). Similar results were observed in humans in a series of studies conducted by Reaven et al. (41-42). In the first study, subjects (n=9) were randomly assigned to either an oleate or linoleate supplemented liquid diet (41). The diets were consumed as the subjects' main energy source for five weeks and contained 40% energy from fat, 45% energy from carbohydrate and 15% energy from protein and varied only in the percentage of MUFA and PUFA. The results of this study showed a significant enrichment of LDL content of oleate or linoleate after consumption of the corresponding diet. The linoleate group generated more total dienes, had a rate of oxidation that was 1.6 times faster and a LDL oxidation lag time that was two times shorter than the oleate group. Increased production of total dienes and lipid

hydroperoxides with a linoleate-rich diet compared with an oleate-rich diet were reported in a second study by these investigators in a group of hypercholesterolemic subjects (n=13) after 8 weeks of dietary intervention (42).

Bonanome et al. (43) compared the effects of a diet high in MUFA compared to a diet high in PUFA on the susceptibility of LDL to oxidative modification in eleven male subjects. Both diets contained 45% total fat, 10% SFA, 15% protein and 40% carbohydrate. The high MUFA diet contained 30% MUFA and 5% PUFA while the high PUFA diet contained 5% MUFA and 30% PUFA. In contrast to the results of the study by Reaven et al. (41), the results of this study showed no significant differences in lag time between the two diets, however the rate of oxidation was significantly higher following the PUFA compared to the MUFA diet ($p<0.01$). The authors concluded that diets rich in MUFA render plasma LDL more resistant to oxidation than diets enriched in linoleic acid and that this effect is related to the enrichment of plasma LDL particles with oleic acid. Similar results were observed in a crossover study by Abbey et al. (44) in which 12 normolipidemic men consumed either a daily diet supplement containing 35 g linoleate-rich oil or 35 g oleate-rich oil. No effect of fatty acid composition on lag time was observed however, rate of oxidation and total dienes produced was greater following the linoleate diet compared with the oleate diet.

Mata et al. (45) evaluated the effects of four diets, differing only in their fat saturation, on LDL oxidation in healthy men and women (n=42). The composition of the diets was 15% protein, 50% carbohydrate, and 35% fat. Each diet was relatively enriched with either SFA, MUFA, n-6 PUFA or n-3 PUFA and each diet was consumed for five weeks. The results of this study indicated that lag time was increased following the

MUFA diet compared with the other three diets as well as a reduced production of total dienes following the MUFA diets compared to both PUFA diets.

Several studies have shown a decreased susceptibility of LDL to oxidation when saturated fat in the diet is reduced (46-47). Previous work in our laboratory showed that a dietary reduction of saturated fat resulted in decreased susceptibility of LDL to oxidation (46). Total and saturated fat were reduced in a stepwise manner (34%, 29% and 25% for total fat and 15%, 9% and 6% for saturated fat). The greatest reduction in rate of oxidation as well as formation of total dienes and lipid peroxides was observed when subjects consumed the diet lowest in both total and saturated fat. Hargrove et al. (47) examined the effects of diets high in MUFA (34% total fat, 7% saturated fat) as well as an average American diet (34% total fat, 16% saturated fat) and a Step 2 diet (25% total fat, 7% saturated fat) on measures of LDL oxidative susceptibility. When the average American diet was compared with the Step 2 diet no significant differences were observed in the amount of total dienes produced or the rate of oxidation. However, lag time was significantly shorter following the average American diet compared with the Step 2 diet.

In summary, these results suggest that diets high in MUFA increase the resistance of LDL cholesterol to oxidative modification compared with diets high in PUFA. Resistance to oxidative modification has also been observed with dietary reductions in total and SFA.

LDL Oxidation and Iron

The Oxidative Stress Theory states that the production of tissue-damaging free radicals is an essential component in the pathogenesis of chronic diseases and that iron may aid in catalyzing the reactions by the production of these free radicals. In 1981, Sullivan (48) proposed that body iron stores were directly related to risk of cardiovascular disease. The basis for this hypothesis was that due to their lower iron stores, pre-menopausal women had a reduced prevalence of coronary heart disease (CHD) than both post-menopausal women and men (48). Renewed interest in this hypothesis emerged in 1992 when Salonen et al. (49) showed a positive linear relationship between risk of heart attack in Finnish men and serum ferritin levels. Since that time there has been a great interest in understanding the relationship between iron status and coronary heart disease risk. Presently, iron is thought to indirectly affect CHD by catalyzing the oxidation of LDL cholesterol (50).

Iron is either carried between tissues by transferrin or stored as ferritin (51). Therefore, "free iron" is not present in significant concentration in a healthy individual. However, stored iron can be released from ferritin by the action of the superoxide radical (52). It is the released form of iron (Fe^{+2}), which initiates the peroxidation of lipids via the Haber-Weiss series of reactions:

$$O_2^{\cdot -} + Fe^{+3} \rightarrow O_2 + Fe^{+2}$$

$$\underline{Fe^{+2} + H_2O_2 \rightarrow Fe^{+3} + OH^- + HO^{\cdot}}$$

$$O_2^{\cdot -} + H_2O_2 \rightarrow O_2 + OH^- + HO^{\cdot}$$

It is the formed hydroxyl radical that gives rise to oxidative stress. The hydroxyl radical has great pathological influence in cardiovascular disease due to the amplified effect that the reduced form of iron has on lipid peroxidation (53). An accumulation of oxidized LDL leads to the development of foam cells that ultimately result in the formation of plaques in the arterial walls.

Despite the theoretical background there has been little evidence to support the hypothesis that increased iron stores increase heart disease risk. Salonen et al. (49) conducted the first prospective study that suggested an association between elevated iron stores and CHD risk. The findings of Salonen et al. (49) were based on results from the Finnish Kuopio Ischemic Heart Disease Risk Factor Study which included 1931 men free of CHD at baseline. Subjects were excluded if they had a history of myocardial infarction (MI), angina or used nitroglycerine tablets one or more times per week. Heart attack as defined by enzyme criteria or electrocardiogram (ECG) occurred in 46 of the men during the 3-year follow-up period. After adjusting for age, cigarette pack-years, ischemic ECG in exercise test, maximal oxygen uptake, systolic blood pressure, blood glucose, serum copper, blood leukocyte count, HDL cholesterol, apolipoprotein B and serum triglyceride levels, a significant positive linear association between serum ferritin and risk of heart attack was observed. Men with a serum ferritin ≥ 200 µg/L had a 2.2-fold (95% CI, 1.2-4.0; $p < 0.1$) risk of acute myocardial infarction compared with those with lower serum ferritin values (< 200 µg/L). Even after 5 years of follow-up and 83 heart attacks, the data indicate that the relationship is still significant (RR: 2.0, 95% CI, 1.2-3.1; $p=0.004$) (54). These data suggest that a possible risk factor for CHD is increased iron storage.

Since the publication of Salonen et al. in 1992 (49), there have been several prospective studies investigating the relationship between serum ferritin concentration and CHD. Although two of these studies support an association between CHD risk and iron stores (55-56), the results of both studies suggest the relationship occurs in individuals already at increased CHD risk due to other risk factors. The relationship between serum ferritin and myocardial infarction was studied in an elderly population of the Rotterdam Study using a nested case-control approach (55). Similar to the results of Salonen et al. (49), subjects with a serum ferritin ≥ 200 μg/L had a risk of 1.82 (95% CI, 0.90-3.69; p = 0.096) for myocardial infarction compared with those with serum ferritin values < 200 μg/L. In addition, risk of myocardial infarction was most pronounced in subjects with serum ferritin in the highest tertile (>171 μg/L) who were current or past smokers (OR: 1.68; 95% CI: 1.17,2.47; p =0.008) or in those with diabetes (OR: 2.41; 95% CI: 1.12,7.67; p =0.027) or hypercholesterolemia (total cholesterol > 6.5 mmol/L) (OR: 1.43; 95% CI: 0.99,2.11; p =0.056). Results from the Bruneck Study showed that serum ferritin levels predicted carotid atherosclerosis progression (56). This prospective study was conducted with 826 men and women 40 to 79 years of age who were followed over five years. One of the strongest predictors of atherosclerosis progression was serum ferritin however the modification of the atherogenic potential of LDL cholesterol accounted for the majority of this association (p=0.0012).

Several other prospective studies did not identify a relationship between body iron stores and CHD (57-64), including a meta-analysis of five prospective studies [570 cases of CHD] that obtained a combined risk ratio of 1.0 (95% CI, 0.8–1.3) when using ferritin as a measure of iron status (61). The National Health and Nutrition Examination Survey

(NHANES) II Mortality Study of 1604 men and women 45-74 years of age who were free CHD at baseline (self-reported) (62) found no association between serum ferritin and death from MI, CHD, or CVD in any of the race/sex groups. In a study by Magnusson et al., (57) a cohort of 2036 Icelandic men and women ages 24-74 were followed for 8.5 years. While no association between ferritin and incidence of CHD was found (RR=0.999, 95% CI, 0.997-1.001), the authors reported a strong significant negative association in men between total iron binding capacity (TIBC) and risk of heart attack (RR=0.95, 95% CI, 0.92-0.98). For each 1 μmol/L increase in TIBC, the risk of MI was reduced 5.1%. However, no association was observed between coronary mortality and TIBC in a prospective study of 6086 men and 6102 women ages 45-64 followed for 14 years (58).

More recently, the Health Professionals Follow-up Study examined the relationship between risk of CHD and blood donation (59) in 38,244 men over 4 years. While a strong association between lifetime blood donation and lower plasma ferritin levels was observed, no association was found between the number of blood donations and the risk of MI. In a nested case-control study (63) involving 238 men participating in the Physicians Health Study who had experienced a MI and 238 controls matched for age and smoking status, men with serum ferritin of 200 μg/L did not have a greater risk for MI (RR=1.1, 95% CI, 0.7-1.6). Similar results were obtained in a nested case-control study involving a subset of men from the Helsinki Heart Trial (64). The risk of developing CHD was not associated with increasing ferritin levels (p=0.8 for trend).

Several studies have examined the possible link between iron and LDL oxidation (60, 65-67). In a study by Salonen et al. (65) that included Finnish men (n = 14) who

were smokers, a reduction in body iron stores by way of venesection (blood letting) increased resistance of serum LDL to oxidation in vitro. Lag time was increased by 33% and there was a 44% reduction in serum ferritin concentration. However, in some studies, there was no association between body iron stores and measures of LDL oxidation (60, 66-67). The relationship between serum ferritin and susceptibility of LDL to in vitro oxidation was studied in a subset of subjects (281 men and 192 women) who participated in the second examination of the Atherosclerosis Risk in Communities (ARIC) Study. No evidence was found to support the hypothesis that high levels of ferritin are associated with increased oxidative stress (60). These findings agree with results previously reported from ARIC between ferritin and asymptomatic carotid atherosclerosis in which there was no association (67). A recent retrospective study conducted in subjects that had participated in well-controlled feeding studies (66) did not support a relationship between iron intake, free iron concentration and measures of lipid peroxidation. However, the amount of iron ingested by these subjects (17–21 mg/d) met the RDA for women (18 mg/d) and therefore, iron status in the normal range, does not appear to have an effect on the availability of iron for intracellular oxidation.

At the present time, most of the epidemiologic evidence fail to support the hypotheses of Sullivan (48) and Salonen et al. (49). It has been suggested that the observed relationship between serum ferritin and risk of CHD may be due to the role serum ferritin plays in inflammation (68-69) and inflammation has been found to be associated with increased risk of CHD (70). Alternatively, increased iron stores may be an indicator for a number of other risk factors thereby potentially confounding the relationship with CHD. For example, body mass index (BMI), fibrinogen, HDL

cholesterol and diastolic blood pressure were all shown to be predictors of serum ferritin concentration in a cross-sectional study of 337 healthy Norwegian men which may explain why some studies have reported an association between iron status and heart disease risk (71). While there are conflicting data in the literature, the evidence supporting the relationship between iron and heart disease has been reported in epidemiologic studies. These studies have provided information only on associations, and not cause and effect relationships. Therefore, it is important to experimentally evaluate the relationship between iron status and heart disease risk in a controlled clinical study in order to determine causal relationships.

LDL Size/Phenotype

LDL subclasses have been defined on the basis of a variety of characteristics, including particle density, size, charge and chemical composition (72). The distribution of mass among these subclasses is reflected by the particle diameter and buoyant density of the predominant LDL species which are determined by nondenaturing gradient gel electrophoesis (72-73) and analytic ultracentrifugation (72,74), respectively. Larger, more buoyant LDL with a peak diameter > 25.5 nm have been defined as pattern or phenotype A while the smaller, more dense LDL with a peak diameter < 25.5 nm have been termed pattern or phenotype B (73,75).

An accumulating body of evidence links the prevalence of small, dense LDL with increased risk and the pathogenesis of atherosclerosis. LDL phenotype B has been associated with a three-fold increase in the risk of acute myocardial infarction (76). In

addition to case control studies of myocardial infarction (76), this association has been demonstrated in angiographically documented coronary disease (77-79). Nested case-control analyses from prospective studies of three population cohorts have all demonstrated that a significant predictor for the development of CHD was a reduced LDL particle size at baseline (80-82). However, in the majority of studies to date, the disease risk associated with small, dense LDL was no longer significant after adjusting for triglycerides (76,78,79,82) or other risk factors (77,80). In fact, the Framingham Offspring Study confirmed plasma triglycerides to be the single most important determinant of LDL size (77,83).

The prevalence of LDL phenotype B is 30-35% in adult men. However prevalence is much lower in men less than 20 years of age and in pre-menopausal women (5-10%) (73,84), and slightly higher (15-25%) in post-menopausal women (84-85). Genetic heritability estimates of LDL particle size range from approximately 30-50% (86). This range indicates the importance of non-genetic and environmental influences.

LDL Size and Dietary Fat

Variations in dietary fat and carbohydrate intake have been shown to contribute to variations in LDL particle size distribution that are observed among individuals and population groups and thus influence the expression of LDL phenotype B. Cross-sectional population analyses (87) have suggested an association between reduced LDL particle size and a low-fat, high carbohydrate diet.

Dietary effects on LDL subclass patterns were explored in a randomized crossover study of 105 normolipidemic men who consumed a high-fat diet (46% total fat) and a low-fat diet (24% total fat) each for six weeks in a randomized crossover design (88). LDL cholesterol was reduced on the low fat diet for both subclasses, however this reduction was significantly greater ($p=0.003$) for individuals with phenotype B ($n=18$), approximately two-fold, compared with those individuals with phenotype A. Additionally, 41% of the men (36 of the 87 men) with phenotype A on the high-fat diet converted to phenotype B on the low-fat diet. These results indicate that in the majority of men, the reduction in LDL cholesterol observed on a low-fat, high-carbohydrate diet is mainly due to a shift from larger, more cholesterol-enriched LDL to smaller, cholesterol-depleted LDL suggesting a change in LDL composition with minimal change in particle number. However, individuals with a predominance of small, dense LDL on a high-fat diet achieve greater reductions in LDL cholesterol, as well as a reduction in the number of smaller LDL particles.

The effects of further reductions in dietary fat were investigated in men who had shown phenotype A on both the high- and low- fat diets ($n=38$) in the previous study (89). A 10% fat diet was consumed for 10 days resulting in a conversion to phenotype B in 12 men while 26 men remained phenotype A. Reductions in LDL cholesterol did not differ in either group from previous values attained with the low fat diet (24%). Therefore, further restriction of dietary fat does not reduce CVD risk in normolipidemic men with LDL phenotype A but an increased risk was observed in those men who converted to phenotype B with further fat restriction. Taken together, the results of these studies have shown that the prevalence of LDL subclass phenotype B in men increased in

direct proportion to the extent to which dietary fat is replaced by carbohydrate. Thus, when 30% of calories in the diet were from fat, approximately one third of the men expressed phenotype B, whereas with short-term challenge of a 10% fat diet, the prevalence of phenotype B increased to an estimated two thirds of the population.

A possible genetic basis for the differential effects of low-fat diets on LDL levels in phenotype B subjects was examined in pre-menopausal women (n=72) who were switched from their usual diet (35% total fat) to an outpatient low-fat (20% total fat) diet for eight weeks (90). Reductions in LDL cholesterol following the 20% fat diet was significantly related (p=0.005) to the number of parents with phenotype B with the greatest reduction in daughters of two phenotype B parents and the least in daughters with no phenotype B parents (daughters with one phenotype B parent had an intermediate reduction).

Differences in LDL phenotype response to low-fat diets also were tested by studying responses to a very low fat diet in a group of 50 children to determine if this response had an underlying genetic basis (91). Offspring of two phenotype B parents had smaller LDL peak particle diameter, greater prevalence of phenotype B, and higher LDL cholesterol and triglycerides than did offspring of two phenotype A parents. The children consumed a very low-fat diet (10% total fat) for 10 days. Greater reductions in LDL particle size were observed following the very-low fat diet in children of two phenotype B parents. Also, the proportion of children shifting from phenotype A to phenotype B were also greater in those of two phenotype B parents. These studies suggest that genetic factors underlying predisposition to LDL subclass phenotype B influence the lipoprotein

response to low-fat diets and determine the propensity to express phenotype B on a low-fat diet.

However, these studies were performed using isocaloric diets designed to maintain stable body weight. Because weight loss has been shown to result in reduction of small, dense LDL and a shift to larger, more buoyant particles, this could attenuate the effects of a low-fat, high-carbohydrate diets described here (92-93).

Total dietary fat has been shown to affect LDL phenotype expression in persons with a genetic predisposition to convert between phenotypes and therefore, total fat recommendations should be individualized in order to maximally reduce an individual's CVD risk.

LDL Oxidation and LDL Phenotype

Small, dense LDL appear to be more atherogenic due to their poor binding affinity for the LDL receptor (94), prolonged residence time in the plasma, and increased susceptibility to oxidation. This prolonged residence time in the plasma may explain the mechanism by which small, dense LDL are more susceptible to oxidation (95-97). Smaller LDL particles have been shown to be cleared from the circulation more slowly than larger LDL both in normal persons and those with hyperapobetalipoproteinemia (98). Entrance into the arterial wall may also be easier for these particles due their smaller size (99-100). Although these particles have reduced binding to the LDL receptor, they bind more to the scavenger receptor (94, 101-102), which may provide the basis for the formation of plaques. Differences in oxidative susceptibility between large,

buoyant and small, dense LDL have been attributed to a number of factors including increased content of polyunsaturated fatty acids (95), altered properties of the surface lipid monolayer (103), and possibly with reduced content of free cholesterol (104).

A number of studies have shown that LDL subclasses differ in susceptibility to in-vitro oxidative stress (95-96, 104-105) with large, buoyant LDL more resistant, and small, dense LDL more susceptible to oxidation, as assessed by the length of the lag period between copper incubation and the propagation phase of free-radical generation. A study by Tribble et al. (106) compared intermediate-density lipoproteins, as well as buoyant and dense LDL subfractions, from 15 subjects with either the large, buoyant or the small, dense LDL phenotype. Oxidative susceptibility increased and antioxidant concentrations decreased with increasing lipoprotein density. Greater oxidative susceptibility and lower antioxidant concentrations were observed in the intermediate-density lipoproteins from subjects with the small, dense LDL phenotype. Chait et al. (105) explored whether subjects with LDL phenotype B demonstrated a greater susceptibility to oxidative modification than subjects with LDL phenotype A. Lag time, rate of oxidation and total diene production were measured in six LDL fractions for each of the 17 subjects. Lag time was inversely correlated with LDL density ($p< 0.001$). However, no effect of lipoprotein phenotype was observed between the two groups ($p=0.80$). The major difference observed between the two phenotypes is that relative to LDL phenotype A subjects, subjects with LDL phenotype B had the majority of their LDL mass in the subfraction more susceptible to oxidation. When comparisons were made between the lag times in the LDL subfraction containing a significant portion of the LDL mass, a significantly shorter lag time in the LDL peak was observed in subjects with

LDL phenotype B. A recent study by Liu et al. (107) explored the oxidizability of LDL in different phenotypes in patients with familial combined hyperlipidemia (FCHL). FCHL patients, independent of phenotype, exhibited more susceptibility of LDL to oxidation as indicated by lag time than did healthy controls. Both the FCHL patients and the healthy control group showed a significant correlation between the lag time for LDL oxidation and LDL size ($r = 0.48$, $p < 0.001$ and $r = 0.48$, $p < 0.01$, respectively). The authors conclude that increased LDL oxidation susceptibility may be attributed to an abundance of small, dense LDL particles.

HDL Subpopulations and Paraoxonase

HDL cholesterol is an important negative risk factor for coronary heart disease (108). The role of HDL subpopulations has received increased attention in recent years with a growing body of evidence showing that these subpopulations differ in their abilities to protect against CHD (109-110). HDL particles have been classified into the larger, lipid-rich HDL_2 subclass and the smaller, more dense HDL_3 subclass.

HDL cholesterol concentrations have been shown to be affected by diet. Berglund et al. (111) observed a significant reduction in HDL_{2b} concentration as well as non-significant increases in the three HDL_3 subpopulations with a step-wise reduction in total and saturated fat. An average American diet (AAD) (34% total fat, 15% SFA), Step 1 diet (29% total fat, 9% SFA) and a Step 2 diet (25% total fat, 6% SFA) were studied. The Step 2 diet decreased HDL_2 by 17.2% and HDL_3 by 5.7% compared with the AAD. Several studies have reported a positive correlation between LDL and HDL size (112-

115). The effect of replacing dietary fat with carbohydrate was examined in a study by Williams et al. (116). Replacing dietary fat with carbohydrates significantly decreased HDL_{3a}, HDL_{2a}, and HDL_{2b} and reduced HDL_{2b} significantly more in subjects with LDL phenotype A than in LDL phenotype B suggesting that unfavorable HDL changes were more likely to occur in persons with LDL phenotype A than in those with phenotype B. However, the study by Williams et al. (116) compared a high fat diet (46% total fat) to a low fat diet (24% total fat) and thus changes in HDL subpopulations in response to more subtle differences in total and saturated fat reflecting an achievable fat intake consistent with current dietary recommendations have yet to be examined in relation to LDL phenotype.

Paraoxonase (PON), a HDL-associated enzyme, is capable of inhibiting LDL oxidation by destroying the biologically active phospholipids in oxidatively modified LDL. It has been reported that HDL can inhibit the oxidative modification of LDL in vitro, and this may contribute to its anti-atherogenic potential. Serum PON activity has been shown to be reduced in patients with diabetes, familial hypercholesterolemia (117) and following a myocardial infarction (118) when compared with healthy controls. Low serum PON has also been associated with increased risk for atherosclerotic disease (119). Avian HDL has been shown to exhibit no PON activity and fails to protect human LDL against lipid peroxidation (120). In apo E deficient mice, increased lipid peroxidation and lesion size were associated with decreased PON activity. An inverse relationship was observed between the progression of the atherosclerotic lesions in the mice and the increment of serum lipid peroxidation as well as a reduction in serum PON activity (121).

Paraoxonase has been suggested to contribute to the antioxidant protection that HDL confers on LDL oxidation (122-125). HDL associated PON has been shown to hydrolyze long-chain oxidized phospholipids isolated from oxidized LDL (122-123). Aviram et al. suggest that PON is responsible for the antioxidant effect of HDL cholesterol (124). While the lag phase of oxidation can be briefly extended by antioxidants, it has been shown not to affect the generation of lipid peroxides (125).

Not much is known about the association between diet and PON activity. Animal studies have shown effects of dietary fat on paraoxonase activity (126-127). Kudchodkar et al. (126) showed that the expression of serum PON can be regulated by dietary fat in rats. A significant increase in serum paraoxonase activity was observed after feeding monounsaturated fatty acids compared to both saturated and highly polyunsaturated fatty acids. Shih et al. (127) observed a reduction in serum PON activity in C57BL/6J atherosclerosis-susceptible mice but not in atherosclerosis-resistant mice when fed a high fat, cholesterol-rich diet.

To date, few human studies have examined the effects of macronutrient intake on paraoxonase activity. In a recent study by Ayub et al. (128), antioxidants such as the flavonoid quercetin were shown to reduce the amount of lipoprotein-associated lipid peroxides. Sutherland et al. (129) examined the effects of a meal rich in fat that had been used in deep-frying (used fat) on postprandial serum paraoxonase activity in healthy men. The used cooking fat contained a higher proportion of saturated fatty acids compared with the unused fat. Mean paraoxonase activity decreased significantly during the used fat meal and increased significantly during the meal rich in the corresponding unused fat. Recently, a study by de Roos et al. (130) showed that replacement of dietary saturated fat

by trans fatty acids decreased both HDL cholesterol as well as the activity of serum paraoxonase. It appears as though type of dietary fat may modulate paraoxonase activity in humans and therefore it would be interesting to determine if a reduction in both total and saturated fat which has been shown to decrease HDL cholesterol would show a similar reduction in paraoxonase activity.

Summary

In summary, oxidative modification of LDL is important in the development of atherosclerosis. Diet has been shown to modulate susceptibility of LDL to oxidative modification. In particular, consumption of dietary MUFA has been shown to increase resistance of LDL oxidation in comparison to dietary PUFA. Increases in body iron stores have been suggested to increase LDL oxidation in some populations groups. However, the body of this literature is epidemiologic studies and thus, controlled clinical trials are necessary to evaluate the relationship between iron and LDL oxidation. Increases in LDL oxidation have been observed in individuals expressing LDL phenotype B. The body of work in the area of LDL phenotype and LDL oxidation has been conducted without considering the effect of diet on LDL oxidation as well as the potential for those with LDL phenotype A to convert to LDL phenotype B in response to diet. In addition, there have been few studies that have considered the effect of LDL phenotype on HDL subpopulations in response to diet. Thus, while it is clear that LDL oxidation is important in the development of atherosclerosis, our understanding of the many different ways that diet could potentially affect LDL oxidation awaits clarification. A better

understanding of the role that diet plays in LDL oxidation may lead to interventions that target this putative CVD risk factor.

Objectives

The overall goal of the studies conducted is to investigate the effects of diet on oxidative stress in different population groups using study-specific methodologies. The specific objectives are described as follows:

1. To evaluate whether women with repleted iron stores due to supplementation have increased susceptibility of LDL to oxidation as well as to assess the possible interaction between dietary fat and iron status on measures of LDL oxidation.
2. To compare the effects of oils varying in unsaturated fatty acid composition on lipids and lipoproteins and measures of oxidative stress in moderately hypercholesterolemic men and women.
3. To determine if the susceptibility of LDL cholesterol to undergo oxidative modification in response to a low fat diet is related to LDL phenotype in men.
4. To assess whether changes in lipids and lipoproteins as well as HDL subpopulations in response to a low fat diet are related to LDL phenotype in men.

Hypotheses

1. Iron supplementation does not increase the susceptibility of LDL to undergo oxidative modification in women with low iron status.
2. A greater reduction in total and LDL cholesterol will be observed in the diet with the most PUFA compared to the diet with a greater percentage of MUFA. LDL may be more susceptible to oxidative modification following the diet with the greatest proportion of PUFA.
3. Susceptibility of LDL to oxidative modification will be increased in individuals with LDL phenotype B as well as those subjects who convert to LDL phenotype B in response to a low fat diet.
4. Individuals with LDL phenotype B as well as those subjects who convert to LDL phenotype B in response to a low fat diet will have increased total and LDL cholesterol and triglycerides and reduced HDL compared to those subjects with LDL phenotype A. In addition, individuals with LDL phenotype B as well as those subjects who convert to LDL phenotype B in response to a low fat diet will have smaller HDL particles due to a shift to the more dense subpopulations in response to a low fat diet.

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Chapter 3

IRON SUPPLEMENTATION DOES NOT AFFECT THE SUSCEPTIBILITY OF LDL TO OXIDATIVE MODIFICATION IN WOMEN WITH LOW IRON STATUS

A reprint can be found at http://www.nutrition.org/cgi/content/full/134/1/99

This includes the following:

Chapter 4

BALANCE OF UNSATURATED FATTY ACIDS IS IMPORTANT TO A CHOLESTEROL-LOWERING DIET: COMPARISON OF MID-OLEIC SUNFLOWER OIL AND OLIVE OIL ON CVD RISK FACTORS

Abstract

Objective: To evaluate a trans-free MUFA-rich vegetable oil (NuSun™ sunflower oil) that is a good source of PUFA and low in SFA on lipids and lipoproteins and oxidative stress.

Design: A double-blind, randomized, three period crossover, controlled feeding study.

Subjects/setting: Thirty-one moderately hypercholesterolemic men (n = 12) and women (n = 19), 25-64 years of age.

Intervention: Experimental diets provided 30% fat (olive oil or NuSun™ sunflower oil contributed one half of the total fat), 8.3% vs. 7.9% SFA, 17.2% vs.14.2% MUFA and 4.3% vs. 7.7% PUFA (olive oil and NuSun™ sunflower oil, respectively), and 294 mg cholesterol. The control diet was an average American diet (AAD) (34% fat, 11.2% SFA, 14.9% MUFA, 7.8% PUFA). Subjects consumed each diet for 4 weeks with a two-week compliance break before crossing over to the other diets.

Main outcome measures: Lipids and lipoproteins and measures of oxidative stress: lag time, rate of oxidation, total dienes, lipid hydroperoxides.

Statistical Analysis: PROC MIXED was used to test for main effects of diet, feeding period and order of diets. Tukey-Kramer adjusted *P* values were used to determine diet effects.

Results: The NuSun™ sunflower oil diet decreased both total and LDL cholesterol compared to the average American diet and the olive oil diet. There was no effect of the olive oil diet compared to the AAD. Total cholesterol decreased 4.7% and LDL cholesterol decreased 5.8% on the NuSun™ sunflower oil diet versus the AAD. There was no effect of the experimental diets on triglycerides, rate of oxidation, total dienes, lipid hydroperoxides or alpha-tocopherol. Lag time was the longest following the olive oil diet and shortest following the NuSun™ sunflower oil diet.

Applications/Conclusions: The higher PUFA content appeared to account for the greater total and LDL cholesterol lowering and reduction in lag time of the NuSun™ sunflower oil diet. However, the fact that there were no differences in the resulting oxidation products suggests there were no adverse effects on LDL oxidation. Since PUFA are important for cholesterol-lowering, foods that replace SFA should include a balance of unsaturated fatty acids.

Introduction

Cardiovascular disease (CVD) continues to be the leading cause of morbidity and mortality in developed countries. Elevated LDL cholesterol is the primary target of cholesterol-lowering therapy to reduce CVD risk (1). Diet is an important cornerstone in the prevention and treatment of CVD. To date, many controlled studies have focused on

comparing a diet low in saturated fatty acids (SFA) to either a diet high in carbohydrates (>60% carbohydrates, total fat < 30%) or high in monounsaturated fatty acids (MUFA) (>20% MUFA, total fat 30-35%). Fewer studies have evaluated the effects of incorporating a higher percentage of MUFA within the constraints of a Step 1 diet on lipids and lipoproteins and measures of oxidative stress. While olive oil has been used traditionally in studies evaluating the effects of MUFAs, other sources are now becoming available such as oleic acid rich sunflower oil. Previous work with hamsters demonstrated a greater reduction in non-HDL cholesterol following a hypercholesterolemic chow-based diet containing mid-oleic sunflower oil than the same diet containing olive oil (2). Food sources of unsaturated fat (that are low in SFA) will facilitate diet planning for persons with metabolic syndrome. For many of these patients, especially those with elevated triglycerides, a moderate fat diet is indicated because of potential adverse effects of a low fat diet on triglycerides (3).

NuSun™ is a mid-oleic sunflower oil developed by standard hybrid breeding that contains a similar proportion of oleic acid and a substantially greater proportion of polyunsaturated fatty acids (PUFA) and less SFAs compared to olive oil (Table 1). This fatty acid profile allows NuSun™ sunflower oil to be highly stable and therefore have a broad-based commercial use that eliminates the need for hydrogenation, a process that creates trans fatty acids. Current dietary guidelines recommend 5-10% (4) and up to 10% (1) of total calories from polyunsaturated fatty acids. PUFA compared to MUFA results in slightly greater LDL cholesterol reduction when substituted for saturated fat in the diet (5).

Oxidative modification of LDL cholesterol is thought to play an initiating role in the development of atherosclerosis (6-8). Diets high in MUFA versus PUFA have been shown to reduce the susceptibility of LDL to oxidative modification (9-12). However, new dietary fat sources such as NuSun™ sunflower oil that contains a balance of both MUFA and PUFA have not been studied. The objective of this study was to evaluate the effects of a new MUFA source that also is a good source of PUFA on lipids and lipoproteins and measures of oxidative stress. The hypothesis was tested that incorporation of NuSun™ sunflower oil into a NCEP Step 1 diet would result in a greater reduction in total and LDL cholesterol compared to both an average American diet and a Step 1 diet rich in olive oil due to the greater proportion of PUFA in the NuSun™ sunflower oil diet. In addition, because of the greater proportion of PUFA in the NuSun™ sunflower oil diet, we hypothesized that LDL cholesterol may be more susceptible to oxidative modification.

Subjects and Methods

Study participants

Thirty-one moderately hypercholesterolemic men (n = 12) and women (n = 19) ages 25-64 years (mean: 46 y) participated in the study. Subjects were recruited by a formal screening process that included a telephone interview, and a brief physical examination. Subjects were eligible for the study if they had serum LDL cholesterol levels between the 40th and 90th percentile and HDL between the 25th and 90th percentile for age, race and gender according to NHANES III data, triglycerides < 3.95 mmol/L and

were in good health. Baseline characteristics are presented in Table 2. Subjects were excluded from the study if they had a medical condition or history of chronic disease, used cholesterol-lowering medications, had a BMI greater than 30, had lost or gained more than ten pounds within the past two months, or had any lifestyle practices (i.e. irregular work schedule, frequent travel, extreme physical activity or heavy alcohol consumption) that would make it difficult to adhere to the restrictions of the study. The study was conducted in accordance with the guidelines of the Pennsylvania State University Institutional Review Board, and all subjects gave written informed consent.

Study design

A three-period crossover study design was used. Subjects consumed each diet for four weeks followed by a two-week compliance break between diet periods during which time subjects consumed their habitual diets. Every subject consumed each experimental diet in a random, balanced order sequence. All meals were provided and subjects were required to eat one meal per day (breakfast or dinner) on weekdays at the Pennsylvania State University Metabolic Diet Study Center; the other two weekday meals and weekend meals were packed for consumption at a time and place of convenience. Non-study foods and beverages were not permitted with the exception of non-energy-containing seasonings and beverages. Subjects were fed a diet that met their energy needs and were weighed daily between Monday and Friday to assure that weight was maintained. Compliance was monitored by body weight measurements and a dietary assessment questionnaire administered daily.

Dietary Intervention

The experimental diets provided the same amount of carbohydrate, protein and total fat; and one half of the fat energy in each test diet was provided by olive oil or NuSun™ sunflower oil (Table 3). Olive oil (OO) was selected as the high MUFA fat source because it has been widely evaluated. NuSun™ sunflower oil (NS) has not been widely evaluated in human subjects, because it is a newly developed fat source. An average American diet (AAD) served as a reference diet to approximate a diet that is typically consumed. Experimental diets met the guidelines of a Step 1 diet (<30% total fat, <10% SFA, <300 mg cholesterol) with approximately 8% of energy from SFAs, 30% of energy from total fat, and 294 mg cholesterol/d and served as a base diet to which the test fats were added. The test fats were incorporated in sauces, spreads, baked goods, granola, salad dressings as well as the dinner entrees (Table 4). The olive oil and NuSun™ sunflower oil diets were designed to have the same SFA level whereas MUFA and PUFA levels were not adjusted and reflected the fatty acid composition of the oils used in the respective diets. MUFA content varied between the diets (17.2% for OO and 14.2% for NS) as did PUFA content with 4.3% PUFA in the olive oil diet compared to 7.7% in the NuSun™ sunflower oil diet (Table 3).

Validation of diet composition

A 6-d menu cycle was planned using the NUTRITIONIST V database (N-Squared Computing, First DataBank Division, San Bruno, CA) and all menus were designed to be nutritionally adequate. The macronutrient profiles (including the fatty acid composition) of the three diets were analyzed chemically to validate the diet composition as described

previously (13). A 2500 kcal diet was chosen as the representative sample and a 6-d menu cycle was analyzed. The assayed experimental diets (Table 3) met the target nutrient goals established initially and were consistent with the nutrient database values.

Outcome Measurements

Blood samples were collected in the morning after a 12-hour fast on two consecutive days at the end of each diet period by nurses at The Pennsylvania State University General Clinical Research Center. Blood was collected into Vacutainer tubes (VWR Scientific Products, West Chester, PA) containing SST gel and clot activator for tubes used for serum collection and containing an anticoagulant, sodium ethylene diamine tetracetic acid (EDTA) for tubes used for plasma collection. Serum and plasma were separated by centrifugation for 15 min at 3000 x *g* and aliquoted into 2.0 ml cryovials and stored at -80°C until the completion of the study.

Lipids and Lipoproteins

Serum lipid, lipoprotein cholesterol, and apo A-1 and apo B were measured using a Cobas Mira Plus Clinical Chemistry Autoanalyzer. Serum total cholesterol (TC) (14) and triacylglycerol (TAG) (15) concentrations were measured enzymatically using the Infinity Cholesterol Reagent (procedure # 401) and Triglyceride (GPO-Trinder) Reagent (procedure 337) from Sigma Diagnostics (Sigma-Aldrich, St. Louis, MO). Serum high-density lipoprotein cholesterol (HDL-C) was measured using the EZ HDL Cholesterol Reagent (procedure 354L, Sigma Diagnostics, Sigma-Aldrich, St. Louis, MO), which is based on an anti-human β-lipoprotein antibody that forms a antigen-antibody complex

which inhibits these lipoproteins from reacting with the enzyme that forms a color complex with HDL. The concentration of LDL-C was calculated via the Friedewald equation (16). Serum apo A-1 and apo-B concentrations were measured using an SPQ Antibody Reagent Set II (procedure # 86059 and 86060, respectively) supplied by DiaSorin (Stillwater, MN), which utilizes an immunoprecipitin analysis. The accuracy of the TC, HDL-C, and TAG assays are maintained by participation in the Lipid Standardization Program of the Center for Disease Control and the National Heart, Blood, and Lung Institute.

LDL Isolation

Plasma LDL was isolated by single near vertical spin discontinuous density gradient ultracentrifugation as we have previously described (17). Briefly, plasma was adjusted to a density of 1.21 g/mL by addition of 0.4898 g solid KBr to 1.5 mL plasma, and then underlayed beneath 3.4 mL of 0.154 M NaCl in an Optiseal ultracentrifuge tube (Beckman Instruments, Palo Alto, CA). Optiseal tubes were placed in a pre-cooled Beckman NVT 65.2 near vertical rotor and centrifuged for 80 min at 170,000 x g and 7°C in a Beckman L8-70 ultracentrifuge. LDL (0.7 – 0.9 mL) was removed from centrifuge tubes by aspiration through the side of the tube using a 1 mL syringe with a 25 gauge needle. The LDL fraction obtained was then filtered through an Acrodisc 0.2 μm sterile syringe filter (Gelman Sciences, Ann Arbor, MI). Protein concentration of the isolated LDL was determined by a modification (18) of the Lowry et al. method (19).

LDL Oxidation

LDL oxidation was measured as conjugated diene production by the method of Frei and Gaziano (20) as described by us previously. Briefly, freshly isolated LDL was incubated at a concentration of 0.1 mg protein/mL assay volume, which included 250 μL of 20 mM HEPES buffer, 40 μL of 80 μM $CuSO_4$ and 0.154 M NaCl (volume = 710 μL – volume of LDL). Incubations were conducted at 37°C in a thermostatted 12-cell holder in a Cary 1E spectrophotometer (Varian Associates Inc., Palo Alto, CA). Conjugated diene formation was monitored every 10 min as the change in 234 nm wavelength absorption as described by Esterbauer et al. (21). Parameters of the conjugated diene assay measured included lag phase (resistance to oxidation), propagation phase (rate of oxidation), and maximum number of dienes formed.

Plasma Lipid Hydroperoxide Measurements

Five hundred μL of plasma was extracted according to the method for Lipid Hydroperoxide Assay from Cayman Chemicals (cat # 705002 Ann Arbor, MI) (22). This assay measures the hydroperoxides directly utilizing the redox reactions with ferrous ion. The resulting ferric ions are detected using thiocyanate ion as the chromogen.

Plasma LDL Tocopherol Analyses

Plasma LDL tocopherol levels were determined as previously described (23). Briefly, 200 μL of LDL sample (approximately 50 μg LDL protein) was treated with 200 μL of ethanol containing butylated hydroxyanisole (BHA) (10 mg/L) and 1.0 mL of hexane followed by vortex mixing. The samples were centrifuged at 500 x g for 5 min

and the organic layer transferred to a 4.0 mL brown borosilicate screw top vial. The samples were re-extracted with 1.0 mL of hexane, centrifuged and the organic layers were combined. The organic layer was evaporated under N_2 and reconstituted with 200 μL of ethanol containing BHA (10 mg/dL and injected into an HPLC). The HPLC system is a Model 5600 CoulArray 8-channel system with two Model 580 pumps, a high-pressure gradient mixer, a PEEK pulse damper, a Model 540 autoinjector, a CoulArray Thermostatic Chamber and a serial array of eight coulometric electrodes (ESA Laboratories, Inc., Chelmsford, MA). The column is a 3.0 x 150 mm, 3 μM, Supelcosil LC-18 (Supelco, Bellefonte, PA). A binary solvent mixture was used in this method. Solvent A consisted of methanol/ 0.2 M ammonium acetate (90:10, v:v). Solvent B consisted of methanol/ 1 Propanol/ 1 M ammonium acetate (78:20:2 v:v:v). A 25-minute gradient elution program of 100% solvent A to 100% solvent B with a 7 min hold of 100% solvent B at a flow rate of 0.8 mL/min was used for analysis. The concentration of plasma LDL tocopherol was determined by external standardization using purified solutions of tocopherol (Sigma Chemicals, St. Louis, MO). Accuracy and precision of tocopherol measurements were monitored by participation in the National Institute of Standards and Technology (NIST) Lipid Soluble Vitamin Quality Assurance Program.

Statistical Analyses

All data analyses were performed using SAS (version 8.0; SAS Institute, Cary, NC). Data are expressed as least squares means ± SEs. The mixed model procedure (PROC MIXED) was used to test for main effects of diet, feeding period and order of diets. Tukey-Kramer adjusted *P* values were used to determine statistical differences

between diets for each of the following variables: serum total cholesterol, LDL cholesterol, HDL cholesterol, triacylglycerol, apo A1, apo B, ratio of total to HDL cholesterol, ratio of LDL to HDL cholesterol, lag time, rate of oxidation, total dienes, lipid hydroperoxides and alpha-tocopherol. Probability values <0.05 were considered significant.

Results

The NuSun™ sunflower oil diet significantly reduced total and LDL cholesterol as well as apolipoprotein A1 compared to the AAD ($p<0.0001$, $p=0.0006$ and $p=0.0004$ respectively) (Table 5). No significant differences were observed between the olive oil diet and the AAD. Total and LDL cholesterol as well as apolipoprotein A1 were significantly lower following the NuSun™ sunflower oil diet compared to the olive oil diet ($p=0.005$, $p=0.008$ and $p=0.002$, respectively). Although the experimental diets were lower in total fat, triglycerides did not differ among the three diets. The ratios of total to HDL cholesterol, and LDL to HDL cholesterol were not significantly different among the three diets. Moreover, there was no diet effect on apolipoprotein B. Compared to the AAD, total and LDL cholesterol were significantly reduced by 4.7% and 5.8% following the NuSun™ sunflower oil diet. No significant differences were observed due to diet for rate of oxidation, total dienes, lipid hydroperoxides or alpha-tocopherol (Table 6). However, susceptibility as indicated by lag time was significantly different between the olive oil and NuSun™ sunflower oil diets ($p=0.01$). Lag time increased by 23% following the olive oil diet as compared to the NuSun™ sunflower oil diet.

Based on the blood cholesterol predictive equations of Mensink and Katan (5) the total and LDL cholesterol reduction predicted for the NuSun™ sunflower oil diet compared with the average American diets would be 4.8 mg/dL and 4.0 mg/dL, respectively. A 10.6 mg/dL reduction in total cholesterol and a 8.6 mg/dL reduction in LDL cholesterol was observed in the present study. Reductions similar to predicted values were noted between the olive oil diet and average American diet (2.9 mg/dL vs 2.6 mg/dL for total cholesterol and 1.7 mg/dL vs. 2.3 mg/dL for LDL cholesterol, observed vs. predicted).

Discussion

Current dietary recommendations for total fat are 20-35% (4) and 25-35% (1) of calories. These recommendations emphasize keeping SFA low (ATP III recommends < 7% of calories). Given that SFA are low and PUFA recommendations are 5-10% (4) and up to 10% of calories (1), the remaining dietary fatty acids are provided by MUFA. Due to concerns regarding the effect of PUFA on CVD risk factors such as oxidative stress, there is increased interest in using MUFA as the predominant fatty acid for manipulating total fat. The present study has shown the importance of PUFA in a moderate fat diet in lowering LDL cholesterol. Our design is unique in that we tested a real world model of incorporating high MUFA fat sources (olive oil and NuSun™ sunflower oil) without manipulating PUFA to a specified target level.

The results of the present study reinforce the importance of PUFA for cholesterol-lowering. Although the olive oil diet contained less saturated fat compared to the AAD, lipid and lipoprotein levels did not differ between these two diets. It is likely this reflected the lower PUFA content of the olive oil diet. Likewise, while the NuSun™ sunflower oil diet contained approximately the same amount of saturated fat as the olive oil diet, total and LDL cholesterol were lower following the NuSun™ sunflower oil diet versus the olive oil diet. This, too, likely reflects the higher PUFA content of the NuSun™ sunflower diet. Thus, even when saturated fat was reduced there was no effect on LDL cholesterol in subjects on the olive oil diet because dietary PUFA also decreased.

While reductions in total and LDL cholesterol were observed on the NuSun™ sunflower oil diet, the ratios of total:HDL cholesterol and LDL:HDL cholesterol did not significantly differ among the three diets. Kinosian et al. have discussed the clinical importance of these ratios (24). Three separate groups were evaluated in this study: men (n=1025) and women (n=1442) who participated in the 1970-1971 Framingham Heart Study biennial examination and the placebo group (n=1898 men) of the Lipid Research Clinics Coronary Primary Prevention Trial (LRC-CPPT). The total cholesterol/HDL ratio was a better measure of CVD risk than LDL cholesterol. Total and LDL cholesterol did not provide additional information when ratios were used as the primary measure to predict risk. However, when total and LDL cholesterol were used as the primary measures to predict risk, both ratios contributed additional predictive power. Apolipoproteins B and A1 track with LDL and HDL, respectively, and add additional information beyond the lipoprotein response relative to estimating CVD risk. Qualitatively, apolipoprotein A1 tracked with HDL cholesterol on the sunflower oil diet,

and to some extent on the olive oil diet. Likewise, apolipoprotein B tracked with LDL cholesterol on the sunflower oil diet, and to some extent even on the olive oil diet. Thus, the findings of the present study are not inconsistent with respect to the effects of the treatment diets on these lipoprotein and apolipoprotein responses.

Elevations in triglycerides are often observed as dietary fat is decreased (4). Thus, an important finding of the present study is that while the experimental diets were lower in total fat, triglycerides were similar among all three diets. Emerging evidence indicates that dietary fiber may prevent the hypertriglyceridemic response to a reduced fat diet (25). In the DASH (Dietary Approaches to Stop Hypertension) Study, Obarzanek et al. (26) showed that a diet providing 27% total fat and 7% saturated fat as well as high dietary fiber (30 g/d) significantly lowered total and LDL cholesterol without altering triglycerides compared to a control diet (37% total fat, 14% SFA, 11 g/d fiber). Triglycerides also were unchanged in a study comparing a typical Western diet (39% total fat, 15% SFA, 10 g fiber/1000 kcal) to a TLC/Step 2 diet (28% total fat, 7% SFA, 16 g fiber/1000 kcal) in moderately hypercholesterolemic subjects (27). In the present study the experimental diets contained more fiber (13.7g/1000 kcal) than the control diet (9.5g/1000 kcal). Therefore, the modest increase in dietary fiber in the experimental diets in the present study may have prevented the expected increase in triglycerides that often accompanies the consumption of diets reduced in total fat.

In a study conducted to evaluate cholesterolemic effects of different fat sources, Lichtenstein et al. (28) reported results similar to the present study for total and LDL cholesterol as well as triglycerides and total to HDL cholesterol ratios. The primary fat sources in the test diets fed in the Lichtenstein et al. study were: canola oil: 29.5% total

fat, 5.4% SFA, 14.5% MUFA, 6.7% PUFA; corn oil: 29.4% total fat, 6.9% SFA, 9.0% MUFA, 11.2% PUFA; olive oil: 30.0% total fat, 6.9% SFA, 17.0% MUFA, 3.9% PUFA. While all of the test oil diets resulted in reductions in total and LDL cholesterol compared to the baseline diet, the greater total cholesterol-lowering effects compared to baseline in subjects fed canola and corn oil diets (12% and 13%, respectively) than the olive oil diet (7%) could be explained by the lower level of dietary PUFA in the olive oil diet. In addition, reductions in LDL cholesterol paralleled those observed for total cholesterol, however these reductions were not significantly different. Similar to the present study, neither plasma triglycerides nor the total cholesterol to HDL cholesterol ratio were different between the baseline diet and the test oil diets in the Lichtenstein study. The results of the present study agree with those reported by Lichtenstein et al. (28) relative to demonstrating the importance of PUFA in a cholesterol-lowering diet.

Diet has been shown to modulate the susceptibility of LDL to oxidative modification. Studies have shown that diets rich in MUFA result in LDL that are less readily oxidized than LDL isolated from subjects who consume diets rich in PUFA (9-12). While some studies have shown a greater production of oxidation products following consumption of a high PUFA diet compared to a high MUFA diet, the results of the present study did not observe an increase in total dienes or lipid hydroperoxides following the NuSun™ sunflower oil diet which had a greater percentage of PUFA than the olive oil diet. Therefore, while the NuSun™ sunflower oil diet did not have a beneficial effect on LDL oxidation there were no adverse effects observed despite the increase in PUFA in this diet. This lack of effect may reflect comparable plasma alpha-tocopherol in the two treatment groups. Consistent with this is a study done by Hargrove

et al. (29) who reported similar diene production in test diets that differed in type and amount of fat but had comparable antioxidant levels. Similar diene production was also observed by Castro et al. (30) who compared test diets that had similar type and amount of fat but differed in MUFA source (oleic-acid rich sunflower oil or olive oil). Although Castro et al. (30) found significant differences in lag time between the two MUFA diets, the oleic acid-rich sunflower oil test diet had a longer lag time compared to the olive oil diet which was likely due to increased alpha-tocopherol in the oleic-rich sunflower oil diet. Taken together with the results of our study, despite increased oxidative susceptibility as indicated by a reduction in lag time, the lack of difference in the resulting oxidation products in these studies suggests no adverse effects on LDL oxidation.

Application

Much progress has been made to define an optimal diet that will reduce the risk of CVD and thereby benefit public health. Within the context of a moderate fat diet, it is becoming clear that a mixture of unsaturated fatty acids provides the greatest health benefits. The results of this study show that PUFA are an important component of a cholesterol-lowering diet. Therefore, an emphasis on a balance of unsaturated fatty acids is important when selecting food sources to replace SFA in the diet. More research is needed on the effects of fatty acids on endpoints that go beyond lipids and lipoproteins in

order to determine the appropriate mixture of unsaturated fatty acids that will maximally lower CVD risk.

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Table 1. Fatty Acid Composition of the Test Fats (%)

Fatty Acid	Olive Oil	NuSun™ sunflower Oil
Total C18:1	69.40	57.27
Total C18:2	13.98	32.30
Total SFAs[a]	14.31	9.60

[a] SFAs = saturated fatty acids

Table 2: Baseline Characteristics of Subjects (n=31)[a]

Age (years)	46.2 ± 0.8
BMI (kg/m^2)[b]	26.1 ± 0.3
Total Cholesterol (mmol/L)[b]	5.69 ± 0.05
LDL Cholesterol (mmol/L)[b]	3.70 ± 0.04
HDL Cholesterol (mmol/L)[b]	1.41 ± 0.02
Triglycerides (mmol/L)[c]	1.30 ± 0.05
TC/HDL[b]	4.2 ± 0.1

[a]Data are expressed as the mean ± SE.
[b]BMI (body mass index), TC (total cholesterol), LDL (low-density lipoprotein), HDL (high-density lipoprotein). To convert mmol/L cholesterol to mg/dL, multiply mmol/L by 38.7. To convert mg/dL cholesterol to mmol/L, multiply mg/dL by 0.026. Cholesterol of 5.00 mmol/L = 193 mg/dL.
[c]To convert mmol/L triglyceride to mg/dL, multiply mmol/L by 88.6. To convert mg/dL triglyceride to mmol/L, multiply mg/dL by 0.0113. Triglyceride of 1.80 mmol/L = 159 mg/dL.

Table 3: Assayed Values of Macronutrients, Fatty Acids, Cholesterol and Fiber of the Experimental Diets

Dietary constituent	AAD[a]	OO[a]	NS[a]
Carbohydrate (% of energy)	51.9	55.6	55.4
Protein (% of energy)	14.2	14.7	14.8
Fat (% of energy)	34.0	29.8	29.8
SFAs[a]	11.2	8.3	7.9
MUFAs[a]	14.9	17.2	14.2
PUFAs[a]	7.8	4.3	7.7
Cholesterol (mg/d)[b]	302.4	293.8	293.8
Fiber (g/1000 kcal)[b]	9.5	13.7	13.7

[a]SFAs (saturated fatty acids), MUFAs (monounsaturated fatty acids), PUFAs (polyunsaturated fatty acids), AAD (average American diet), OO (olive oil diet), NS (NuSun™ sunflower oil diet).
[b]Estimated using the NUTRITIONIST V database (N-Squared Computing, San Bruno, CA).

Table 4: NuSun™ Sunflower Oil Menu Example (1800 kcal)

Meal	Food	Amount (grams)
Breakfast	*Yoplait* 99% fat free original yogurt, fruit flavor	227
	Blueberries, frozen	70
	Skim milk	200
	NuSun™ sunflower oil granola	30
	Kellogg's All-Bran cereal	20
Lunch	Whole wheat bread	50
	Healthy Choice Deli smoked ham	53
	NuSun™ sunflower oil honey mustard spread	20
	Fig Newtons cookies	15
	Rold Gold thin twist pretzels	30
Dinner	Turkey Taco	100
	Egg yolk	13
	Butter	4
	NuSun™ sunflower oil	20
	Romaine lettuce	56
	Tomato	60
	Sweet corn	110
	Old El Paso Chunky salsa dip	30
	Cheddar cheese, shredded	12
	Tostitos Baked tortilla chips	30
Snack	Pear halves, canned in extra light syrup	130
	JELL-O gelatin snack	99

TABLE 5: Effect of the Experimental Diets on Lipids and Lipoproteins in Moderately Hypercholesterolemic Men and Women[a]

	Average American Diet	Olive Oil Diet	NuSun™ Sunflower Oil Diet
Total Cholesterol (mmol/L)[d]	5.75 ± 0.14	5.67 ± 0.14	5.47 ± 0.14[*#]
LDL Cholesterol (mmol/L)[bd]	3.76 ± 0.11	3.72 ± 0.11	3.54 ± 0.11[*#]
HDL Cholesterol (mmol/L)[b]	1.36 ± 0.06	1.34 ± 0.06	1.32 ± 0.06
Triglycerides (mmol/L)[c]	1.38 ± 0.11	1.28 ± 0.11	1.34 ± 0.11
TC/HDL[b]	4.4 ± 0.2	4.4 ± 0.2	4.4 ± 0.2
LDL/HDL[b]	2.9 ± 0.2	2.9 ± 0.2	2.8 ± 0.2
Apolipoprotein A1 (g/L)[d]	1.57 ± 0.06	1.56 ± 0.06	1.50 ± 0.06[*#]
Apolipoprotein B (g/L)	1.11 ± 0.03	1.08 ± 0.03	1.08 ± 0.03

[a]Data are expressed as least squares means ± SE.
[b]TC (total cholesterol), LDL (low-density lipoprotein), HDL (high-density lipoprotein). To convert mmol/L cholesterol to mg/dL, multiply mmol/L by 38.7. To convert mg/dL cholesterol to mmol/L, multiply mg/dL by 0.026. Cholesterol of 5.00 mmol/L = 193 mg/dL.
[c]To convert mmol/L triglyceride to mg/dL, multiply mmol/L by 88.6. To convert mg/dL triglyceride to mmol/L, multiply mg/dL by 0.0113. Triglyceride of 1.80 mmol/L = 159 mg/dL.
[d]Significantly different from Average American Diet: $^{*}P<0.05$, Significantly different from Olive Oil Diet: $^{\#}P<0.05$

Table 6: Effect of the Experimental Diets on the Susceptibility of LDL to Oxidation in Moderately Hypercholesterolemic Men and Women[a]

	Average American Diet	Olive Oil Diet	NuSun™ Sunflower Oil Diet
Lag time(min)[b]	73.9 ± 3.8	83.4 ± 3.8	67.9 ± 3.8*
Rate of Oxidation (nmol/min/mg protein)	38.1 ± 2.0	34.5 ± 2.0	37.3 ± 2.0
Maximum Dienes (nmol/mg protein)	2318.2 ± 94.7	2236.3 ± 94.7	2331.0 ± 94.7
Lipid Hydroperoxides (µmol/L)	65.7 ± 1.1	65.9 ± 1.1	65.9 ± 1.1
α-tocopherol (ng/µg LDL protein)	8.3 ± 0.8	8.2 ± 0.8	8.5 ± 0.8

[a]Data are expressed as least squares means ± SE
[b]Significantly different from Olive Oil Diet: *$P<0.01$

Chapter 5

INCREASED LDL OXIDATION IN SUBJECTS WITH LOW FAT DIET-INDUCED LDL PHENOTYPE B

Abstract

Background: Previous studies have shown that a low fat diet may be contraindicated for persons with LDL phenotype A who are susceptible to convert to LDL phenotype B but preferable for individuals with LDL phenotype B.

Objective: To determine if diet responsiveness including changes in lipids and lipoproteins, susceptibility of LDL to oxidative modification and HDL subpopulations differs between subjects with LDL phenotype A or B as well as those subjects who convert from LDL phenotype A to B in response to reductions in total and saturated fat.

Design: A randomized, double-blind, crossover, controlled feeding study was conducted in normocholesterolemic men (n=87) ages 25-64 years of age. The experimental diets were a NCEP Step 1 diet (28% fat, 9% SFA) and a Step 2 diet (24% fat, 6% SFA). An average American diet (AAD) (37% fat, 14% SFA) was the control diet. Subjects consumed each diet for 6 weeks.

Results: Total, LDL and HDL cholesterol as well as apolipoprotein B were significantly reduced and triglycerides significantly increased following both the Step 1 ($p<0.0001$) and Step 2 diets ($p<0.0001$) compared to the AAD in the sample as a whole. Total, LDL and HDL cholesterol as well as apo B were further reduced following the Step 2 diet ($p\leq0.02$) compared to the Step 1 diet. The analysis included subjects who remained LDL

phenotype A on all three diets (Stable A; n=55), those that remained LDL phenotype B on all three diets (Stable B; n=22), and a "change" group (n=10) which converted from LDL phenotype A to LDL phenotype B in response to reductions in total and saturated fat on the Step 1 and Step 2 diets. LDL size decreased following the Step 2 diet compared to the AAD in the "change" group compared to both the Stable A group ($p=0.0002$) and the Stable B group ($p=0.0003$). Rate of LDL oxidation and total dienes were increased in the "change" group across all diets compared to the Stable A group ($p=0.03$ and $p=0.02$, respectively) and the Stable B group ($p=0.06$ and $p=0.06$, respectively). No effect of diet or group was observed for lag time or paraoxonase activity. Reductions in apolipoprotein A1 were observed in the Stable A and Stable B subjects following both the Step 1 and Step 2 diets compared to the AAD ($p<0.0001$). The "change" group did not have a reduction in apo A1 but did have an increase in HDL_{3b} on the Step 2 diet compared to the AAD ($p=0.02$), indicative of a shift to a more dense HDL particle. In addition, HDL_{3a} was significantly larger following the Step 1 diet ($p=0.01$) and the Step 2 diet ($p=0.03$) compared to the AAD in all subjects.

Conclusion: Reductions in dietary total and saturated fat to levels recommended in clinical practice result in a reduction in both LDL and HDL particle size in some individuals, the "change" group. Coupled with an increase in LDL oxidative susceptibility, individuals who change from LDL phenotype A to B may be at increased risk for CVD. This may be of clinical concern, since particle size and LDL oxidative susceptibility are typically not assessed in practice.

Introduction

Smaller, more dense LDL particles have been associated with a threefold greater risk of myocardial infarction compared with larger, more buoyant particles (1). Recently, the National Cholesterol Education Program Adult Treatment Panel (ATP) III defined small, dense LDL particles as an emerging risk factor for coronary artery disease (2). LDL cholesterol has been classified as either large, buoyant LDL phenotype A (peak diameter > 25.5nm) or smaller, more dense LDL phenotype B (peak diameter < 25.5 nm). The prevalence of LDL phenotype B is 30-35% in adult men. However prevalence is lower in men less than 20 years of age and in premenopausal women (5-10%) (3, 4) and slightly higher (15-25%) in postmenopausal women (4, 5). Heritability estimates of LDL particle size range from approximately 30-50% (6). This range indicates the importance of non-genetic and environmental influences.

Dreon et al. reported that LDL phenotype modulates dietary lipid response (7). When subjects consumed a low fat diet (24% of total calories), those with LDL phenotype B showed a two-fold greater reduction in LDL cholesterol than those with LDL phenotype A (7). In addition, 41% of the subjects with LDL phenotype A on the high-fat diet (46% of total calories) converted to LDL phenotype B on the low fat diet. Therefore, a low fat diet may be preferable for individuals expressing LDL phenotype B. In addition, a moderate fat diet may be preferable for individuals with LDL phenotype A who are susceptible to converting to LDL phenotype B on a reduced fat diet. A growing body of evidence shows that HDL subpopulations may differ in their ability to protect against cardiovascular disease (8, 9). Berglund et al. examined the diet-induced changes

in HDL-subpopulation distribution as well as HDL particle size and showed that a gradual decrease in total and saturated fat intake significantly decreased HDL_2 and HDL_{2b}-cholesterol concentrations (10). While the relationship between diet and HDL subpopulations has been studied, there have been few studies that have considered the moderating effect of LDL phenotype on diet-induced changes in HDL subpopulations. The present study was designed to examine this question.

Oxidative modification of LDL cholesterol is thought to play an important role in the development of atherosclerosis (11-13). Diet can modulate the susceptibility of LDL to oxidative modification. Previous work has shown decreased susceptibility of LDL to oxidation with a reduction in dietary total fat and saturated fatty acids (SFA) (14). When total and saturated fat were reduced in a stepwise manner (34%, 29% and 25% for total fat and 15%, 9% and 6% for SFA, respectively), the greatest reduction in rate of oxidation as well as formation of conjugated dienes and lipid peroxides was observed when subjects consumed the diet lowest in both total and saturated fat. A number of in vitro studies have shown that susceptibility to oxidative stress differs between LDL phenotypes with large, buoyant LDL being more resistant, and small, dense LDL being more susceptible to oxidation (15-17). These differences in oxidative susceptibility have been attributed to variations in the physical-chemical properties of the LDL particle. To our knowledge there have not been any studies that have considered the interactive effects of diet and LDL phenotype on LDL oxidation. However, cross-sectional studies have found increased LDL oxidation in subjects expressing LDL phenotype B. Therefore, the question remains whether persons with LDL phenotype B will have increased oxidation in response to a low fat diet (low in saturated fat and cholesterol)

when this diet may improve their lipid profile. Due to the expected greater reduction in LDL cholesterol on a low fat/saturated fat diet in subjects with phenotype B compared with phenotype A, we hypothesized that these subjects would also exhibit less LDL oxidation. Therefore, an objective of this study was to determine if the susceptibility of LDL cholesterol to undergo oxidative modification differed between subjects with LDL phenotype A or B in response to a low fat/saturated fat diet, as well as in those individuals who converted from LDL phenotype A to B as the result of a blood cholesterol-lowering diet.

Subjects and Methods

Subjects

One hundred twenty male subjects between the ages of 22 and 64 were recruited to participate in the study conducted at the Pennington Biomedical Research Center. Subjects had LDL cholesterol between the 10th and 90th percentile, HDL cholesterol above 25 mg/dL and below the 95th percentile and triglycerides below the 95th percentile adjusted for age and gender values from NHANES II (18). Subjects were excluded if they had a BMI greater than 32 kg/m^2, hypertension, history of drug or alcohol abuse, extreme dietary habits, multiple food allergies or extreme levels of physical or athletic activity. Potential subjects were also excluded if they had evidence of any renal, hepatic, cardiovascular, endocrine, gastrointestinal or other systemic disease as determined by medical questionnaires, blood chemistry, urinalyses and physical examination during screening visits. Prior to admission into the study, potential subjects that met the

inclusion criteria were further screened with respect to LDL phenotype. The study was conducted in accordance with the guidelines of the Pennington Biomedical Research Center Institutional Review Board, and all subjects gave written informed consent.

Experimental Design

The study employed a randomized, double-blind, three-period, crossover design. Subjects consumed each of the diets for six weeks followed by a short compliance break between diet periods. Every subject consumed each experimental diet in a random balanced order sequence. A one-week diet 'run-in' period was implemented in order to familiarize subjects with the requirements of the study and to allow those subjects who felt that they could not tolerate the study's demands to drop out prior to randomization. Subjects who successfully completed the "run-in" period were then randomized to one of the six dietary sequences. Subject randomization provided balanced assignments with respect to screening LDL phenotype, to each of the six dietary sequences. A total of 87 subjects completed all three diet periods.

Experimental Diets

Subjects were fed three diets differing in total fat content: an Average American Diet (AAD) containing 37% calories as fat; a diet similar to the National Cholesterol Education Program (NCEP) Step 1 diet containing 30% calories as fat; and a diet similar to the NCEP Step 2 diet containing 25% calories as fat (Table 1). Although these diets have been studied on outcome variables such as total and LDL cholesterol, there is only

limited information regarding potential differential responses of these diets by specific LDL subclasses.

Subjects were provided with all food for the duration of the study. On weekdays, subjects were required to consume breakfast and dinner at the Pennington Biomedical Research Center dining facility. Weekday packaged lunches were distributed at breakfast and evening snacks were distributed at dinner. Weekend meals were packaged and distributed at the Friday dinner. Subjects were allowed the option of a "free choice meal" for Saturday dinner in order to enhance compliance and subject retention. Subjects were provided with guidelines so that the "free choice meal" was similar in composition to the Step 1 diet. Subjects who elected to consume a "free choice meal" were asked to record the foods that they consumed at this meal. The food records were examined and if the meal deviated substantially from the guidelines, the subjects were appropriately counseled. Endpoint measurements were collected towards the end of each week, thereby minimizing any short-term effects of this "free choice meal".

Biochemical Analyses

Fasting blood samples were obtained from each subject during weeks 5 and 6 of each dietary period for lipid and lipoprotein determinations, LDL size, HDL subpopulation distribution and LDL oxidation. Venous blood was collected with minimal hemostasis with subjects in a sitting position. Blood was drawn in the morning after a 12 hr fast. Subjects were not allowed to consume alcohol 48 hours prior sampling. Blood was collected in tubes containing 1.5 mg/mL EDTA for procedures requiring plasma and "red-top" tubes for procedures requiring serum. Samples were stored at room

temperature (serum) or on ice (plasma) for 15 minutes. Samples were centrifuged at the appropriate temperature at 2000 X g for 20 minutes. Upon completion of centrifugation, samples were appropriately aliquoted and stored at -80°C or transported to the laboratory on ice if immediate processing was required (i.e. ultracentrifugational isolation of lipoproteins). At the completion of the study (after all three dietary periods) all appropriate measurements for a given subject were conducted at one time to minimize the effects of inter-assay variations on the outcome of the results.

Lipids, lipoproteins and apolipoproteins

Serum total cholesterol, triglycerides, HDL cholesterol, and LDL cholesterol were determined on each of two separate occasions, taken one week apart. All routine lipid chemistry analyses were performed on the Beckman Synchron CX5 automated chemistry analyzer. HDL cholesterol was performed on the Beckman CX5 after precipitation of the non HDL fractions by dextran sulfate (50,000 MW) (DMA, Dallas, TX) following the protocol of Warnick et al. (19). Assayed controls by DMA were used to verify accuracy. LDL cholesterol was calculated using the Friedewald equation. The coefficient of variation for these assays is less then 2.0%. The Clinical Laboratory is certified by the CDC. ApoA-1, apo B were measured on a Beckman Array analyzer using reagents supplied by the manufacturer. The inter-assay coefficients of variation for these assays are on the order of 7%.

Susceptibility of LDL to oxidative modification

LDL was isolated as described above and stored at 4°C in the dark, under N_2 to minimize spontaneous oxidation. Susceptibility of LDL to oxidation was assessed by monitoring the formation of conjugated dienes at 235 nm following the addition of exogenous Cu^{2+} ions. Prior to analysis, LDL samples were diluted to 100 μg/2.0 ml in 1xPBS. Three mL samples were placed in cuvettes and copper acetate was added to a final concentration of 5 μM. Cuvettes were placed into a 37°C thermostated multicell transport of a spectrophotometer and the absorbance was determined every 5 minutes for 240 minutes. Data was analyzed to determine: 1) lag time preceding the onset of rapid formation of conjugated dienes; 2) the maximum rate of formation of conjugated dienes; and 3) and the maximum content of conjugated dienes.

Paraoxonase Activity

Citrated plasma samples were collected from each participant at specified time points during the study and frozen at -80°C until assayed. At the time of the assay, plasma samples were thawed, diluted 1:10 with 1X PBS and run in triplicate; samples which had been previously thawed were not used. Five microliters of the sample dilution was added to 1.0 mL of freshly mixed substrate solution in a quartz cuvette, mixed by inversion and placed into a spectrophotometer. Phenylacetate (4mM freshly mixed in 20mM Tris, pH 8.0/ 20mM $CaCl_2$) was used as a substrate for the enzymatic reaction. A reference blank, containing the same substrate solution, was included to correct for spontaneous hydrolysis of phenylacetate. Changes in absorbance at 270 nm, 25°C were

measured for 15 –20 minutes with readings taken every two minutes and enzymatic activity, expressed as units/mg protein, was calculated from the molar extinction co-efficient 1.310 $M^{-1}cm^{-1}$; one unit of arylesterase (paraoxonase) activity is defined as 1μM phenylacetate hydrolyzed per minute.

LDL size and HDL size distribution

LDL and HDL size distribution were determined in single frozen plasma samples obtained during screening and from each of the final two weeks of every dietary period from each subject. Published data (20) and preliminary results suggest that both LDL and HDL profiles remain stable after freezing at -80°C. LDL and HDL size distribution were determined by nondenaturing gradient gel electrophoresis as described by Krauss and Burke (21) and Blanche et al. (22) with the exception that in-house 2-16% concave acrylamide gels were used for LDL size and 4-30% gels for HDL size (23). All samples from a given individual were analyzed at the same time on two respective gels. Two quality-control samples, obtained from single-use aliquots of frozen (-80°C) plasma, were included on each gel. The quality-control plasma was chosen to provide different LDL phenotypes and high and low HDL_2 (HDL_{2a}+HDL_{2b}) levels. Each gel was stained with Oil Red O for lipid visualization, followed by Coomassie Blue to reveal protein distribution. Scanned images were made after each respective stain procedure. The lipid distribution, as a function of gel migration (R_f), was determined by densitometry at a resolution of 84 μM (BioRad GS-670 Imaging Densitometer). The R_f-based distribution was converted to a particle size-based distribution employing the paradigm developed by

Williams et al. (24) or by custom software available at PBRC. From the distribution of relative lipid-stain intensity versus particle diameter, the following parameters were determined: 1) LDL phenotype based upon the peak diameter for LDL (phenotype A: major peak >25.5 nm; phenotype B: major peak < 25.5 nm); 2) Relative HDL subpopulation distribution expressed as the percent of total HDL lipid staining intensity distributed among five HDL size classes as defined by Blanche et al. (22).

Statistical Analyses

All data analyses were performed using SAS (version 8.0; SAS Institute, Cary, NC). Data are expressed as least squares means ± SEs. The mixed model procedure (PROC MIXED) was used to test for main effects of diet and LDL phenotype (Stable A group, Stable B group or low fat inducible B ("change" group)) as well as the interaction between diet and group. Tukey-Kramer adjusted *P* values were used to determine statistical differences between diets and groups for each of the following variables: total cholesterol, LDL cholesterol, HDL cholesterol, triacylglycerol, apo A1, apo B, lag time, the rate of oxidation of total dienes, total dienes, paraoxonase activity, HDL subpopulations and LDL size. Probability values <0.05 were considered significant.

Results

As expected, total, LDL and HDL cholesterol as well as apolipoprotein B were significantly reduced and triglycerides significantly increased following the Step 1 diet ($p<0.0001$ for all) and Step 2 diet ($p<0.0001$ for all) compared to the AAD in the sample as a whole (Table 2). Compared to the Step 1 diet, total, LDL and HDL cholesterol as

well as apo B were further reduced following the Step 2 diet (p=0.0002, for total and LDL cholesterol and p=0.02 for HDL cholesterol and apo B).

Ten subjects converted from LDL phenotype A to LDL phenotype B during the study when switching from AAD to the Step 1 diet (n = 7) or the Step 2 diet (n = 3). Therefore, our analysis compared a Stable A LDL phenotype (subjects were LDL phenotype A during all three diet periods n = 55), Stable B LDL phenotype (subjects were LDL phenotype B during all three diet periods n = 22), and a "change" group in which subjects converted from LDL phenotype A to LDL phenotype B during the intervention diets (n = 10). Prior to treatment, both the Stable B group and the "change" group had higher triglycerides ($p<0.01$) and lower HDL cholesterol ($p<0.05$) compared to the Stable A group (Table 3).

LDL size was significantly reduced in all groups following both the Step 1 and Step 2 diets compared to the AAD (Table 4). Compared to the AAD, the "change" group, as expected, showed a greater reduction in LDL size following the Step 2 diet compared to the Stable A group (p=0.0002) and the Stable B group (p=0.0003) (Figure 1). In addition, a greater reduction in LDL size was observed in the "change" group following the Step 2 diet versus the Step 1 diet (p=0.002) (Figure 1).

No significant differences were observed due to diet or group for lag time or paraoxonase activity (Table 6). Differences between groups were observed for both rate of oxidation (p=0.03) and total dienes (p=0.02). The "change" group had an increased rate of oxidation and total dienes compared to the Stable A group (p=0.03 and p=0.02, respectively) and the Stable B group (p=0.06 and p=0.07, respectively).

Although no significant interactions between diet and group were observed for lipids and lipoproteins (with the exception of apo A1; p=0.02), group differences were observed across all diets. Compared to the Stable A group, both the Stable B group and the "change" group had increased apolipoprotein B, triglycerides, TC:HDL, LDL:HDL as well as reduced HDL cholesterol across all of the diets (Table 4). Apolipoprotein A1 was reduced following both the Step 1 and Step 2 diets ($p<0.0001$ for both) compared to the AAD in both Stable A and Stable B subjects (Table 4**)**. Compared to the Step 1 diet, apo A1 was further reduced on the Step 2 diet in Stable A subjects only (p=0.0006).

In the various HDL subpopulations, a significant effect of diet was observed for HDL_{3a} in all subjects (p=0.007). HDL_{3a} was significantly larger following the Step 1 diet (p=0.01) and the Step 2 diet (p=0.03) compared to the AAD (Table 5). Differences between groups were observed for HDL_{2b} (p=0.01). The Stable A group had increased HDL_{2b} compared with both the Stable B group (p=0.02) and the "change" group (p=0.09). In addition, a significant interaction between diet and group was observed for HDL_{3b} (p=0.005). In the Stable B group, HDL_{3b} was increased following the AAD (p=0.002), Step 1 diet (p=0.03) and Step 2 diet (p=0.01) compared with the Stable A group.

In the "change" group, HDL_{3b} increased on the Step 2 diet compared to the AAD in the "change" group (p=0.02). In addition, this increase in HDL_{3b} in the "change" group on the Step 2 diet was significantly different compared to the Stable A group (p=0.02) on the Step 2 diet. Compared to the AAD, only the "change" group had an increase in HDL_{3b} on the Step 2 diet (Figure 2).

Discussion

This study provided a unique opportunity to study the effects of diets reduced in SFA and cholesterol consistent with both population-based recommendations and treatment guidelines to decrease CVD risk. Studies have reported dietary effects on lipids and lipoproteins (25) as well as risk factors such as LDL size (7), susceptibility of LDL to oxidative modification (14, 26) and HDL subpopulations (10). To our knowledge, this study is the first to comprehensively explore differences between LDL phenotypes, including those subjects that convert to LDL phenotype B in response to diet, on risk factors beyond lipids and lipoproteins such as changes in LDL size, HDL subpopulations and LDL oxidative modification using diets that are currently recommended.

In the present study we observed reductions in total, LDL and HDL cholesterol as well as the expected increase in triglycerides as total fat was reduced from the AAD to the Step 1 and the Step 2 diet in all subjects. Our results are similar to those reported by Ginsberg et al. (25) in which an AAD was compared to Step 1 and Step 2 diets. In both studies, similar reductions in total, LDL and HDL cholesterol were observed between the Step 1 diet and AAD (5%, 7% and 7% respectively in both studies) and between the Step 2 diet and AAD (9% total cholesterol, 13% (our study) and 11% (Ginsberg et al.) for LDL cholesterol and 11% for HDL cholesterol) (25). In contrast we observed a 17% increase in triglycerides following the Step 1 diet whereas Ginsberg et al. observed 9%. No further increases in triglycerides following the Step 2 diet were observed in either study. The decrease in total and LDL cholesterol is expected to decrease CVD risk,

whereas the clinical impact of modestly increasing triglycerides and decreasing HDL cholesterol on both the Step 1 and Step 2 diets remains to be established.

Beyond the lipid and lipoprotein response in all subjects, the present study observed differing responses to a cholesterol-lowering diet in persons with LDL phenotype A, LDL phenotype B and those that changed from LDL phenotype A to B in response to a reduction in total fat. While the "change" group experienced the greatest reduction in LDL size as expected, reductions in LDL size were observed in both the Stable A and Stable B subjects following the Step 1 and Step 2 diets compared to the AAD. In general, our results are consistent with those reported by Dreon et al. (7). However, in the present study only 11% of subjects converted to LDL phenotype B in response to diet compared to Dreon et al. in which 41% of the LDL phenotype A subjects experienced a reduction in particle size in response to a reduction in dietary fat (7). This difference may be due to a less dramatic change in total fat between the experimental diets (37%, 28% and 24% for AAD, Step 1 and Step 2 diets, respectively) in our study compared to the much greater range of total fat (46% vs. 24%) in the study by Dreon et al. (7). This difference in the magnitude of total and saturated fat between the experimental diets may also explain why our results do not demonstrate greater LDL cholesterol lowering in those subjects with LDL phenotype B following a low fat diet. Therefore, consuming diets that are prescribed in clinical practice may cause a reduction in LDL particle size resulting in a conversion to LDL phenotype B in susceptible individuals. A unique characteristic of the "change" group is that although they present as LDL phenotype A, both their HDL cholesterol and triglycerides appear to be more like LDL phenotype B (Table 3). Thus, since LDL size is not routinely measured in clinical

practice susceptible individuals may be able to be presumptively identified based on lower HDL cholesterol and increased triglycerides. It will be important for clinicians to pay close attention to diet responses to lipids and lipoproteins and be prepared to revise dietary interventions if indicated.

In contrast to studies that report an increase in LDL oxidation for LDL phenotype B, the results of our study showed no difference in susceptibility of LDL to oxidative modification between subjects with LDL phenotype A and LDL phenotype B (15-17). However, the "change" group did have both an increased rate of oxidation and total dienes compared to both the Stable A and Stable B groups. Interestingly, while the "change" group had the greatest increase in LDL oxidation this group did not have the smallest LDL particle size. Therefore, there may be something metabolically unique about this group which makes its' LDL more susceptible to oxidation.

HDL subpopulations are affected by changing fat intake (27, 28). However, there is less information about changes in HDL subpopulations with more subtle changes in fat intake. Berglund et al. observed a significant reduction in HDL_{2b} concentration as well as a non-significant increases in the three HDL_3 subpopulations with a step-wise reduction in total and saturated fat (10). The results of our study show reduction in HDL_{2b} in both the Stable B and "change" group compared to the Stable A group regardless of diet the and a significant increase in HDL_{3a} as dietary total and saturated fat is reduced in all subjects. Therefore, while Berglund et al. observed a significant reduction in HDL_{2b} as dietary fat was reduced, we observed a significant increase in HDL_{3a}. Since these values are expressed as the percentage of total HDL, it is not surprising that HDL_{3a}, HDL_{3b} and HDL_{3c} are increased across the diets as HDL_{2a} and HDL_{2b} are decreased.

Reductions in HDL_{2b} as well as HDL_{2a} and HDL_{3a} with reductions in dietary fat were observed in a study by Williams et al. in which the difference in dietary fat between the diets was more dramatic (46% vs. 24%) than the present study (27). This study also observed a greater reduction in HDL_{2b} in LDL phenotype A subjects compared with LDL phenotype B subjects (27). Whereas Williams observed a greater decrease in HDL_{2b} in LDL phenotype A subjects, we observed an increased HDL_{3b} in the "change" group in response to a low fat diet. Taken together with the lack of reduction in apo A1 in the "change" group and a decrease in total HDL following the Step 2 diet it appears as though there is a shift in HDL particle size to a smaller and thus, less cardioprotective HDL particle. In addition, all subjects increase HDL_{3a} on the Step 1 and Step 2 diets compared to the AAD. Although this increase did not differ by group, the "change" group likely had a shift to a smaller particle whereas the Stable A and Stable B groups had a decrease in particle number due to the reduction of apo A1 in these two groups. Barzilai et al. (29) found larger HDL and LDL particles in group of centenarians and their offspring compared to a general population control group. Those with larger particles had a lower prevalence of hypertension ($p=0.001$), CVD ($p=0.008$) and metabolic syndrome ($p<0.001$). Individuals with type 2 diabetes have been shown not only to have reduced HDL cholesterol but a reduction in HDL_{2b} with relative increases in both HDL_{3b} and HDL_{3c} as well (30). Small HDL particles in individuals with both type 2 diabetes and CAD were also observed by Syvanne et al. (31). The evidence to date indicates that small HDL may increase risk of CVD. Further studies are needed to evaluate the effect of diet on CVD risk in response to a reduction in HDL size.

The reduction in both LDL and HDL size in the "change" group in response to diet is important in the context of how this might affect CVD risk. This is of particular concern because they converted to the more atherogenic LDL phenotype B on a Step 1/Step 2 diet. While the "change" group had a beneficial diet response with reductions in total and LDL cholesterol as well as total:HDL cholesterol and LDL:HDL cholesterol, reductions in HDL cholesterol and increases in triglycerides also were observed. The dietary guidance to lower total and saturated fat will result in some individuals converting to a more atherogenic LDL phenotype. Compared to those with who remain LDL phenotype A or B with dietary intervention there appear to be metabolic differences in individuals susceptible to changing phenotype with diet. Therefore, individuals who change LDL phenotype in response to diet appear to be at increased risk in terms of their overall lipid profile, LDL and HDL size and susceptibility of LDL to oxidation regardless of the type of diet they consume. Further studies are needed to clarify how changes in both LDL and HDL size affect CVD risk. It will be important to develop clinically feasible strategies to identify those individuals "at-risk" of converting to LDL phenotype B and prescribe a diet intervention that prevents this from occurring.

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Table 1. Assayed Nutrient Composition of Experimental Diets[1-2]

Diet component	AAD	Step 1 diet	Step 2 diet
Protein (%)	13.6 ± 1.2	13.9 ± 1.2	14.4 ± 1.3
Carbohydrate (%)	49.6 ± 1.9	58.0 ± 1.9	61.9 ± 2.2
Fat (%)	36.8 ± 1.4	28.1 ± 1.2	23.7 ± 1.4
Saturated	14.1 ± 1.2	8.8 ± 0.8	6.2 ± 0.8
Monounsaturated	14.5 ± 0.8	11.5 ± 0.8	9.7 ± 0.9
Polyunsaturated	8.3 ± 0.6	7.9 ± 0.6	7.8 ± 0.8
Cholesterol (mg/1000 Kcal)	104 ± 10	76 ± 8	63 ± 6
Fiber (g/1000 Kcal)	10	10	10

[1]Data are expressed as Mean ± SD.
[2] AAD: average American Diet.

Table 2. Effect of the Experimental Diets on Lipids and Lipoproteins in all Subjects[1-3]

	AAD	Step 1 diet	Step 2 diet
Total Cholesterol (mg/dL)[*†]	192.3 ± 3.5[a]	183.4 ± 3.5[b]	175.8 ± 3.5[c]
LDL Cholesterol (mg/dL)[*†]	130.5 ± 2.9[a]	120.8 ± 2.9[b]	113.9 ± 2.9[c]
HDL Cholesterol (mg/dL)[*†]	39.3 ± 1.1[a]	36.5 ± 1.1[b]	35.3 ± 1.1[c]
Triglycerides (mg/dL)[*]	110.1 ± 8.2[a]	128.6 ± 8.2[b]	134.2 ± 8.2[b]
TC/HDL	5.09 ± 0.15	5.23 ± 0.15	5.20 ± 0.15
LDL/HDL	3.47 ± 0.12	3.44 ± 0.12	3.36 ± 0.12
Apolipoprotein A1 (mg/dL)	121.0 ± 1.7	116.4 ± 1.7	114.6 ± 1.7
Apolipoprotein B (mg/dL)[*†]	102.5 ± 2.5[a]	97.9 ± 2.5[b]	95.3 ± 2.5[c]

[1]Data are expressed as Mean ± SE.
[2]AAD: average American diet, TC: total cholesterol, LDL: low-density lipoprotein, HDL:high-density lipoprotein.
[3]Values with different superscripts within a row are significantly different.
[*] $p<0.0001$ for comparisons between AAD and Step 1 diet and AAD and Step 2 diet.
[†] $p\leq 0.02$ for comparisons between Step 1 diet and Step 2 diet.

Table 3. Subject Characteristics at Screening[1-3]

	Stable A	Stable B	Change Group
Total Cholesterol (mg/dL)	182.4 ± 3.8	194.1 ± 5.5	192.2 ± 8.2
LDL Cholesterol (mg/dL)	124.9 ± 3.2	129.8 ± 4.7	131.1 ± 6.9
HDL Cholesterol (mg/dL)*	43.1 ± 1.1[a]	36.2 ± 1.6[b]	36.4 ± 2.4[b]
Triglycerides (mg/dL)†	71.5 ± 7.0[a]	141.4 ± 10.1[b]	120.9 ± 15.0[b]
Age (years)	36.3 ± 1.6	41.8 ± 2.3	37.7 ± 3.4
BMI (kg/m^2)	25.4 ± 0.5	26.5 ± 0.7	25.5 ± 1.1
Glucose (mg/dL)	95.2 ± 1.2	97.0 ± 1.8	99.4 ± 2.7
Insulin (mU/L)	7.7 ± 0.7	8.6 ± 1.0	8.2 ± 1.5
HOMA	1.9 ± 0.2	2.1 ± 0.3	2.1 ± 0.4
Waist (cm)	88.6 ± 1.5	90.5 ± 2.1	90.8 ± 3.2
Waist:Hip Ratio	0.88 ± 0.01	0.90 ± 0.01	0.89 ± 0.02
Systolic Blood Pressure (mmHg)	113.9 ± 1.3	118.2 ± 1.9	118.2 ± 2.8
Diastolic Blood Pressure (mmHg)	76.3 ± 1.1	79.8 ± 1.6	79.2 ± 2.4
DEXA body fatness (%)	23.2 ± 0.9	25.1 ± 1.4	25.6 ± 2.1

[1]Data expressed as mean ± SE.
[2]LDL: low-density lipoprotein, HDL: high-density lipoprotein, BMI: body mass index, HOMA: homeostasis model assessment, DEXA: Dual energy X-ray absorptiometry.
[3]Values with different superscripts within a row are significantly different *$p<0.05$, †$p<0.01$.

Table 4. Lipid and Lipoprotein Responses to the Experimental Diets[1-4]

	AAD			Step 1 diet			Step 2 Diet		
	Stable A	**Stable B**	**Change**	**Stable A**	**Stable B**	**Change**	**Stable A**	**Stable B**	**Change**
LDL size (nm)	$26.7 \pm 0.1^{a}_{x}$	$25.6 \pm 0.1^{b}_{x}$	$26.2 \pm 0.1^{c}_{x}$	$26.6 \pm 0.01^{a}_{y}$	$25.4 \pm 0.1^{b}_{y}$	$25.8 \pm 0.1^{c}_{y}$	$26.5 \pm 0.1^{a}_{z}$	$25.4 \pm 0.1^{b}_{y}$	$25.7 \pm 0.1^{b}_{y}$
TC (mg/dL)	181.6 ± 3.8	195.0 ± 5.5	200.1 ± 8.1	172.2 ±3.8	187.1 ± 5.5	190.9 ± 8.1	163.8 ±3.8	177.3 ± 5.5	186.4 ± 8.1
LDL Cholesterol (mg/dL)	123.2 ± 3.1	128.9 ± 4.6	139.4 ± 6.7	115.1 ±3.1	120.1 ± 4.5	127.2 ± 6.7	107.5 ± 3.1	111.9 ± 4.6	122.5 ± 6.7
HDL Cholesterol (mg/dL)*	43.4 ± 1.2	37.4 ± 1.7	37.1 ± 2.6	40.8 ± 1.2	34.1 ± 1.7	34.7 ± 2.6	39.3 ± 1.2	32.8 ± 1.7	33.7 ± 2.6
TG (mg/dL)*	71.9 ± 8.8	142.0 ± 12.9	116.5 ± 19.1	79.5 ± 8.8	162.8 ± 12.9	143.4 ± 19.1	82.7 ± 8.8	170.8 ± 12.9	149.1 ± 19.1
TC/HDL*	4.40 ± 0.16	5.35 ± 0.24	5.53 ± 0.35	4.41 ± 0.16	5.62 ± 0.24	5.65 ± 0.35	4.36 ± 0.16	5.61 ± 0.24	5.62 ± 0.35
LDL/HDL*	3.02 ± 0.12	3.51 ± 0.18	3.87 ± 0.27	2.98 ± 0.12	3.59 ± 0.18	3.75 ± 0.27	2.89 ± 0.12	3.50 ± 0.18	3.67 ± 0.27
Apolipoprotein A1 (mg/dL)	$125.9 \pm 1.8^{a}_{x}$	$120.0 \pm 2.7^{a}_{x}$	$117.2 \pm 3.9^{a}_{x}$	$120.1 \pm 1.8^{a}_{y}$	$113.1 \pm 2.7^{a}_{y}$	$116.2 \pm 3.9^{a}_{x}$	$116.2 \pm 1.8^{a}_{z}$	$112.5 \pm 2.7^{a}_{y}$	$115.3 \pm 3.9^{a}_{x}$
Apolipoprotein B (mg/dL)*	92.0 ± 2.7	106.3 ± 3.9	109.1 ± 5.8	89.0 ± 2.7	103.2 ± 3.9	101.5 ± 5.8	85.1 ± 2.7	98.6 ± 3.9	102.1 ± 5.8

[1]Data expressed as mean ± SE
[2]AAD: average American diet, LDL: low-density lipoprotein, TC: total cholesterol, HDL: high-density lipoprotein, TG: triglycerides.
[3]Values with different subscripts within a group denote significant differences between diets ($p \leq 0.03$).
[4]Values with different superscripts within a diet denote significant differences between groups ($p < 0.001$).
*Group difference across all diets. Stable A group is significantly different than Stable B group and "change" group ($p<0.05$).

Table 5: HDL-Cholesterol Subpopulation Distribution among Phenotype Groups during the Dietary Intervention[1-4]

	AAD			Step 1 diet			Step 2 diet		
	Stable A	**Stable B**	**Change**	**Stable A**	**Stable B**	**Change**	**Stable A**	**Stable B**	**Change**
HDL_{2b}*	28.8 ± 1.1	23.3 ± 1.5	24.6 ± 2.3	28.0 ± 1.1	23.8 ± 1.5	23.4 ± 2.3	28.9 ± 1.1	23.7 ± 1.5	21.6 ± 2.3
HDL_{2a}	18.9 ± 0.5	17.0 ± 0.8	16.7 ± 1.1	18.9 ± 0.5	17.1 ± 0.8	16.7 ± 1.1	18.6 ± 0.5	17.9 ± 0.8	15.7 ± 1.1
HDL_{3a}†	19.9 ± 0.6	20.9 ± 0.8	20.9 ± 1.3	20.4 ± 0.6	21.2 ± 0.8	22.5 ± 1.3	20.0 ± 0.6	21.8 ± 0.8	22.0 ± 1.3
HDL_{3b}	15.4 ± 0.5^{a}	18.5 ± 0.7^{b}	$17.7 \pm 1.1^{ab}{}_{x}$	15.6 ± 0.5^{a}	18.1 ± 0.7^{b}	$18.3 \pm 1.1^{ab}{}_{xy}$	15.4 ± 0.5^{a}	17.9 ± 0.7^{b}	$19.9 \pm 1.1^{b}{}_{y}$
HDL_{3c}	17.5 ± 1.1	20.3 ± 1.7	19.7 ± 2.4	16.9 ± 1.1	19.8 ± 1.6	18.7 ± 2.4	16.8 ± 1.1	18.8 ± 1.6	20.4 ± 2.4

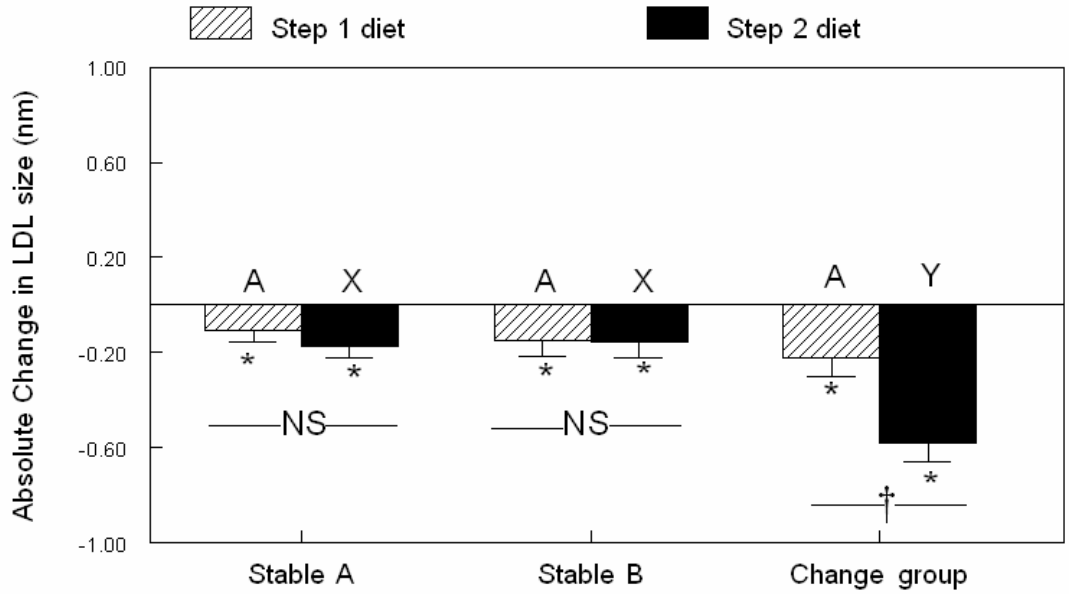
[1]Data expressed as mean ± SE
[2]AAD: average American diet, HDL: high-density lipoprotein.
[3]Values with different subscripts within a group denote significant differences between diets (p=0.02).
[4]Values with different superscripts within a diet denote significant differences between groups ($p \leq 0.05$) .
*Group effect across all diets (p=0.01). Stable A group is different than Stable B group (p=0.02) and "change" group (p=0.09).
† Diet effect across all groups (p=0.007). AAD significantly different than Step 1 diet (p=0.01) and Step 2 diet (p=0.03).

Table 6. Oxidation Responses to the Experimental Diets[1-2]

	AAD			Step 1 diet			Step 2 diet		
	Stable A	**Stable B**	**Change**	**Stable A**	**Stable B**	**Change**	**Stable A**	**Stable B**	**Change**
Lag time (min)	84.5 ± 6.7	83.6 ± 10.0	80.6 ± 13.8	84.3 ± 6.7	80.9 ± 10.1	89.7 ± 13.8	85.9 ± 6.6	72.4 ± 10.1	89.1 ± 13.8
Rate of Oxidation ($x10^{-3}$od/min)*	9.7± 0.6	10.4 ± 0. 8	14.0 ± 1.0	9.7 ± 0.6	10.1 ± 0.9	12.2 ± 1.2	9.9 ± 0.6	9.2 ± 0.8	12.9 ± 1.2
Total Dienes (od)†	0.59 ± 0.03	0.62 ± 0.04	0.79 ± 0.06	0.59 ± 0.03	0.64 ± 0.04	0.72 ± 0.06	0.61± 0.03	0.57± 0.04	0.78± 0.06
Paraoxonase Activity (U)	92.2 ± 3.2	89.5 ± 4.9	97.6 ± 6.8	92.1 ± 3.2	90.6 ± 4.9	95.9 ± 6.8	90.5 ± 3.2	90.9 ± 4.9	97.0 ± 6.8

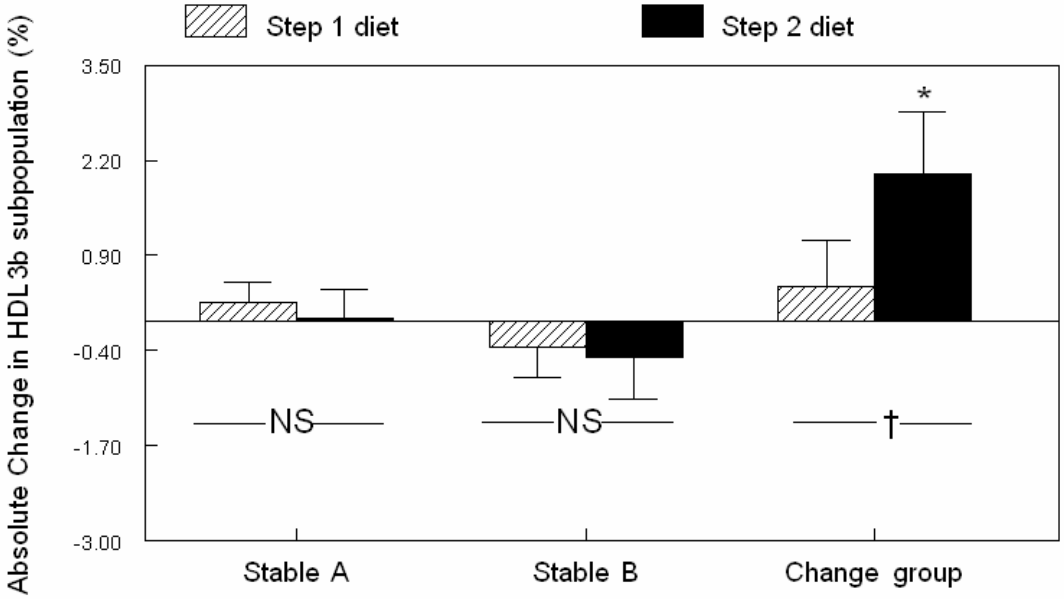
[1]Data are expressed as Mean ± SE.
[2] AAD: average American diet, OD: optical density.
*Group effect across all diets (p=0.03). "Change" group is different than Stable A group (p=0.03) and Stable B group (p=0.06).
† Group effect across all diets (p=0.02). "Change" group is different than Stable A group (p=0.02) and Stable B group (p=0.06).

Figure 1. Reductions in LDL Size in Response to the Experimental Diets



[1]Data are expressed as mean ± SE
[2]Letters that are different for a specific diet treatment are significantly different (p=0.0003).
[3]AAD: average American diet, LDL: low-density lipoprotein, NS: not significant
[*]Significantly different from AAD (p<0.0001).
[†]Significant difference between diets (p=0.0002).

Figure 2. Change in HDL3b in Response to the Experimental Diets



[1]Data are expressed as mean ± SE
[2]AAD: average American diet, HDL: high-density lipoprotein, NS: not significant
[*]Significantly different from AAD (p=0.02).
[†]Significant difference between diets (p=0.05).

CHAPTER 6

SUMMARY, LIMITATIONS AND FUTURE DIRECTIONS

Low density lipoprotein oxidation is thought to play an important role in the development and progression of atherosclerosis. Therefore, understanding how diet affects this CVD risk factor may provide an opportunity to intervene to decrease CVD risk. The objective of this thesis was to evaluate the effects of diet on the susceptibility of LDL to oxidative modification. Three research studies were conducted to address the overarching question of how modifications in diet affect oxidative stress in different population groups. Both type and amount of dietary fat and introduction of a potential pro-oxidant in the diet were used to evaluate the impact of diet on LDL modification. Importantly, the research conducted addressed clinically relevant issues that have the potential to be the basis for new diet strategies to reduce CVD risk.

In the first study, a pharmacologic approach was used to determine the combined effect of dietary fat and iron status on LDL oxidation using iron supplementation in women with low iron status. Although supplemental iron did not act as an oxidant in this study, we demonstrated that a blood cholesterol lowering diet favorably affected LDL oxidative susceptibility. Thus a blood cholesterol-lowering diet should be recommended for those treated with supplemental iron for poor iron status in order to decrease cardiovascular disease risk. The strength of this study was that we chose a clinically relevant model to test the effects of iron supplementation on LDL oxidation.

The second study examined diets differing in unsaturated fatty acid compositions in a population with moderately elevated cholesterol levels in order to determine how

changes in the unsaturated fatty acid profile the optimal balance of fatty acids in the diet would affect oxidative stress. While we observed greater reductions in total and LDL cholesterol following the NuSun oil diet (high in PUFA) compared to the olive oil diet (high in MUFA), only subtle changes were observed in terms of LDL oxidation. Although lag time was greater following the olive oil diet, the lack of difference in the resulting oxidation products in these studies suggests no adverse effects on LDL oxidation. A strength of this study is that we tested the effects of fats incorporated into the diet, and consequently allowed the fatty acid profile to reflect the experimental fats tested. We may have observed greater differences in the LDL oxidation endpoints had we had greater differences between MUFA and PUFA in the experimental diets.

The final study conducted evaluated the effects of fat-modified diets on LDL oxidation in individuals with different LDL phenotypes. The results of this study identified a unique group of individuals with the propensity to convert from LDL phenotype A to LDL phenotype B in response to diet. This group had both an increased rate of oxidation and total dienes as well as reductions in both LDL and HDL size. A group of individuals that had an increased susceptibility to oxidative modification was identified as a result of dietary induced change in LDL phenotype. A limitation of this study was that there was not equal recruitment of LDL phenotype A and B subjects into the study. This reflects the fact that we could not control how many subjects would change LDL phenotype in response to diet. With a larger number of subjects who changed LDL phenotype we may have observed greater effects.

A potential limitation in all three studies in the method used to determine susceptibility to oxidative stress. This method tests susceptibility of LDL to oxidation in

vitro in which oxidation is initiated by a large quantity of an oxidant and likely does not reflect what occurs in vivo. Therefore, questions remain as to whether measurement of in vitro LDL oxidation reflects LDL oxidation status in vivo. Despite these limitations, increases in lag time were observed in both the Step 2 diet in the iron supplementation study and following the olive oil diet in the second study. However, further studies are needed to determine if changes in lag time are biologically meaningful without an increase in total dienes. In the final study, increases in total dienes were observed regardless of diet in a group of individuals susceptible to conversion of LDL phenotype in response to diet. Further studies incorporating a moderate fat diet are needed to determine if the change in LDL phenotype can be prevented with changes in diet.

In summary, diet has subtle effects on LDL oxidation which seems to vary in manner that reflects type and amount of fat in the diet and the population group studied. Further studies are needed to establish the contribution that LDL oxidative modification has on CVD risk and what diet strategies can be developed that prevent LDL oxidation.

APPENDIX A
RAW DATA FOR CHAPTER 3

subject	supple	order	diet	period	lagtime	rateox	dienes	ferritin	fe	tibc	hb	hct	transfsat	ferrbl	febl	tibcbl	trnsfsatb	hbbl	hctbl
1000	p	1	aa	1	28.80	25.59	351.81	7.42	264.87	428.9	13	38.4	61.8	7	72	419	17	12.7	37.6
1000	p	1	lf	2	56.68	27.40	382.15	7.51	71.4	400.9	13.1	39	17.8	7	72	419	17	12.7	37.6
1005	s	2	aa	2	61.43	27.23	409.02	54.13	74.03	386.9	13.7	40.1	19.1	32	73	322	22	13.3	38.5
1005	s	2	lf	1	61.32	27.29	408.48	27.75	107.38	340.6	13.6	38.9	31.5	32	73	322	22	13.3	38.5
1015	s	1	aa	1	38.39	23.05	305.65	11.11	96.58	376.2	12.5	37.3	25.7	7	62	354	17	12.1	35.3
1015	s	1	lf	2	42.87	23.84	348.81	12.68	117.89	433.9	13.7	40.7	27.2	7	62	354	17	12.1	35.3
1045	s	2	aa	2	41.13	19.04	293.13	60.76	76.66	412.9	11.2	33.5	18.6	29	69	300	23	11.8	34.8
1045	s	2	lf	1	50.22	29.60	300.29	17.27	53.34	309.5	10.4	31.1	17.2	29	69	300	23	11.8	34.8
1115	p	1	aa	1	40.88	24.80	373.23	6.45	68	446.9	11.1	33.2	15.2	7	31	496	6	11.9	35.7
1115	p	1	lf	2	50.28	23.22	356.86	6.27	72.87	567.7	11.4	34.8	12.8	7	31	496	6	11.9	35.7
1155	p	2	aa	2	15.87	20.34	454.37	16.19	107.33	290.8	11.2	32.8	36.9	32	44	267	16	11.4	33.2
1155	p	2	lf	1	57.28	28.14	378.44	29.54	94.24	331.6	10.7	31.1	28.4	32	44	267	16	11.4	33.2
1180	p	2	aa	2	24.23	25.14	341.80	6.9	55.81	414.9	12.1	36.3	13.5	14	108	344	31	13.5	39.6
1180	p	2	lf	1	50.46	25.14	333.19	15.35	85.01	375.5	12.1	35.6	22.6	14	108	344	31	13.5	39.6
1285	s	2	aa	2	.	46.66	463.06	38.3	94.52	285.6	12.9	38	33.1	37	44	304	14	13.3	39.5
1285	s	2	lf	1	.	33.94	387.36	28.56	69.56	292.9	12.2	35.5	23.7	37	44	304	14	13.3	39.5
1345	s	1	aa	1	42.87	31.19	313.45	23.3	118.95	361.6	14	40.5	32.9	27	89	370	24	13.9	40.6
1345	s	1	lf	2	53.70	26.38	378.16	42.81	117.02	388.6	14.6	42.6	30.1	27	89	370	24	13.9	40.6
1355	p	2	aa	2	45.19	18.98	311.23	17.1	129.54	406.9	12.6	37	31.8	20	34	320	10	13.1	38.5
1355	p	2	lf	1	63.73	17.85	320.48	10.86	115.1	373.4	12.7	37.8	30.8	20	34	320	10	13.1	38.5
1410	s	2	aa	2	36.49	23.11	413.77	71.35	115.11	394.4	12.2	35.9	29.2	31	109	354	30	12.5	36.5
1410	s	2	lf	1	45.30	19.89	422.56	55.98	161.45	436	11.8	33.9	37	31	109	354	30	12.5	36.5
1415	s	2	aa	2	.	31.69	296.64	41.81	64.48	383.9	14	39.4	41.7	30	45	318	14	13.2	39.4
1415	s	2	lf	1	.	24.58	299.92	31.16	77.27	328.7	13.4	39.4	39.4	30	45	318	14	13.2	39.4
1525	p	2	aa	2	24.56	27.23	409.18	7.88	123.18	496	13.7	40.2	24.8	28	186	517	35	12.8	36.9
1525	p	2	lf	1	43.66	28.93	403.56	11.27	176.12	525.2	13.2	38.8	33.5	28	186	517	35	12.8	36.9
1545	s	1	aa	1	21.28	26.67	409.23	31.65	102.74	379.9	13.2	38.7	27	20	158	379	41	13.9	39.7
1545	s	1	lf	2	79.73	14.92	382.75	55.42	123.38	343.5	13.6	39.8	35.9	20	158	379	41	13.9	39.7
1565	p	1	aa	1	36.97	23.28	321.39	38.43	123.59	324.4	13.4	39.1	38.1	45	88	259	33	13.9	41.2
1565	p	1	lf	2	70.14	27.80	201.80	4.89	77.3	491	13.5	39.8	15.7	45	88	259	33	13.9	41.2
1585	p	2	aa	2	45.73	25.82	402.78	45.21	94.53	374.1	13.6	40.1	25.3	38	102	316	32	12.6	36.4
1585	p	2	lf	1	73.75	17.12	283.81	35.31	181.54	385.4	13.2	38.3	47.1	38	102	316	32	12.6	36.4
1600	s	1	aa	1	52.65	23.84	391.46	34.61	143.68	350.2	13.9	40.4	41	35	74	303	24	13.5	39.1
1600	s	1	lf	2	48.53	23.67	427.50	30.9	108.96	370.4	14.1	41.2	29.4	35	74	303	24	13.5	39.1
1625	p	1	aa	1	12.84	24.18	431.66	24.12	120.51	352.4	12.6	36.2	34.2	25	79	333	23	12.4	35.5
1625	p	1	lf	2	37.72	26.25	322.74	10.24	82.63	371.9	12.2	35.5	22.2	25	79	333	23	12.4	35.5
1655	s	2	aa	2	42.34	23.11	371.25	15.41	110.92	427	12.4	37	26	9	91	397	22	12	36.2
1655	s	2	lf	1	71.75	16.50	379.91	22.74	74.93	485.9	13	39.4	15.4	9	91	397	22	12	36.2
1665	p	1	aa	1	46.39	18.42	307.04	11.01	89.61	553	12	35.2	16.2	22	101	452	22	11.7	33.8
1665	p	1	lf	2	80.43	18.08	263.62	16.6	60.33	526.8	12.2	36	11.5	22	101	452	22	11.7	33.8
1680	p	1	aa	1	35.69	25.48	408.58	30.79	91.17	352.4	12.6	36.4	25.9	37	76	315	24	13.4	39.2
1680	p	1	lf	2	39.91	26.72	445.42	23.88	107.5	352.9	13	38.6	30.5	37	76	315	24	13.4	39.2
1690	s	2	aa	2	33.60	29.77	412.63	31.04	92.77	387.3	13.2	38.9	24	13	36	390	9	12.4	36.5
1690	s	2	lf	1	54.33	23.33	345.89	19.89	98.9	392.9	12.5	36.6	25.2	13	36	390	9	12.4	36.5
1745	s	1	aa	1	44.04	23.45	342.05	40.16	118.19	396.1	13.4	39.8	29.8	46	130	342	38	13.2	38.3
1745	s	1	lf	2	41.67	24.52	329.03	48	145.91	370	13.6	40.7	39.4	46	130	342	38	13.2	38.3
1790	s	1	aa	1	33.68	24.63	397.82	24.43	144.46	411.5	12.7	36.8	35.1	23	67	341	19	12.6	37.1
1790	s	1	lf	2	33.91	27.01	410.99	26.8	132.88	310.9	13.1	39.2	42.7	23	67	341	19	12.6	37.1
1825	p	1	aa	1	31.49	32.54	390.38	14.43	93.52	346.4	13.2	38.7	27	18	126	292	43	14	40.4
1825	p	1	lf	2	42.30	30.06	396.33	15.68	137.35	374.1	15	43.9	36.7	18	126	292	43	14	40.4
1830	s	1	aa	1	37.51	21.81	417.79	5.54	85	406.2	11.3	33.4	20.9	4	21	476	4	11.2	34.4
1830	s	1	lf	2	52.89	21.69	422.77	1.4	57.44	385.9	12.5	37.7	14.9	4	21	476	4	11.2	34.4

APPENDIX B
RAW OXIDATION DATA FOR CHAPTER 4

subject	order	period	diet	hydroperoxides	lag time	rate of oxidation	total dienes	alpha tocopherol
CCH11163	3	1	oo	67.8	79.4	32.65	2621	5.93
CCH11163	3	2	aa	65.32	74.86	36.7	3065	7.82
CCH11163	3	3	ns	67.44	80.2	31.1	2563	5.49
SLD030541	5	1	ns	71.96	71.08	36.75	2687	7.3
SLD030541	5	2	aa	68.24	70.08	36.8	2681	6.97
SLD030541	5	3	oo	71.76	67.61	39.27	2769	6.39
ASS011077	4	1	oo	69.12	66.11	33	2361	1.46
ASS011077	4	2	ns	68.32	73.25	27.69	2441	2.74
ASS011077	4	3	aa	72.76	77.64	37.63	2839	0.87
CLB101446	6	1	ns	54.96	74.69	30.55	2299	8.1
CLB101446	6	2	oo	53.88	80.27	34	2442	25.96
CLB101446	6	3	aa	55.16	61.71	41.69	2263	13.55
RLH121972	2	1	aa	70.2	75.92	26.6	1978	1.96
RLH121972	2	2	ns	70.48	62.74	29.65	1371	1.84
RLH121972	2	3	oo	70.72	67.2	29.11	1963	2.03
MLS07294	2	1	aa	62.44	66.23	47.16	3022	9.65
MLS07294	2	2	ns	64	65.15	47.79	2310	7.06
MLS07294	2	3	oo	67.84	69.17	42.7	2393	5.46
LJM102561	4	1	oo	54.72	69.34	40.14	2531	12.3
LJM102561	4	2	ns	55.56	75.19	40.62	2599	12.51
LJM102561	4	3	aa	55.84	61.04	48.63	2547	11.42
AJH060162	3	1	oo	64.04	74.59	27.49	2450	6.52
AJH060162	3	2	aa	68.2	65.78	26.97	2128	15.56
AJH060162	3	3	ns	65.8	70.79	37.34	3330	8.58
MG052458	6	1	ns	66.6	78.39	22.19	891	6.99
MG052458	6	2	oo	61.64	65.31	17.46	705	5.61
MG052458	6	3	aa	56.36	111.64	23.53	1130	6.45
CJC072252	6	1	ns	65.04	69.51	34.24	2078	7.81
CJC072252	6	2	oo	68.88	98.34	17.56	1774	8.57
CJC072252	6	3	aa	67.88	69.38	19.5	961	5.35
TXL031850	1	1	aa	70.48	67.43	26.79	2202	14.67
TXL031850	1	2	oo	69.52	68.9	28.15	2264	16.57
TXL031850	1	3	ns	69.16	66.09	18.56	2417	18.01
RGS07194	1	1	aa	68.24	74.81	32.17	2518	2.47
RGS07194	1	2	oo	67.2	81.95	25.21	1829	2.97
RGS07194	1	3	ns	68.72	72.55	27.7	2113	5.11
RAC011567	3	1	oo	65.8	71.81	41.47	2134	20.11
RAC011567	3	2	aa	64	68.35	47.89	2562	19.26
RAC011567	3	3	ns	64.68	68.66	35.29	2191	21.4
NPM05225	1	1	aa	68.2	91.38	24.52	2859	7.91
NPM05225	1	2	oo	68.32	80.37	25.8	2461	3.49
NPM05225	1	3	ns	68.16	82.99	27.66	2408	4.93
DLC032051	5	1	ns	52.56	77.94	31.53	2420	5.5
DLC032051	5	2	aa	54.72	80.06	28.73	2387	4.88
DLC032051	5	3	oo	54.04	75.46	32.74	2593	10.1
JLH022669	5	1	ns	74.24	67.15	37.93	2479	4.29
JLH022669	5	2	aa	80.92	71.93	35.28	2465	6.87
JLH022669	5	3	oo	81.6	78.62	39.77	2897	7.48
JMG09253	5	1	ns	65.72	88.31	23.69	2057	6.74
JMG09253	5	2	aa	64.88	79.48	29.74	2173	7.38
JMG09253	5	3	oo	64.92	85.51	28.51	2094	6.36
IXB120652	3	1	oo	66.44	58.15	23.18	977	5.24
IXB120652	3	2	aa	66.8	61.58	31.82	2035	7.46
IXB120652	3	3	ns	64.48	53.32	26.27	1894	6.96
VCW01237	6	1	ns	65.92	89.24	33.55	3410	11.53
VCW01237	6	2	oo	63.52	111	24.29	2384	28.39
VCW01237	6	3	aa	94.32	37.15	32.82	2533	8.09

APPENDIX B
RAW OXIDATION DATA FOR CHAPTER 4

subject	order	period	diet	hydroperoxides	lag time	rate of oxidation	total dienes	alpha tocopherol
RMG05154	4	1	oo	68.24	103.73	35.01	2741	9.18
RMG05154	4	2	ns	68.88	37.15	56.56	3071	8.72
RMG05154	4	3	aa	68.64	67.48	26.71	1673	8.07
SEB080647	5	1	ns	54.92	67.09	46.52	2532	18.18
SEB080647	5	2	aa	53.96	61.14	52.62	2408	19.07
SEB080647	5	3	oo	53.6	66.83	40.46	2412	19.51
BSL051042	2	1	aa	63.8	50.83	45.47	2323	8.6
BSL051042	2	2	ns	64.64	49.36	47.06	2218	9.47
BSL051042	2	3	oo	63.88	49.87	48.11	2301	9
DAD041544	5	1	ns	63.8	72.84	41.77	1913	7.12
DAD041544	5	2	aa	62.36	58.2	31.73	1700	5.29
DAD041544	5	3	oo	64	172.03	27.68	1342	3.76
DAH101259	1	1	aa	69.36	51.68	53.43	2470	6.15
DAH101259	1	2	oo	66.16	95.28	22.77	2323	9.24
DAH101259	1	3	ns	67.04	73.09	52	2421	7.53
MEW07195	3	1	oo	71.12	125.03	55.28	2701	8.52
MEW07195	3	2	aa	68.2	87.97	58.92	2573	6.9
MEW07195	3	3	ns	69.96	51.7	57.76	3016	8.7
KJG033159	1	1	aa	67.88	121.9	46.93	2739	7.89
KJG033159	1	2	oo	68.28	58.79	51.35	2728	6.89
KJG033159	1	3	ns	70.28	72.88	41.19	2701	8.82
KLR070851	4	1	oo	65.96	56.37	56.28	2686	7.32
KLR070851	4	2	ns	68.8	57.7	53.15	2465	8.6
KLR070851	4	3	aa	64.2	57.42	56.42	2927	7.43
DRP090659	4	1	oo	67.16	70.86	52.56	2706	9.02
DRP090659	4	2	ns	67.2	76	48.51	2710	9.3
DRP090659	4	3	aa	83.24	75.8	64.24	2754	9.46
SLB120473	6	1	ns	70.72	62.44	58.31	2404	7.65
SLB120473	6	2	oo	66.72	147.76	41.65	2594	6.85
SLB120473	6	3	aa	73.32	130.56	37.89	2696	7.29
KEM021362	2	1	aa	65.12	178.18	45.49	1980	6.94
KEM021362	2	2	ns	63.4	356.25	29.28	1641	6.09
KEM021362	2	3	oo	64.92	361.03	39.84	1979	7.98
JLH120338	2	1	aa	66.28	93.87	25.33	1265	7.06
JLH120338	2	2	ns	67.76	42.33	22.67	1289	8.82
JLH120338	2	3	oo	68.72	118.34	15.12	1217	10.09

APPENDIX C
RAW LIPID DATA FOR CHAPTER 4

Subject	Diet	Total cholesterol	HDL cholesterol	LDL cholesterol	Triglycerides
CCH11163	oo	196	46	122	140
CCH11163	oo	189	41	119	146
CCH11163	aa	214	48	144	109
CCH11163	ns	217	48	130	196
CCH11163	ns	237	53	150	169
SLD030541	ns	222	60	140	110
SLD030541	ns	215	62	130	114
SLD030541	aa	224	64	137	117
SLD030541	aa	221	59	139	116
SLD030541	oo	187	71	104	62
SLD030541	oo	191	66	112	67
CLB101446	ns	205	47	145	64
CLB101446	ns	208	46	151	57
CLB101446	oo	264	52	195	84
CLB101446	oo	254	51	184	94
CLB101446	aa	256	52	182	110
CLB101446	aa	276	54	203	97
MLS072948	aa	234	63	154	83
MLS072948	aa	235	64	155	79
MLS072948	ns	205	59	131	77
MLS072948	ns	200	56	129	75
MLS072948	oo	210	61	133	78
MLS072948	oo	215	60	141	68
LJM102561	oo	194	52	131	57
LJM102561	oo	206	53	139	71
LJM102561	ns	176	52	115	46
LJM102561	ns	152	51	89	59
LJM102561	aa	180	52	117	56
LJM102561	aa	173	52	109	58
AJH060162	oo	179	34	106	196
AJH060162	oo	184	32	109	217
AJH060162	aa	179	37	119	115
AJH060162	aa	182	36	118	142
AJH060162	ns	189	36	130	113
MG052458	ns	152	33	103	78
MG052458	ns	152	33	100	95
MG052458	oo	152	33	87	161
MG052458	oo	164	35	100	145
MG052458	aa	197	39	131	137
MG052458	aa	186	38	127	103
TXL031850	aa	234	28	117	445
TXL031850	aa	257	32	161	321
TXL031850	oo	241	32	174	176
TXL031850	oo	237	33	163	206
TXL031850	ns	233	30	159	220
TXL031850	ns	229	30	158	204
JLH022669	ns	174	32	127	73
JLH022669	ns	189	34	139	79
JLH022669	aa	180	39	127	70
JLH022669	aa	179	36	129	72
JLH022669	oo	235	46	173	78
JLH022669	oo	227	47	163	83
IXB120652	oo	253	44	177	158
IXB120652	oo	240	42	165	167
IXB120652	aa	294	43	210	203
IXB120652	aa	291	45	208	189
IXB120652	ns	260	41	177	212
IXB120652	ns	259	43	183	163

APPENDIX C
RAW LIPID DATA FOR CHAPTER 4

Subject	Diet	Total cholesterol	HDL cholesterol	LDL cholesterol	Triglycerides
SEB080647	ns	216	46	155	73
SEB080647	ns	214	45	154	77
SEB080647	aa	227	49	157	104
SEB080647	aa	212	46	150	80
SEB080647	oo	230	45	165	102
SEB080647	oo	249	50	174	123
BSL051042	aa	258	60	179	97
BSL051042	aa	239	53	162	119
BSL051042	ns	232	52	159	103
BSL051042	ns	249	53	174	108
BSL051042	oo	263	52	188	114
BSL051042	oo	241	48	173	102
DAD041544	ns	223	35	145	214
DAD041544	ns	227	36	158	167
DAD041544	aa	255	42	167	228
DAD041544	aa	233	38	154	203
DAD041544	oo	260	38	185	186
DAD041544	oo	256	35	185	181
DAH101259	aa	247	63	163	104
DAH101259	aa	250	61	165	122
DAH101259	oo	237	61	157	96
DAH101259	oo	238	64	153	104
DAH101259	ns	227	61	143	115
DAH101259	ns	241	60	156	127
MEW071955	oo	184	42	129	65
MEW071955	oo	183	43	130	51
MEW071955	aa	185	49	125	53
MEW071955	aa	192	50	127	74
MEW071955	ns	203	54	138	55
MEW071955	ns	194	49	132	64
KJG033159	aa	210	48	143	97
KJG033159	aa	207	49	133	125
KJG033159	oo	231	42	167	110
KJG033159	oo	217	43	151	117
KJG033159	ns	212	46	143	113
KJG033159	ns	199	44	133	108
KLR070851	oo	198	54	127	83
KLR070851	oo	200	54	129	83
KLR070851	ns	197	54	122	107
KLR070851	ns	202	56	132	70
KLR070851	aa	205	62	124	95
KLR070851	aa	197	58	121	92
DRP090659	oo	252	63	171	90
DRP090659	oo	249	66	163	101
DRP090659	ns	252	69	170	63
DRP090659	aa	245	74	160	55
DRP090659	aa	247	65	165	83
SLB120473	ns	168	35	118	76
SLB120473	ns	164	35	112	84
SLB120473	oo	182	37	125	99
SLB120473	oo	191	39	126	129
SLB120473	aa	205	42	137	130
SLB120473	aa	206	38	139	143
KEM021362	aa	193	40	124	145
KEM021362	aa	191	39	128	120
KEM021362	ns	210	42	121	237
KEM021362	ns	219	44	140	173
KEM021362	oo	210	44	138	142
KEM021362	oo	226	46	151	145
JLH120338	aa	253	63	152	192
JLH120338	aa	261	61	156	218
JLH120338	ns	259	57	160	209
JLH120338	ns	258	58	145	273
JLH120338	oo	260	64	152	222
JLH120338	oo	282	55	173	269

APPENDIX D
RAW SCREENING DATA FOR CHAPTER 5

SubjectID	Race	S1TC	S1TG	S1HDL	S1LDL	S2TC	S2TG	S2HDL	S2LDL
BCF-41-4745	0	165	49	43.0	112	158	39	38.9	111
BCG-70-6783	0	161	50	30.3	122	170	129	35.8	113
BJC-82-7657	0	202	64	44.2	145	256	100	41.4	194
BLB-39-5161	0	196	104	33.0	143	199	118	37.0	139
BLM-37-2312	0	156	102	43.2	92	166	56	42.0	112
BMB-53-1389	0	163	35	44.3	111	157	32	42.4	108
BPF-52-8789	0	201	91	39.6	143	199	66	39.6	146
CAV-29-4434	0	178	50	46.9	121	184	56	45.0	127
CMB-61-1861	0	180	123	34.5	120	183	95	37.5	126
CRR-37-3333	0	152	68	31.4	107	151	69	31.2	106
D_H-92-6569	1	155	79	47.3	95	148	51	47.9	91
D_L-89-7473	2	199	55	65.6	122	199	49	66.7	122
DCS-04-4041	0	164	96	41.8	106	162	111	37.0	107
DDD-35-0736	0	167	49	44.4	114	173	63	38.0	124
DDW-27-1270	0	223	73	40.4	170	228	101	45.8	162
DJS-29-7999	0	149	42	48.0	92	151	46	48.9	92
DLC-08-2664	0	194	225	33.5	115	194	312	33.8	97
DPB-64-7804	0	179	84	33.7	128	181	73	45.6	120
DRF-37-5270	0	155	46	50.9	94	152	41	52.8	91
DWS-98-8742	0	192	75	40.5	136	174	94	39.1	116
DYN-54-3286	0	224	122	43.1	156	208	105	46.5	140
EAB-57-9471	0	155	62	40.4	102	140	55	40.2	88
ECG-56-8967	1	223	82	43.8	162	223	67	43.0	166
F_S-82-1006	1	174	95	34.4	120	174	73	34.0	125
G_J-62-5517	0	180	67	33.4	133	172	77	34.0	122
GAH-13-6357	0	167	51	42.5	114	161	69	38.5	108
GLG-27-2176	0	210	63	49.7	147	203	59	46.7	144
GML-84-1785	0	211	102	29.5	161	202	97	33.2	149
GOB-90-9808	0	173	141	35.1	109	166	106	36.0	108
GWA-98-6492	0	194	86	39.2	137	210	60	41.6	156
H_J-32-0201	0	221	336	29.0	125	238	192	25.0	175
HPB-70-2696	0	194	138	32.7	133	207	102	39.2	147
IGH-88-3817	1	261	86	59.1	184	234	80	55.5	162
JAB-37-6390	0	209	149	40.8	138	192	171	34.2	123
JAB-72-0488	0	217	90	38.0	161	200	147	35.0	135
JAD-52-9560	0	191	150	46.5	114	172	145	38.6	104
JAL-68-1009	0	211	79	36.0	159	216	169	35.0	147
JAM-68-6945	0	209	192	28.0	142	233	128	31.0	177
JBG-37-0774	0	191	102	37.8	132	175	94	40.0	116
JBT-31-2471	0	173	129	36.0	111	161	170	33.0	94
JCK-90-6103	0	188	105	46.0	121	196	71	46.3	135
JCR-19-0674	0	183	46	54.0	119	187	44	54.5	123
JDL-57-0943	0	155	42	49.3	97	149	58	44.3	93
JES-39-1460	1	164	39	50.6	105	169	48	50.8	108
JET-64-1777	0	187	161	32.9	121	210	93	38.6	152
JHW-52-1222	0	201	114	37.0	141	.	.	.	.
JLD-82-6128	0	214	97	32.8	161	195	70	36.3	144
JLK-24-2936	0	176	119	42.0	110	159	122	38.9	95
JMG-24-4026	0	258	301	31.0	166	251	281	29.5	165
JMP-04-5284	0	172	72	44.5	113	169	54	39.2	119
JTM-15-3065	0	181	89	37.8	125	181	197	36.7	104
JWH-27-7128	0	186	33	50.4	129	208	50	55.2	142
JWM-84-9528	0	217	36	59.8	150	231	52	60.3	160
K_W-02-8695	0	149	49	36.4	102	145	27	19.4	100
KFW-35-5107	0	193	56	51.5	132	154	57	37.2	107
LBT-66-9014	0	210	237	33.8	128	230	196	29.7	161
LCF-94-1044	0	206	68	39.0	154	166	39	35.0	123
LCO-51-7401	3	135	115	27.9	84	153	139	27.4	97
LJC-76-4231	0	212	137	45.8	144	189	44	46.2	135
MJB-02-2375	0	174	43	41.0	124	163	38	40.7	114
MLL-68-3135	0	172	51	59.0	103	178	56	56.8	110
MLS-82-5875	0	256	203	39.2	176	222	315	45.3	113
MWB-82-6035	1	201	37	34.9	158	201	93	34.7	147
PJB-43-3639	0	170	81	31.8	122	168	70	30.5	123
PJD-13-4775	0	166	77	34.4	116	162	32	32.8	122
R_D-70-0888	0	189	49	48.3	132	173	48	47.0	116
R_G-92-3746	0	165	100	35.0	110	159	123	35.0	110
R_M-92-9942	2	168	78	42.8	112	158	41	45.1	106
RAS-47-7434	0	206	45	47.6	149	193	44	46.6	137
RAW-58-9624	1	173	51	39.1	123	174	49	40.2	124
RDS-94-2909	0	165	72	39.0	111	166	66	37.2	115
REJ-42-1333	0	201	91	35.2	147	214	113	31.4	160
RLB-90-6883	0	186	162	32.4	121	189	94	36.1	134
RPM-35-9363	0	146	20	33.6	108	156	25	36.8	114
SAD-00-8872	1	166	73	40.8	110	147	61	36.4	98
SCM-35-5124	0	223	130	35.8	161	227	98	39.6	167
SGC-98-6374	0	144	50	43.8	90	159	52	42.1	106
SHS-48-1211	0	181	181	28.7	116	205	210	29.2	133
SPH-53-4229	0	186	102	36.3	133	180	77	35.8	131
SRC-74-4595	0	196	107	31.3	143	187	90	27.1	141
TLM-74-2189	1	183	108	33.6	127	180	70	35.8	130
TWB-57-9837	0	154	115	38.3	92	144	127	36.4	82
V_S-06-8525	2	177	225	33.2	98	175	188	31.9	105
W_H-56-8407	0	233	102	46.0	167	213	140	43.0	142
WHS-67-7302	0	170	27	62.4	103	170	36	57.7	106
WJP-80-2929	0	195	144	37.6	128	200	191	38.4	123
Y_S-85-4659	2	244	139	56.7	159	226	102	56.5	149

APPENDIX D
RAW SCREENING DATA FOR CHAPTER 5

SubjectID	Glucose	Insulin	HOMA	Age	BMI	Waist	WH	SBP	DBP	DEXAFat
BCF-41-4745	96	5.1	1.2	27	19.6	72.5	0.80	103	67	15.1
BCG-70-6783	93	12.5	2.9	26	30.1	96.0	0.89	121	81	26.8
BJC-82-7657	109	8.0	2.2	46	25.3	92.5	0.95	120	86	30.1
BLB-39-5161	90	7.1	1.6	27	26.5	84.0	0.83	112	67	20.9
BLM-37-2312	90	10.9	2.4	26	25.7	89.0	0.86	116	85	26.2
BMB-53-1389	103	5.7	1.4	23	25.2	94.5	0.89	113	75	25.5
BPF-52-8789	82	2.7	0.5	56	24.3	84.0	0.89	112	73	23.2
CAV-29-4434	94	4.4	1.0	36	24.5	87.0	0.87	104	58	24.9
CMB-61-1861	98	5.4	1.3	22	22.4	79.5	0.80	126	75	25.4
CRR-37-3333	88	4.1	0.9	32	22.6	75.7	0.86	100	62	14.0
D_H-92-6569	93	8.7	2.0	35	29.6	97.0	0.94	119	80	19.4
D_L-89-7473	94	5.1	1.2	31	19.6	66.1	0.78	112	80	10.2
DCS-04-4041	93	3.8	0.9	23	22.8	83.6	0.85	111	75	19.3
DDD-35-0736	83	6.7	1.4	30	23.2	85.1	0.86	104	69	25.9
DDW-27-1270	98	4.3	1.0	38	22.6	78.0	0.80	93	62	22.8
DJS-29-7999	93	6.6	1.5	29	24.6	80.5	0.86	125	81	15.0
DLC-08-2664	95	6.3	1.5	30	27.3	96.5	0.9	118	78	22.7
DPB-64-7804	99	10.9	2.7	47	25.7	100.5	0.94	118	84	38.5
DRF-37-5270	76	3.1	0.6	34	20.7	85.2	0.94	116	78	24.2
DWS-98-8742	81	7.5	1.5	29	23.2	83.0	0.84	116	80	20.9
DYN-54-3286	104	8.8	2.3	55	26.3	99.0	0.97	113	75	28.9
EAB-57-9471	93	6.8	1.6	25	22.9	84.5	0.89	110	81	19.9
ECG-56-8967	100	14.3	3.5	48	32.2	102.0	0.88	108	78	32.4
F_S-82-1006	115	18.0	5.1	45	31.7	99.5	0.93	125	85	33.4
G_J-62-5517	94	8.0	1.9	53	27.1	100.9	0.97	102	68	25.0
GAH-13-6357	79	1.8	0.4	36	23.3	76.6	0.84	134	94	13.9
GLG-27-2176	97	4.7	1.1	31	25	83.2	0.89	114	74	15.1
GML-84-1785	104	9.3	2.4	41	23.8	90.4	0.94	112	76	24.6
GOB-90-9808	94	8.7	2.0	41	29.1	94.0	0.87	116	80	29.4
GWA-98-6492	97	9.1	2.2	39	23.4	87.3	0.92	132	82	24.0
H_J-32-0201	93	3.4	0.8	51	26.6	92.0	0.94	128	89	28.6
HPB-70-2696	89	6.5	1.4	43	26.5	99.3	0.97	106	72	30.1
IGH-88-3817	112	12.5	3.5	41	24.5	90.0	0.92	122	87	23.7
JAB-37-6390	93	10.8	2.5	34	20.7	85.0	0.89	112	80	26.3
JAB-72-0488	107	7.9	2.1	39	28.7	92.5	0.91	121	81	24.9
JAD-52-9560	96	2.2	0.5	52	19.8	77.6	0.85	94	68	16.4
JAL-68-1009	99	15.4	3.8	46	31.6	108.5	0.95	115	81	38.1
JAM-68-6945	104	6.0	1.5	49	23.8	85.5	0.91	113	87	19.5
JBG-37-0774	98	6.6	1.6	30	25.6	91.9	0.89	105	80	21.0
JBT-31-2471	99	9.4	2.3	22	24.2	91.6	0.85	133	91	24.6
JCK-90-6103	103	9.4	2.4	28	27.2	95.1	0.96	115	79	18.6
JCR-19-0674	95	2.0	0.5	37	21	77.3	0.85	118	86	16.4
JDL-57-0943	91	4.1	0.9	27	23.6	82.1	0.85	124	89	16.3
JES-39-1460	83	2.4	0.5	28	25.1	85.1	0.80	110	82	14.9
JET-64-1777	98	7.2	1.7	51	25.3	91.5	0.89	100	74	24.8
JHW-52-1222	92	9.9	2.2	55	33	110.5	0.95	129	89	35.8
JLD-82-6128	91	5.4	1.2	46	30.2	98.8	0.91	111	73	34.0
JLK-24-2936	105	7.7	2.0	64	27.6	90.0	0.94	131	91	19.0
JMG-24-4026	104	17.2	4.4	47	33.2	107.0	0.94	122	81	32.3
JMP-04-5284	89	7.2	1.6	38	25.8	81.0	0.95	116	78	25.6
JTM-15-3065	97	3.4	0.8	31	23.5	86.0	0.86	116	80	23.1
JWH-27-7128	104	9.5	2.4	33	27.5	92.0	0.89	120	87	24.8
JWM-84-9528	95	8.0	1.9	48	24.7	90.4	0.84	118	72	20.1
K_W-02-8695	96	6.2	1.5	28	25	82.0	0.84	106	68	18.2
KFW-35-5107	86	5.7	1.2	28	22.8	83.0	0.79	117	71	25.0
LBT-66-9014	118	7.4	2.2	50	25.7	96.5	0.94	121	84	29.3
LCF-94-1044	.	3.8	.	38	25.7	92.0	0.96	101	73	26.4
LCO-51-7401	105	18.0	4.7	24	32.5	117.0	0.98	111	76	39.4
LJC-76-4231	90	5.7	1.3	45	23.8	85.3	0.91	127	81	23.1
MJB-02-2375	100	3.8	0.9	40	20	76.0	0.87	128	85	11.5
MLL-68-3135	87	3.9	0.8	47	26.7	91.0	0.87	117	74	24.7
MLS-82-5875	104	6.5	1.7	44	25.6	89.0	0.87	118	66	24.7
MWB-82-6035	104	17.4	4.5	42	30.7	103.9	0.94	132	88	28.6
PJB-43-3639	89	6.7	1.5	23	27.9	83.6	0.87	116	72	26.0
PJD-13-4775	97	7.3	1.7	38	19.9	68.5	0.81	110	64	18.0
R_D-70-0888	79	1.6	0.3	48	24.2	79.0	0.82	111	59	16.3
R_G-92-3746	105	13.0	3.4	43	28.8	98.5	0.93	131	90	27.3
R_M-92-9942	85	4.5	0.9	34	21	85.0	0.88	119	75	23.0
RAS-47-7434	98	5.5	1.3	26	24.7	87.0	0.90	107	75	21.2
RAW-58-9624	104	19.6	5.0	62	27.4	89.0	0.88	122	80	28.1
RDS-94-2909	109	10.6	2.9	39	27.8	95.5	0.93	122	82	23.3
REJ-42-1333	112	17.3	4.8	62	32.5	115.0	0.96	138	86	40.6
RLB-90-6883	92	4.1	0.9	42	24.1	94.0	0.97	116	74	21.5
RPM-35-9363	95	9.2	2.2	31	25.7	89.5	0.84	112	78	23.1
SAD-00-8872	103	7.3	1.9	22	23.7	76.5	0.76	113	78	12.6
SCM-35-5124	97	6.6	1.6	33	25.4	88.0	0.85	110	78	22.2
SGC-98-6374	90	6.1	1.4	30	28.5	91.5	0.93	127	73	22.5
SHS-48-1211	100	12.6	3.1	41	23.1	87.0	0.96	119	75	27.9
SPH-53-4229	91	3.8	0.9	25	21.2	73.0	0.81	117	77	9.7
SRC-74-4595	90	7.5	1.7	31	27.6	91.5	0.89	116	78	30.4
TLM-74-2189	93	2.4	0.6	51	24.4	81.0	0.82	118	78	15.1
TWB-57-9837	103	13.7	3.5	27	27.9	93.4	0.90	112	80	27.0
V_S-06-8525	102	22.2	5.6	34	30.7	101.2	0.95	99	78	29.1
W_H-56-8407	99	6.0	1.5	51	27.8	95.0	0.95	115	84	28.2
WHS-67-7302	96	4.3	1.0	28	20.5	74.0	0.81	123	71	9.8
WJP-80-2929	96	12.7	3.0	28	27.2	91.3	0.81	117	83	25.2
Y_S-85-4659	99	4.8	1.2	29	23.1	79.5	0.85	112	84	17.9

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	Cohort	Week	Diet	LDLszML	LDLszLT	LDLszSubj	LDLPhen
BCF-41-4745	3	5	A	25.5	27.9	27.2	A
BCF-41-4745	3	6	A	25.5	27.9	27.4	A
BCF-41-4745	3	11	B	25.5	27.9	26.8	A
BCF-41-4745	3	12	B	25.5	27.9	26.9	A
BCF-41-4745	3	17	C	25.5	27.9	26.8	A
BCF-41-4745	3	18	C	25.5	27.9	26.2	A
BCG-70-6783	1	5	B	25.5	27.8	26.5	A
BCG-70-6783	1	6	B	25.5	27.8	26.6	A
BCG-70-6783	1	11	A	25.5	27.8	25.8	A
BCG-70-6783	1	12	A	25.5	27.8	26.9	A
BCG-70-6783	1	17	C	25.5	27.8	26.2	A
BCG-70-6783	1	18	C	25.5	27.8	26.8	A
BJC-82-7657	5	5	C	25.6	27.7	25.9	A
BJC-82-7657	5	6	C	25.6	27.7	26.4	A
BJC-82-7657	5	11	B	25.6	27.7	26.3	I
BJC-82-7657	5	12	B	25.6	27.7	25.5	I
BJC-82-7657	5	17	A	25.6	27.7	26.3	A
BJC-82-7657	5	18	A	25.6	27.7	26.5	A
BLB-39-5161	1	5	A	25.5	27.8	26.4	A
BLB-39-5161	1	6	A	25.5	27.8	27	A
BLB-39-5161	1	11	C	25.5	27.8	26.3	A
BLB-39-5161	1	12	C	25.5	27.8	26.9	A
BLB-39-5161	1	17	B	25.5	27.8	26.1	A
BLB-39-5161	1	18	B	25.5	27.8	26.3	A
BLM-37-2312	2	5	C	25.9	27.5	26.9	A
BLM-37-2312	2	6	C	25.9	27.5	27.2	A
BLM-37-2312	2	11	A	25.9	27.5	27.5	A
BLM-37-2312	2	12	A	25.9	27.5	27.5	A
BLM-37-2312	2	17	B	25.9	27.5	26.7	A
BLM-37-2312	2	18	B	25.9	27.5	26.8	A
BMB-53-1389	2	5	A	25.6	27.7	27	A
BMB-53-1389	2	6	A	25.6	27.7	27	A
BMB-53-1389	2	11	C	25.6	27.7	26.4	A
BMB-53-1389	2	12	C	25.6	27.7	26.4	A
BMB-53-1389	2	17	B	25.6	27.7	26.7	A
BMB-53-1389	2	18	B	25.6	27.7	26.7	A
BPF-52-8789	2	5	C	25.6	27.7	25.6	B
BPF-52-8789	2	6	C	25.6	27.7	25.8	B
BPF-52-8789	2	11	B	25.6	27.7	25.1	B
BPF-52-8789	2	12	B	25.6	27.7	25.4	B
BPF-52-8789	2	17	A	25.6	27.7	26	B
BPF-52-8789	2	18	A	25.6	27.7	25.6	B
CAV-29-4434	4	5	C	25.9	27.5	26.1	A
CAV-29-4434	4	6	C	25.9	27.5	26.3	A
CAV-29-4434	4	11	A	25.9	27.5	26.4	A
CAV-29-4434	4	12	A	25.9	27.5	26.3	A
CAV-29-4434	4	17	B	25.9	27.5	26.3	A
CAV-29-4434	4	18	B	25.9	27.5	26.2	A
CMB-61-1861	6	5	A	25.8	27.6	26.2	A
CMB-61-1861	6	6	A	25.8	27.6	26.4	A
CMB-61-1861	6	11	C	25.8	27.6	25	B
CMB-61-1861	6	12	C	25.8	27.6	25.1	B
CMB-61-1861	6	17	B	25.8	27.6	25	B
CMB-61-1861	6	18	B	25.8	27.6	24.9	B
CRR-37-3333	6	5	C	25.8	27.6	26.2	I
CRR-37-3333	6	6	C	25.8	27.6	25.7	B
CRR-37-3333	6	11	B	25.8	27.6	26.4	I
CRR-37-3333	6	12	B	25.8	27.6	26.6	A
CRR-37-3333	6	17	A	25.8	27.6	26.5	A
CRR-37-3333	6	18	A	25.8	27.6	26.4	A
D_H-92-6569	1	5	C	25.7	27.7	26.1	A
D_H-92-6569	1	6	C	25.7	27.7	26.3	A
D_H-92-6569	1	11	B	25.7	27.7	26.2	A
D_H-92-6569	1	12	B	25.7	27.7	26.1	A
D_H-92-6569	1	17	A	25.7	27.7	26.1	A
D_H-92-6569	1	18	A	25.7	27.7	26	A
D_L-89-7473	4	5	C	25.7	27.7	27.1	A
D_L-89-7473	4	6	C	25.7	27.7	27.3	A
D_L-89-7473	4	11	B	25.7	27.7	26.9	A
D_L-89-7473	4	12	B	25.7	27.7	27.2	A
D_L-89-7473	4	17	A	25.7	27.7	27.4	A
D_L-89-7473	4	18	A	25.7	27.7	27.2	A
DCS-04-4041	1	5	C	25.8	27.6	26.1	A
DCS-04-4041	1	6	C	25.8	27.6	26.2	A
DCS-04-4041	1	11	A	25.8	27.6	26.4	A
DCS-04-4041	1	12	A	25.8	27.6	26.4	A
DCS-04-4041	1	17	B	25.8	27.6	26.2	A
DCS-04-4041	1	18	B	25.8	27.6	26.4	A
DDD-35-0736	1	5	C	25.7	27.6	26.9	A
DDD-35-0736	1	6	C	25.7	27.6	27	A
DDD-35-0736	1	11	A	25.7	27.6	26.6	A
DDD-35-0736	1	12	A	25.7	27.6	26.7	A
DDD-35-0736	1	17	B	25.7	27.6	26.6	A
DDD-35-0736	1	18	B	25.7	27.6	26.5	A
DDW-27-1270	3	5	C	25.4	27.9	26.9	A
DDW-27-1270	3	6	C	25.4	27.9	26.5	A
DDW-27-1270	3	11	B	25.4	27.9	26.5	A
DDW-27-1270	3	12	B	25.4	27.9	26.1	A
DDW-27-1270	3	17	A	25.4	27.9	26.7	A
DDW-27-1270	3	18	A	25.4	27.9	26.4	A
DJS-29-7999	2	5	B	26.1	27.2	27.7	A
DJS-29-7999	2	6	B	26.1	27.2	27.3	A
DJS-29-7999	2	11	C	26.1	27.2	26.8	A
DJS-29-7999	2	12	C	26.1	27.2	26.4	A
DJS-29-7999	2	17	A	26.1	27.2	26.7	A
DJS-29-7999	2	18	A	26.1	27.2	25.7	B
DLC-08-2664	7	5	A	26	27.4	25.8	B
DLC-08-2664	7	6	A	26	27.4	25.5	B
DLC-08-2664	7	11	C	26	27.4	25.5	B
DLC-08-2664	7	12	C	26	27.4	25.5	B
DLC-08-2664	7	17	B	26	27.4	25.6	B
DLC-08-2664	7	18	B	26	27.4	25.6	B
DPB-64-7804	4	5	C	25.9	27.5	27.1	A
DPB-64-7804	4	6	C	25.9	27.5	27.1	A
DPB-64-7804	4	11	A	25.9	27.5	26.5	A
DPB-64-7804	4	12	A	25.9	27.5	26.5	A
DPB-64-7804	4	17	B	25.9	27.5	26.5	A
DPB-64-7804	4	18	B	25.9	27.5	26.4	A
DRF-37-5270	5	5	B	25.7	27.7	27.3	A
DRF-37-5270	5	6	B	25.7	27.7	26.9	A
DRF-37-5270	5	11	C	25.7	27.7	26.3	A
DRF-37-5270	5	12	C	25.7	27.7	26.5	A
DRF-37-5270	5	17	A	25.7	27.7	26.2	A
DRF-37-5270	5	18	A	25.7	27.7	26.2	A

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	Cohort	Week	Diet	LDLszML	LDLszLT	LDLszSubj	LDLPhen
DWS-98-8742	2	5	B	25.9	27.5	25.7	B
DWS-98-8742	2	6	B	25.9	27.5	25.5	B
DWS-98-8742	2	11	C	25.9	27.5	25.5	B
DWS-98-8742	2	12	C	25.9	27.5	25.7	B
DWS-98-8742	2	17	A	25.9	27.5	25.9	B
DWS-98-8742	2	18	A	25.9	27.5	26.2	B
DYN-54-3286	2	5	B	25.8	27.6	26.5	A
DYN-54-3286	2	6	B	25.8	27.6	26.7	A
DYN-54-3286	2	11	A	25.8	27.6	27	A
DYN-54-3286	2	12	A	25.8	27.6	26.6	A
DYN-54-3286	2	17	C	25.8	27.6	26.3	A
DYN-54-3286	2	18	C	25.8	27.6	26.2	A
EAB-57-9471	7	5	C	25.7	27.6	26.8	A
EAB-57-9471	7	6	C	25.7	27.6	26.8	A
EAB-57-9471	7	11	A	25.7	27.6	26.8	A
EAB-57-9471	7	12	A	25.7	27.6	26.8	A
EAB-57-9471	7	17	B	25.7	27.6	26.8	A
EAB-57-9471	7	18	B	25.7	27.6	26.5	A
ECG-56-8967	2	5	C	25.5	27.9	26.8	A
ECG-56-8967	2	6	C	25.5	27.9	26.9	A
ECG-56-8967	2	11	B	25.5	27.9	27.2	A
ECG-56-8967	2	12	B	25.5	27.9	27.1	A
ECG-56-8967	2	17	A	25.5	27.9	27.1	A
ECG-56-8967	2	18	A	25.5	27.9	27.1	A
F_S-82-1006	2	5	B	26.0	27.4	25.7	B
F_S-82-1006	2	6	B	26.0	27.4	25.6	B
F_S-82-1006	2	11	C	26.0	27.4	25.6	B
F_S-82-1006	2	12	C	26.0	27.4	25.6	B
F_S-82-1006	2	17	A	26.0	27.4	25.8	B
F_S-82-1006	2	18	A	26.0	27.4	26.2	A
G_J-62-5517	7	5	A	25.9	27.5	26.1	I
G_J-62-5517	7	6	A	25.9	27.5	26.2	I
G_J-62-5517	7	11	C	25.9	27.5	26	I
G_J-62-5517	7	12	C	25.9	27.5	26.1	I
G_J-62-5517	7	17	B	25.9	27.5	26.3	A
G_J-62-5517	7	18	B	25.9	27.5	26.1	I
GAH-13-6357	5	5	A	25.7	27.6	26.7	A
GAH-13-6357	5	6	A	25.7	27.6	26.3	A
GAH-13-6357	5	11	C	25.7	27.6	25.8	I
GAH-13-6357	5	12	C	25.7	27.6	26	I
GAH-13-6357	5	17	B	25.7	27.6	26.9	A
GAH-13-6357	5	18	B	25.7	27.6	26.9	A
GLG-27-2176	5	5	B	25.5	27.8	26.5	A
GLG-27-2176	5	6	B	25.5	27.8	26.3	A
GLG-27-2176	5	11	A	25.5	27.8	26.2	A
GLG-27-2176	5	12	A	25.5	27.8	26.5	A
GLG-27-2176	5	17	C	25.5	27.8	26.4	A
GLG-27-2176	5	18	C	25.5	27.8	26.1	A
GML-84-1785	5	5	C	25.9	27.5	26.5	A
GML-84-1785	5	6	C	25.9	27.5	26.4	A
GML-84-1785	5	11	A	25.9	27.5	26.5	A
GML-84-1785	5	12	A	25.9	27.5	26.4	A
GML-84-1785	5	17	B	25.9	27.5	26.3	A
GML-84-1785	5	18	B	25.9	27.5	26.4	A
GOB-90-9808	4	5	B	25.8	27.6	25.2	B
GOB-90-9808	4	6	B	25.8	27.6	25.3	B
GOB-90-9808	4	11	A	25.8	27.6	25.4	B
GOB-90-9808	4	12	A	25.8	27.6	25.4	B
GOB-90-9808	4	17	C	25.8	27.6	25.5	B
GOB-90-9808	4	18	C	25.8	27.6	25.1	B
GWA-98-6492	6	5	B	26	27.4	26.3	I
GWA-98-6492	6	6	B	26	27.4	26.3	I
GWA-98-6492	6	11	A	26	27.4	26.6	A
GWA-98-6492	6	12	A	26	27.4	26.6	A
GWA-98-6492	6	17	C	26	27.4	26.1	B
GWA-98-6492	6	18	C	26	27.4	25.8	B
H_J-32-0201	1	5	A	25.7	27.6	25.1	B
H_J-32-0201	1	6	A	25.7	27.6	25.1	B
H_J-32-0201	1	11	C	25.7	27.6	24.8	B
H_J-32-0201	1	12	C	25.7	27.6	24.6	B
H_J-32-0201	1	17	B	25.7	27.6	24.5	B
H_J-32-0201	1	18	B	25.7	27.6	24.5	B
HPB-70-2696	5	5	A	25.8	27.6	26.1	A
HPB-70-2696	5	6	A	25.8	27.6	26.5	A
HPB-70-2696	5	11	B	25.8	27.6	25.3	B
HPB-70-2696	5	12	B	25.8	27.6	26.3	A
HPB-70-2696	5	17	C	25.8	27.6	26.1	A
HPB-70-2696	5	18	C	25.8	27.6	25.8	B
IGH-88-3817	4	5	A	26	27.4	27.2	A
IGH-88-3817	4	6	A	26	27.4	27.2	A
IGH-88-3817	4	11	C	26	27.4	26.6	A
IGH-88-3817	4	12	C	26	27.4	26.1	A
IGH-88-3817	4	17	B	26	27.4	26.4	A
IGH-88-3817	4	18	B	26	27.4	26.7	A
JAB-37-6390	4	5	B	25.7	27.7	25.9	B
JAB-37-6390	4	6	B	25.7	27.7	25.8	B
JAB-37-6390	4	11	A	25.7	27.7	25.4	B
JAB-37-6390	4	12	A	25.7	27.7	25.6	B
JAB-37-6390	4	17	C	25.7	27.7	25.8	B
JAB-37-6390	4	18	C	25.7	27.7	25.7	B
JAB-72-0488	1	5	A	25.5	27.8	25.7	B
JAB-72-0488	1	6	A	25.5	27.8	25.9	B
JAB-72-0488	1	11	B	25.5	27.8	25.7	B
JAB-72-0488	1	12	B	25.5	27.8	25.7	B
JAB-72-0488	1	17	C	25.5	27.8	25.8	B
JAB-72-0488	1	18	C	25.5	27.8	25.6	B
JAD-52-9560	5	5	B	25.7	27.6	26.1	A
JAD-52-9560	5	6	B	25.7	27.6	26.5	A
JAD-52-9560	5	11	A	25.7	27.6	26	A
JAD-52-9560	5	12	A	25.7	27.6	26.2	A
JAD-52-9560	5	17	C	25.7	27.6	25.8	I
JAD-52-9560	5	18	C	25.7	27.6	25.9	I
JAL-68-1009	1	5	B	25.4	27.9	25.9	A
JAL-68-1009	1	6	B	25.4	27.9	26.2	A
JAL-68-1009	1	11	C	25.4	27.9	26.6	A
JAL-68-1009	1	12	C	25.4	27.9	26.5	A
JAL-68-1009	1	17	A	25.4	27.9	26.8	A
JAL-68-1009	1	18	A	25.4	27.9	26.4	A

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	Cohort	Week	Diet	LDLszML	LDLszLT	LDLszSubj	LDLPhen
JAM-68-6945	1	5	C	25.4	27.9	25.3	B
JAM-68-6945	1	6	C	25.4	27.9	25.6	B
JAM-68-6945	1	11	A	25.4	27.9	25.4	B
JAM-68-6945	1	12	A	25.4	27.9	25.4	B
JAM-68-6945	1	17	B	25.4	27.9	25.2	B
JAM-68-6945	1	18	B	25.4	27.9	25.6	B
JBG-37-0774	3	5	B	25.6	27.8	26.1	A
JBG-37-0774	3	6	B	25.6	27.8	26.3	A
JBG-37-0774	3	11	C	25.6	27.8	25.4	B
JBG-37-0774	3	12	C	25.6	27.8	24.7	B
JBG-37-0774	3	17	A	25.6	27.8	26.1	A
JBG-37-0774	3	18	A	25.6	27.8	26.3	A
JBT-31-2471	1	5	A	25.6	27.8	25.8	B
JBT-31-2471	1	6	A	25.6	27.8	25.8	B
JBT-31-2471	1	11	C	25.6	27.8	25.8	B
JBT-31-2471	1	12	C	25.6	27.8	26.9	A
JBT-31-2471	1	17	B	25.6	27.8	26.5	A
JBT-31-2471	1	18	B	25.6	27.8	27.1	A
JCK-90-6103	2	5	C	25.7	27.7	26.4	A
JCK-90-6103	2	6	C	25.7	27.7	26.4	A
JCK-90-6103	2	11	B	25.7	27.7	26.5	A
JCK-90-6103	2	12	B	25.7	27.7	26.5	A
JCK-90-6103	2	17	A	25.7	27.7	26.8	A
JCK-90-6103	2	18	A	25.7	27.7	27.1	A
JCR-19-0674	5	5	B	26.2	27.1	26.4	A
JCR-19-0674	5	6	B	26.2	27.1	26.6	A
JCR-19-0674	5	11	A	26.2	27.1	26.7	A
JCR-19-0674	5	12	A	26.2	27.1	27.0	A
JCR-19-0674	5	17	C	26.2	27.1	.	.
JCR-19-0674	5	18	C	26.2	27.1	.	.
JDL-57-0943	3	5	C	25.6	27.7	26.5	A
JDL-57-0943	3	6	C	25.6	27.7	26.4	A
JDL-57-0943	3	11	A	25.6	27.7	26.8	A
JDL-57-0943	3	12	A	25.6	27.7	26.5	A
JDL-57-0943	3	17	B	25.6	27.7	26.6	A
JDL-57-0943	3	18	B	25.6	27.7	26.5	A
JES-39-1460	4	5	A	25.6	27.7	27.7	A
JES-39-1460	4	6	A	25.6	27.7	27.7	A
JES-39-1460	4	11	C	25.6	27.7	27.5	A
JES-39-1460	4	12	C	25.6	27.7	27.5	A
JES-39-1460	4	17	B	25.6	27.7	27.5	A
JES-39-1460	4	18	B	25.6	27.7	27.5	A
JET-64-1777	5	5	C	25.5	27.8	26	A
JET-64-1777	5	6	C	25.5	27.8	26.1	A
JET-64-1777	5	11	B	25.5	27.8	25.9	A
JET-64-1777	5	12	B	25.5	27.8	26	A
JET-64-1777	5	17	A	25.5	27.8	26.2	A
JET-64-1777	5	18	A	25.5	27.8	26	A
JHW-52-1222	4	5	C	25.7	27.6	26.3	A
JHW-52-1222	4	6	C	25.7	27.6	26.5	A
JHW-52-1222	4	11	B	25.7	27.6	26.1	A
JHW-52-1222	4	12	B	25.7	27.6	26.1	A
JHW-52-1222	4	17	A	25.7	27.6	26.5	A
JHW-52-1222	4	18	A	25.7	27.6	26	A
JLD-82-6128	2	5	C	26.1	27.3	25.5	B
JLD-82-6128	2	6	C	26.1	27.3	25.4	B
JLD-82-6128	2	11	A	26.1	27.3	26.2	B
JLD-82-6128	2	12	A	26.1	27.3	26.0	B
JLD-82-6128	2	17	B	26.1	27.3	26.1	B
JLD-82-6128	2	18	B	26.1	27.3	25.3	B
JLK-24-2936	4	5	C	25.5	27.9	25.6	B
JLK-24-2936	4	6	C	25.5	27.9	25.5	B
JLK-24-2936	4	11	B	25.5	27.9	25.3	B
JLK-24-2936	4	12	B	25.5	27.9	25.4	B
JLK-24-2936	4	17	A	25.5	27.9	25.7	B
JLK-24-2936	4	18	A	25.5	27.9	25.6	B
JMG-24-4026	2	5	C	25.4	27.9	25.1	B
JMG-24-4026	2	6	C	25.4	27.9	25.2	B
JMG-24-4026	2	11	A	25.4	27.9	25.3	B
JMG-24-4026	2	12	A	25.4	27.9	25.4	B
JMG-24-4026	2	17	B	25.4	27.9	24.8	B
JMG-24-4026	2	18	B	25.4	27.9	26.3	A
JMP-04-5284	2	5	B	25.9	27.5	26.7	A
JMP-04-5284	2	6	B	25.9	27.5	26.8	A
JMP-04-5284	2	11	A	25.9	27.5	26.9	A
JMP-04-5284	2	12	A	25.9	27.5	26.9	A
JMP-04-5284	2	17	C	25.9	27.5	26.7	A
JMP-04-5284	2	18	C	25.9	27.5	26.5	A
JTM-15-3065	7	5	A	26.0	27.4	26.1	A
JTM-15-3065	7	6	A	26.0	27.4	26.1	A
JTM-15-3065	7	11	B	26.0	27.4	25.5	B
JTM-15-3065	7	12	B	26.0	27.4	25.5	B
JTM-15-3065	7	17	C	26.0	27.4	25.3	B
JTM-15-3065	7	18	C	26.0	27.4	25.5	B
JWH-27-7128	3	5	B	25.5	27.8	26.4	A
JWH-27-7128	3	6	B	25.5	27.8	26.4	A
JWH-27-7128	3	11	A	25.5	27.8	26.4	A
JWH-27-7128	3	12	A	25.5	27.8	26.3	A
JWH-27-7128	3	17	C	25.5	27.8	26.2	A
JWH-27-7128	3	18	C	25.5	27.8	26.2	A
JWM-84-9528	6	5	B	25.7	27.6	26.7	A
JWM-84-9528	6	6	B	25.7	27.6	26.5	A
JWM-84-9528	6	11	C	25.7	27.6	26.6	A
JWM-84-9528	6	12	C	25.7	27.6	26.6	A
JWM-84-9528	6	17	A	25.7	27.6	26.5	A
JWM-84-9528	6	18	A	25.7	27.6	26.5	A
K_W-02-8695	2	5	A	25.9	27.5	27.3	A
K_W-02-8695	2	6	A	25.9	27.5	27.3	A
K_W-02-8695	2	11	B	25.9	27.5	27	A
K_W-02-8695	2	12	B	25.9	27.5	26.8	A
K_W-02-8695	2	17	C	25.9	27.5	26.6	A
K_W-02-8695	2	18	C	25.9	27.5	26.3	A
KFW-35-5107	1	5	B	25.7	27.6	26.1	A
KFW-35-5107	1	6	B	25.7	27.6	26.7	A
KFW-35-5107	1	11	C	25.7	27.6	26	A
KFW-35-5107	1	12	C	25.7	27.6	26.1	A
KFW-35-5107	1	17	A	25.7	27.6	26.2	A
KFW-35-5107	1	18	A	25.7	27.6	26.3	A
LBT-66-9014	6	5	B	26	27.4	26.3	I
LBT-66-9014	6	6	B	26	27.4	26.5	A
LBT-66-9014	6	11	A	26	27.4	26.4	A
LBT-66-9014	6	12	A	26	27.4	26.2	I
LBT-66-9014	6	17	C	26	27.4	25.9	B
LBT-66-9014	6	18	C	26	27.4	25.9	B

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	Cohort	Week	Diet	LDLszML	LDLszLT	LDLszSubj	LDLPhen
LCF-94-1044	1	5	B	25.5	27.8	26.5	A
LCF-94-1044	1	6	B	25.5	27.8	26.6	A
LCF-94-1044	1	11	A	25.5	27.8	26.6	A
LCF-94-1044	1	12	A	25.5	27.8	26.1	A
LCF-94-1044	1	17	C	25.5	27.8	26.7	A
LCF-94-1044	1	18	C	25.5	27.8	25.9	A
LCO-51-7401	3	5	C	25.6	27.7	26	A
LCO-51-7401	3	6	C	25.6	27.7	26.4	A
LCO-51-7401	3	11	A	25.6	27.7	26.5	A
LCO-51-7401	3	12	A	25.6	27.7	26.4	A
LCO-51-7401	3	17	B	25.6	27.7	26.4	A
LCO-51-7401	3	18	B	25.6	27.7	26.4	A
LJC-76-4231	1	5	C	25.7	27.7	25.4	B
LJC-76-4231	1	6	C	25.7	27.7	25	B
LJC-76-4231	1	11	B	25.7	27.7	25.3	B
LJC-76-4231	1	12	B	25.7	27.7	25.2	B
LJC-76-4231	1	17	A	25.7	27.7	25.5	B
LJC-76-4231	1	18	A	25.7	27.7	25.5	B
MJB-02-2375	2	5	A	25.8	27.6	25.9	A
MJB-02-2375	2	6	A	25.8	27.6	26.3	A
MJB-02-2375	2	11	B	25.8	27.6	27	A
MJB-02-2375	2	12	B	25.8	27.6	26.3	A
MJB-02-2375	2	17	C	25.8	27.6	26.3	A
MJB-02-2375	2	18	C	25.8	27.6	25.7	B
MLL-68-3135	1	5	B	25.4	28	27.2	A
MLL-68-3135	1	6	B	25.4	28	26.9	A
MLL-68-3135	1	11	A	25.4	28	27	A
MLL-68-3135	1	12	A	25.4	28	26.6	A
MLL-68-3135	1	17	C	25.4	28	26.6	A
MLL-68-3135	1	18	C	25.4	28	26.9	A
MLS-82-5875	4	5	B	25.4	27.9	25.3	B
MLS-82-5875	4	6	B	25.4	27.9	25.4	B
MLS-82-5875	4	11	A	25.4	27.9	25.2	B
MLS-82-5875	4	12	A	25.4	27.9	25.2	B
MLS-82-5875	4	17	C	25.4	27.9	25.1	B
MLS-82-5875	4	18	C	25.4	27.9	25.1	B
MWB-82-6035	5	5	A	25.7	27.7	26.3	A
MWB-82-6035	5	6	A	25.7	27.7	26.3	A
MWB-82-6035	5	11	B	25.7	27.7	25.9	A
MWB-82-6035	5	12	B	25.7	27.7	26	A
MWB-82-6035	5	17	C	25.7	27.7	25.7	I
MWB-82-6035	5	18	C	25.7	27.7	26	I
PJB-43-3639	7	5	C	26.1	27.3	26.2	I
PJB-43-3639	7	6	C	26.1	27.3	26	B
PJB-43-3639	7	11	B	26.1	27.3	26	B
PJB-43-3639	7	12	B	26.1	27.3	26.3	I
PJB-43-3639	7	17	A	26.1	27.3	26.2	I
PJB-43-3639	7	18	A	26.1	27.3	26	B
PJD-13-4775	7	5	B	25.9	27.5	26.2	I
PJD-13-4775	7	6	B	25.9	27.5	26.1	I
PJD-13-4775	7	11	A	25.9	27.5	26.4	A
PJD-13-4775	7	12	A	25.9	27.5	26.4	A
PJD-13-4775	7	17	C	25.9	27.5	26	I
PJD-13-4775	7	18	C	25.9	27.5	26.2	I
R_D-70-0888	1	5	A	25.5	27.9	26.6	A
R_D-70-0888	1	6	A	25.5	27.9	27	A
R_D-70-0888	1	11	C	25.5	27.9	25.9	A
R_D-70-0888	1	12	C	25.5	27.9	26.8	A
R_D-70-0888	1	17	B	25.5	27.9	27	A
R_D-70-0888	1	18	B	25.5	27.9	26.8	A
R_G-92-3746	1	5	B	25.7	27.7	25.5	B
R_G-92-3746	1	6	B	25.7	27.7	25.6	B
R_G-92-3746	1	11	C	25.7	27.7	25.6	B
R_G-92-3746	1	12	C	25.7	27.7	25.3	B
R_G-92-3746	1	17	A	25.7	27.7	25.6	B
R_G-92-3746	1	18	A	25.7	27.7	25.6	B
R_M-92-9942	1	5	A	25.6	27.8	25.8	B
R_M-92-9942	1	6	A	25.6	27.8	26	B
R_M-92-9942	1	11	B	25.6	27.8	25.6	B
R_M-92-9942	1	12	B	25.6	27.8	25.5	B
R_M-92-9942	1	17	C	25.6	27.8	25.6	B
R_M-92-9942	1	18	C	25.6	27.8	25.8	B
RAS-47-7434	3	5	A	25.6	27.7	26.6	A
RAS-47-7434	3	6	A	25.6	27.7	26.7	A
RAS-47-7434	3	11	C	25.6	27.7	26.4	A
RAS-47-7434	3	12	C	25.6	27.7	26.3	A
RAS-47-7434	3	17	B	25.6	27.7	26.6	A
RAS-47-7434	3	18	B	25.6	27.7	26.6	A
RAW-58-9624	6	5	B	25.9	27.4	26.2	I
RAW-58-9624	6	6	B	25.9	27.4	26.3	A
RAW-58-9624	6	11	A	25.9	27.4	26.3	A
RAW-58-9624	6	12	A	25.9	27.4	26.3	A
RAW-58-9624	6	17	C	25.9	27.4	26.2	I
RAW-58-9624	6	18	C	25.9	27.4	26.2	I
RDS-94-2909	2	5	B	26.0	27.4	26.3	A
RDS-94-2909	2	6	B	26.0	27.4	26.2	A
RDS-94-2909	2	11	A	26.0	27.4	27.1	A
RDS-94-2909	2	12	A	26.0	27.4	26.9	A
RDS-94-2909	2	17	C	26.0	27.4	25.8	B
RDS-94-2909	2	18	C	26.0	27.4	26.1	B
REJ-42-1333	6	5	C	26	27.3	26.2	I
REJ-42-1333	6	6	C	26	27.3	26.1	I
REJ-42-1333	6	11	A	26	27.3	26.5	A
REJ-42-1333	6	12	A	26	27.3	26.3	I
REJ-42-1333	6	17	B	26	27.3	26.6	A
REJ-42-1333	6	18	B	26	27.3	26.4	A
RLB-90-6883	5	5	A	25.5	27.8	25.5	B
RLB-90-6883	5	6	A	25.5	27.8	25.6	B
RLB-90-6883	5	11	B	25.5	27.8	24.8	B
RLB-90-6883	5	12	B	25.5	27.8	25	B
RLB-90-6883	5	17	C	25.5	27.8	26.1	A
RLB-90-6883	5	18	C	25.5	27.8	25.9	A
RPM-35-9363	6	5	A	26	27.4	26.7	A
RPM-35-9363	6	6	A	26	27.4	26.4	A
RPM-35-9363	6	11	B	26	27.4	26.5	A
RPM-35-9363	6	12	B	26	27.4	26.5	A
RPM-35-9363	6	17	C	26	27.4	26.2	I
RPM-35-9363	6	18	C	26	27.4	25.9	B
SAD-00-8872	2	5	A	25.6	27.8	25.6	B
SAD-00-8872	2	6	A	25.6	27.8	25.5	B
SAD-00-8872	2	11	C	25.6	27.8	25.2	B
SAD-00-8872	2	12	C	25.6	27.8	25.6	B
SAD-00-8872	2	17	B	25.6	27.8	25.4	B
SAD-00-8872	2	18	B	25.6	27.8	25.2	B

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	Cohort	Week	Diet	LDLszML	LDLszLT	LDLszSubj	LDLPhen
SCM-35-5124	7	5	C	.	.	.	.
SCM-35-5124	7	6	C	.	.	.	.
SCM-35-5124	7	11	A	.	.	.	.
SCM-35-5124	7	12	A	.	.	.	.
SCM-35-5124	7	17	B	.	.	.	.
SCM-35-5124	7	18	B	.	.	.	.
SGC-98-6374	4	5	B	25.8	27.6	27.2	A
SGC-98-6374	4	6	B	25.8	27.6	27	A
SGC-98-6374	4	11	C	25.8	27.6	26.6	A
SGC-98-6374	4	12	C	25.8	27.6	26.6	A
SGC-98-6374	4	17	A	25.8	27.6	26.7	A
SGC-98-6374	4	18	A	25.8	27.6	26.8	A
SHS-48-1211	2	5	B	25.6	27.8	25.3	B
SHS-48-1211	2	6	B	25.6	27.8	25.3	B
SHS-48-1211	2	11	C	25.6	27.8	25.1	B
SHS-48-1211	2	12	C	25.6	27.8	25.2	B
SHS-48-1211	2	17	A	25.6	27.8	25.5	B
SHS-48-1211	2	18	A	25.6	27.8	25.4	B
SPH-53-4229	1	5	A	25.7	27.6	26.7	A
SPH-53-4229	1	6	A	25.7	27.6	26.9	A
SPH-53-4229	1	11	B	25.7	27.6	26.3	A
SPH-53-4229	1	12	B	25.7	27.6	26.4	A
SPH-53-4229	1	17	C	25.7	27.6	26.3	A
SPH-53-4229	1	18	C	25.7	27.6	26.1	A
SRC-74-4595	3	5	A	25.7	27.7	26.5	A
SRC-74-4595	3	6	A	25.7	27.7	26.1	A
SRC-74-4595	3	11	C	25.7	27.7	25.6	B
SRC-74-4595	3	12	C	25.7	27.7	25.5	B
SRC-74-4595	3	17	B	25.7	27.7	25.9	A
SRC-74-4595	3	18	B	25.7	27.7	26.1	A
TLM-74-2189	6	5	C	25.7	27.6	25.5	B
TLM-74-2189	6	6	C	25.7	27.6	25.5	B
TLM-74-2189	6	11	B	25.7	27.6	25.4	B
TLM-74-2189	6	12	B	25.7	27.6	25.5	B
TLM-74-2189	6	17	A	25.7	27.6	25.7	B
TLM-74-2189	6	18	A	25.7	27.6	25.9	B
TWB-57-9837	6	5	B	26	27.4	27.8	A
TWB-57-9837	6	6	B	26	27.4	27.9	A
TWB-57-9837	6	11	C	26	27.4	27.8	A
TWB-57-9837	6	12	C	26	27.4	27.8	A
TWB-57-9837	6	17	A	26	27.4	27.7	A
TWB-57-9837	6	18	A	26	27.4	28.4	A
V_S-06-8525	7	5	B	25.7	27.6	24.7	B
V_S-06-8525	7	6	B	25.8	27.6	24.3	B
V_S-06-8525	7	11	A	25.8	27.6	24.8	B
V_S-06-8525	7	12	A	25.8	27.6	24.7	B
V_S-06-8525	7	17	C	25.8	27.6	24.6	B
V_S-06-8525	7	18	C	25.8	27.6	24.6	B
W_H-56-8407	1	5	B	25.7	27.7	25.3	B
W_H-56-8407	1	6	B	25.7	27.7	25.4	B
W_H-56-8407	1	11	A	25.7	27.7	26.1	A
W_H-56-8407	1	12	A	25.7	27.7	25.1	B
W_H-56-8407	1	17	C	25.7	27.7	25.5	B
W_H-56-8407	1	18	C	25.7	27.7	25	B
WHS-67-7302	1	5	C	25.8	27.6	26.9	A
WHS-67-7302	1	6	C	25.8	27.6	26.9	A
WHS-67-7302	1	11	B	25.8	27.6	26.7	A
WHS-67-7302	1	12	B	25.8	27.6	26.6	A
WHS-67-7302	1	17	A	25.8	27.6	26.6	A
WHS-67-7302	1	18	A	25.8	27.6	26.7	A
WJP-80-2929	6	5	C	25.9	27.5	26.2	I
WJP-80-2929	6	6	C	25.9	27.5	26.2	I
WJP-80-2929	6	11	B	25.9	27.5	25.7	B
WJP-80-2929	6	12	B	25.9	27.5	25.3	B
WJP-80-2929	6	17	A	25.9	27.5	25.3	B
WJP-80-2929	6	18	A	25.9	27.5	25.3	B
Y_S-85-4659	4	5	B	25.7	27.6	27.2	A
Y_S-85-4659	4	6	B	25.7	27.6	26.8	A
Y_S-85-4659	4	11	C	25.7	27.6	26.8	A
Y_S-85-4659	4	12	C	25.7	27.6	26.8	A
Y_S-85-4659	4	17	A	25.7	27.6	26.9	A
Y_S-85-4659	4	18	A	25.7	27.6	26.9	A

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	TC	TG	HDL	LDL	ApoA1	ApoB
BCF-41-4745	162	45	41	112	121	84
BCF-41-4745	168	32	44	117	119	87
BCF-41-4745	147	33	38	102	111	74
BCF-41-4745	151	29	43	102	119	78
BCF-41-4745	135	36	38	89	109	72
BCF-41-4745	141	52	35	95	110	73
BCG-70-6783	177	110	32	122	108	98
BCG-70-6783	183	139	31	124	106	100
BCG-70-6783	187	152	31	125	109	102
BCG-70-6783	179	98	31	128	104	96
BCG-70-6783	181	142	31	121	108	103
BCG-70-6783	182	117	32	126	108	98
BJC-82-7657	187	132	39	121	128	112
BJC-82-7657	214	121	34	155	116	135
BJC-82-7657	228	100	38	170	118	139
BJC-82-7657	218	135	39	151	120	129
BJC-82-7657	223	78	47	160	132	125
BJC-82-7657	211	79	45	150	133	115
BLB-39-5161	180	95	35	125	113	94
BLB-39-5161	160	88	34	108	110	81
BLB-39-5161	160	139	37	95	116	99
BLB-39-5161	171	57	37	122	112	94
BLB-39-5161	177	99	34	123	114	94
BLB-39-5161	177	109	32	123	111	96
BLM-37-2312	162	128	36	100	106	80
BLM-37-2312	184	139	37	119	117	89
BLM-37-2312	180	101	44	115	126	81
BLM-37-2312	171	71	42	114	119	77
BLM-37-2312	191	124	40	126	119	94
BLM-37-2312	177	112	37	118	117	87
BMB-53-1389	170	52	46	113	131	75
BMB-53-1389	169	44	46	114	134	74
BMB-53-1389	145	53	33	101	115	68
BMB-53-1389	151	82	33	101	116	72
BMB-53-1389	145	41	40	97	118	67
BMB-53-1389	147	52	37	99	116	68
BPF-52-8789	181	86	32	132	104	109
BPF-52-8789	178	66	34	131	109	104
BPF-52-8789	193	117	33	136	109	119
BPF-52-8789	192	81	34	142	113	116
BPF-52-8789	214	81	41	157	122	124
BPF-52-8789	206	76	38	152	121	117
CAV-29-4434	167	58	37	118	113	91
CAV-29-4434	160	66	34	112	106	88
CAV-29-4434	179	54	44	124	122	90
CAV-29-4434	167	52	41	115	122	86
CAV-29-4434	169	64	40	116	114	88
CAV-29-4434	164	52	39	114	119	86
CMB-61-1861	169	61	39	117	86	112
CMB-61-1861	173	83	37	119	104	137
CMB-61-1861	151	123	28	98	123	118
CMB-61-1861	169	120	30	114	120	100
CMB-61-1861	184	104	35	128	122	96
CMB-61-1861	181	107	31	128	118	97
CRR-37-3333	137	94	28	90	104	76
CRR-37-3333	141	92	28	94	109	78
CRR-37-3333	144	86	28	98	110	80
CRR-37-3333	148	61	32	104	113	82
CRR-37-3333	162	75	31	115	110	84
CRR-37-3333	160	53	35	114	118	83
D_H-92-6569	151	77	42	93	129	72
D_H-92-6569	144	76	42	86	119	69
D_H-92-6569	145	62	42	90	125	68
D_H-92-6569	140	60	39	89	119	68
D_H-92-6569	154	59	45	97	127	75
D_H-92-6569	161	65	45	103	128	77
D_L-89-7473	184	70	60	110	130	77
D_L-89-7473	164	61	54	97	125	70
D_L-89-7473	182	71	61	107	135	75
D_L-89-7473	186	75	61	110	136	75
D_L-89-7473	194	71	60	120	136	81
D_L-89-7473	178	64	58	107	126	75
DCS-04-4041	131	102	46	64	118	56
DCS-04-4041	148	69	50	84	132	64
DCS-04-4041	155	67	40	101	113	73
DCS-04-4041	151	66	39	99	109	70
DCS-04-4041	146	70	36	96	109	68
DCS-04-4041	156	62	44	99	123	70
DDD-35-0736	153	37	39	106	111	75
DDD-35-0736	136	50	36	90	103	68
DDD-35-0736	181	53	44	126	121	88
DDD-35-0736	176	55	43	121	118	87
DDD-35-0736	157	62	40	104	112	78
DDD-35-0736	174	84	43	114	123	87
DDW-27-1270	193	73	42	136	116	98
DDW-27-1270	192	105	37	133	117	101
DDW-27-1270	226	78	45	165	131	119
DDW-27-1270	203	88	42	143	124	104
DDW-27-1270	244	98	44	180	128	124
DDW-27-1270	225	69	45	166	128	113
DJS-29-7999	130	57	48	71	129	54
DJS-29-7999	132	43	47	76	120	55
DJS-29-7999	128	60	42	74	118	57
DJS-29-7999	120	56	39	70	114	55
DJS-29-7999	158	47	53	95	146	67
DJS-29-7999	152	37	53	91	141	64
DLC-08-2664	206	214	36	127	124	102
DLC-08-2664	210	159	39	139	121	104
DLC-08-2664	181	276	32	93	112	90
DLC-08-2664	185	235	32	106	111	95
DLC-08-2664	203	174	36	132	113	104
DLC-08-2664	181	195	34	107	110	90
DPB-64-7804	161	68	44	103	125	83
DPB-64-7804	157	72	39	103	114	78
DPB-64-7804	167	76	46	106	130	81
DPB-64-7804	178	71	49	115	131	87
DPB-64-7804	192	78	49	127	138	99
DPB-64-7804	187	79	45	126	130	98
DRF-37-5270	139	46	49	80	124	62
DRF-37-5270	146	58	49	85	129	65
DRF-37-5270	153	82	50	87	135	68
DRF-37-5270	159	56	56	91	137	69
DRF-37-5270	180	83	55	108	149	83
DRF-37-5270	195	81	58	121	151	87

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	TC	TG	HDL	LDL	ApoA1	ApoB
DWS-98-8742	147	78	32	99	107	86
DWS-98-8742	176	98	35	121	127	102
DWS-98-8742	167	119	32	111	116	95
DWS-98-8742	170	86	36	117	121	97
DWS-98-8742	185	57	41	132	137	102
DWS-98-8742	178	37	42	128	136	96
DYN-54-3286	235	160	44	159	119	130
DYN-54-3286	221	149	41	149	116	118
DYN-54-3286	221	138	44	149	131	119
DYN-54-3286	220	143	42	149	123	115
DYN-54-3286	206	173	40	131	114	114
DYN-54-3286	203	177	37	130	113	115
EAB-57-9471	137	55	43	83	109	63
EAB-57-9471	144	52	38	95	102	68
EAB-57-9471	173	46	57	106	141	74
EAB-57-9471	146	59	46	88	125	66
EAB-57-9471	147	57	43	92	115	69
EAB-57-9471	149	82	47	86	121	69
ECG-56-8967	181	120	40	116	131	120
ECG-56-8967	188	90	43	127	139	115
ECG-56-8967	183	79	38	129	137	118
ECG-56-8967	213	70	37	161	122	120
ECG-56-8967	176	59	34	130	109	122
ECG-56-8967	162	58	37	113	108	104
F_S-82-1006	187	110	34	130	126	116
F_S-82-1006	178	102	32	125	117	113
F_S-82-1006	161	111	29	109	113	102
F_S-82-1006	154	106	27	106	106	101
F_S-82-1006	171	81	33	122	119	107
F_S-82-1006	177	75	31	131	115	115
G_J-62-5517	163	76	31	116	114	88
G_J-62-5517	150	50	31	109	105	79
G_J-62-5517	141	73	26	100	94	75
G_J-62-5517	132	57	28	92	92	70
G_J-62-5517	143	63	31	99	105	77
G_J-62-5517	142	61	32	98	102	75
GAH-13-6357	178	54	45	122	122	88
GAH-13-6357	170	41	43	118	117	84
GAH-13-6357	158	55	41	105	116	81
GAH-13-6357	155	52	39	105	111	79
GAH-13-6357	180	94	37	123	113	101
GAH-13-6357	178	46	41	128	115	94
GLG-27-2176	163	57	48	103	124	77
GLG-27-2176	173	56	48	114	129	81
GLG-27-2176	166	62	48	106	134	79
GLG-27-2176	184	34	56	121	126	82
GLG-27-2176	146	37	50	88	116	65
GLG-27-2176	145	81	43	85	118	66
GML-84-1785	167	75	30	122	91	91
GML-84-1785	172	79	32	124	97	99
GML-84-1785	197	63	34	150	106	105
GML-84-1785	178	57	34	133	101	98
GML-84-1785	187	90	31	138	97	107
GML-84-1785	187	80	33	138	104	108
GOB-90-9808	153	156	32	89	110	88
GOB-90-9808	154	195	34	81	113	86
GOB-90-9808	172	145	35	108	115	100
GOB-90-9808	154	151	33	91	115	91
GOB-90-9808	141	118	33	84	106	81
GOB-90-9808	129	173	27	67	108	72
GWA-98-6492	179	71	41	124	125	92
GWA-98-6492	173	89	39	116	119	88
GWA-98-6492	198	66	43	141	134	101
GWA-98-6492	172	49	40	121	120	85
GWA-98-6492	165	59	39	114	119	84
GWA-98-6492	157	64	40	104	122	79
H_J-32-0201	185	231	24	114	96	123
H_J-32-0201	189	290	26	105	102	118
H_J-32-0201	173	479	.	.	100	107
H_J-32-0201	188	359	.	.	95	115
H_J-32-0201	242	339	35	139	115	155
H_J-32-0201	237	342	33	136	119	146
HPB-70-2696	219	142	34	157	110	123
HPB-70-2696	215	126	35	155	111	119
HPB-70-2696	192	178	32	124	110	111
HPB-70-2696	185	129	32	127	107	105
HPB-70-2696	187	146	32	126	107	104
HPB-70-2696	174	142	32	113	108	95
IGH-88-3817	251	85	53	180	142	132
IGH-88-3817	260	80	52	192	140	136
IGH-88-3817	205	82	47	141	127	106
IGH-88-3817	222	87	47	157	130	120
IGH-88-3817	235	110	53	160	136	119
IGH-88-3817	241	61	54	175	135	126
JAB-37-6390	174	141	33	113	106	99
JAB-37-6390	168	118	32	112	106	96
JAB-37-6390	193	136	35	130	111	113
JAB-37-6390	186	130	35	125	110	105
JAB-37-6390	172	124	35	112	108	97
JAB-37-6390	166	112	35	109	109	90
JAB-72-0488	209	224	35	129	129	116
JAB-72-0488	219	217	36	139	135	120
JAB-72-0488	240	199	35	165	130	135
JAB-72-0488	213	190	31	143	115	119
JAB-72-0488	233	252	37	145	121	129
JAB-72-0488	229	252	34	144	124	129
JAD-52-9560	210	105	47	141	127	122
JAD-52-9560	193	120	44	125	120	106
JAD-52-9560	217	194	46	132	132	121
JAD-52-9560	211	141	46	136	127	114
JAD-52-9560	199	157	38	129	116	114
JAD-52-9560	213	169	42	136	126	123
JAL-68-1009	199	136	34	137	125	104
JAL-68-1009	211	100	38	153	133	113
JAL-68-1009	213	110	36	155	125	111
JAL-68-1009	201	112	37	141	127	107
JAL-68-1009	232	126	43	163	144	114
JAL-68-1009	233	127	45	162	146	117

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	TC	TG	HDL	LDL	ApoA1	ApoB
JAM-68-6945	148	125	25	97	96	98
JAM-68-6945	127	92	34	74	98	97
JAM-68-6945	177	122	35	117	110	119
JAM-68-6945	208	130	33	149	110	122
JAM-68-6945	195	104	30	143	109	117
JAM-68-6945	199	104	33	145	109	101
JBG-37-0774	147	84	29	100	97	80
JBG-37-0774	150	100	30	99	103	81
JBG-37-0774	168	105	33	113	113	90
JBG-37-0774	121	54	30	80	92	63
JBG-37-0774	168	74	40	113	121	87
JBG-37-0774	174	46	46	118	123	90
JBT-31-2471	163	180	28	99	101	89
JBT-31-2471	149	149	27	92	97	76
JBT-31-2471	150	156	28	91	96	78
JBT-31-2471	144	127	27	91	96	74
JBT-31-2471	166	133	29	110	94	83
JBT-31-2471	146	127	26	94	86	71
JCK-90-6103	140	76	26	98	98	83
JCK-90-6103	147	68	32	101	108	91
JCK-90-6103	155	75	28	111	109	96
JCK-90-6103	155	107	32	101	106	93
JCK-90-6103	181	70	32	134	118	103
JCK-90-6103	175	38	38	129	123	94
JCR-19-0674	195	63	56	126	136	85
JCR-19-0674	178	56	63	104	138	77
JCR-19-0674	200	67	58	128	139	86
JCR-19-0674	188	44	57	122	135	86
JCR-19-0674	185	58	52	121	129	86
JCR-19-0674	176	120	48	104	134	77
JDL-57-0943	153	67	47	92	130	75
JDL-57-0943	156	71	46	95	132	78
JDL-57-0943	174	45	51	114	142	85
JDL-57-0943	182	58	51	119	142	90
JDL-57-0943	156	57	48	96	133	76
JDL-57-0943	147	51	47	90	132	71
JES-39-1460	173	40	53	111	128	76
JES-39-1460	171	45	56	105	140	76
JES-39-1460	144	46	49	86	120	64
JES-39-1460	133	32	45	81	115	61
JES-39-1460	151	41	50	92	128	68
JES-39-1460	142	36	47	88	115	65
JET-64-1777	169	106	30	117	101	98
JET-64-1777	152	107	41	89	98	96
JET-64-1777	184	113	36	125	108	95
JET-64-1777	168	101	44	103	110	97
JET-64-1777	169	69	45	110	110	103
JET-64-1777	176	91	38	119	108	104
JHW-52-1222	174	107	32	121	102	106
JHW-52-1222	195	89	34	142	106	115
JHW-52-1222	193	99	36	137	112	110
JHW-52-1222	202	89	38	145	115	115
JHW-52-1222	187	79	39	132	117	106
JHW-52-1222	209	90	39	152	115	120
JLD-82-6128	193	159	29	132	103	114
JLD-82-6128	210	159	31	147	105	120
JLD-82-6128	239	121	39	176	118	137
JLD-82-6128	222	111	35	164	114	122
JLD-82-6128	210	130	36	148	113	119
JLD-82-6128	194	171	31	129	112	113
JLK-24-2936	174	132	38	110	122	103
JLK-24-2936	184	144	38	117	123	107
JLK-24-2936	226	113	38	165	116	132
JLK-24-2936	183	133	38	118	123	109
JLK-24-2936	226	77	53	158	143	124
JLK-24-2936	209	112	45	141	137	123
JMG-24-4026	220	290	27	134	104	128
JMG-24-4026	162	223	18	99	101	118
JMG-24-4026	192	185	43	112	105	128
JMG-24-4026	204	196	33	131	97	125
JMG-24-4026	237	326	32	139	114	130
JMG-24-4026	206	228	46	114	111	131
JMP-04-5284	166	80	41	108	128	83
JMP-04-5284	154	66	41	99	120	74
JMP-04-5284	176	77	49	111	147	82
JMP-04-5284	182	62	49	120	145	84
JMP-04-5284	160	73	41	104	98	81
JMP-04-5284	157	104	41	95	129	78
JTM-15-3065	232	113	46	163	138	114
JTM-15-3065	215	109	48	145	138	104
JTM-15-3065	186	113	38	125	119	97
JTM-15-3065	198	147	39	129	125	102
JTM-15-3065	194	160	36	125	120	104
JTM-15-3065	195	159	38	125	119	101
JWH-27-7128	174	97	41	113	129	96
JWH-27-7128	188	98	44	124	133	105
JWH-27-7128	212	106	48	142	150	118
JWH-27-7128	225	78	49	160	148	125
JWH-27-7128	199	76	45	139	142	116
JWH-27-7128	211	84	46	147	140	120
JWM-84-9528	202	62	63	126	149	94
JWM-84-9528	185	48	61	114	144	83
JWM-84-9528	205	63	61	131	154	98
JWM-84-9528	204	63	61	130	155	96
JWM-84-9528	178	72	60	103	157	80
JWM-84-9528	188	45	65	114	163	87
K_W-02-8695	164	53	48	105	133	87
K_W-02-8695	143	46	39	95	114	74
K_W-02-8695	136	54	36	89	104	73
K_W-02-8695	134	64	35	86	114	71
K_W-02-8695	139	50	36	93	111	77
K_W-02-8695	145	67	38	93	121	78
KFW-35-5107	160	122	37	98	118	80
KFW-35-5107	151	92	38	95	125	73
KFW-35-5107	142	86	32	93	104	69
KFW-35-5107	132	57	33	87	102	59
KFW-35-5107	146	69	37	95	114	73
KFW-35-5107	142	59	40	89	118	65
LBT-66-9014	203	219	28	131	106	108
LBT-66-9014	199	255	25	123	108	105
LBT-66-9014	226	210	30	153	116	120
LBT-66-9014	248	232	32	170	119	129
LBT-66-9014	195	251	28	116	112	109
LBT-66-9014	180	158	29	119	109	97

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	TC	TG	HDL	LDL	ApoA1	ApoB
LCF-94-1044	141	65	15	112	110	103
LCF-94-1044	110	45	25	75	108	102
LCF-94-1044	217	69	19	184	110	107
LCF-94-1044	193	152	22	140	124	117
LCF-94-1044	126	51	28	87	115	102
LCF-94-1044	188	129	33	129	123	109
LCO-51-7401	150	145	24	97	96	94
LCO-51-7401	145	82	28	100	88	95
LCO-51-7401	155	91	26	110	99	94
LCO-51-7401	153	97	25	108	96	93
LCO-51-7401	150	91	24	108	91	93
LCO-51-7401	169	83	29	123	101	101
LJC-76-4231	193	100	36	137	111	101
LJC-76-4231	197	135	38	131	127	107
LJC-76-4231	202	106	41	140	123	110
LJC-76-4231	172	79	42	113	115	106
LJC-76-4231	218	94	46	152	133	111
LJC-76-4231	232	89	48	166	139	115
MJB-02-2375	156	54	31	114	115	87
MJB-02-2375	155	50	29	116	114	84
MJB-02-2375	156	79	31	109	113	89
MJB-02-2375	147	58	30	106	109	81
MJB-02-2375	144	65	31	99	106	85
MJB-02-2375	147	77	30	102	106	83
MLL-68-3135	167	77	57	94	137	70
MLL-68-3135	182	51	64	107	158	79
MLL-68-3135	192	62	64	115	152	80
MLL-68-3135	154	42	66	80	144	69
MLL-68-3135	171	60	58	100	138	71
MLL-68-3135	148	48	55	84	131	59
MLS-82-5875	202	392	27	96	117	70
MLS-82-5875	212	323	27	120	117	72
MLS-82-5875	229	359	40	117	121	76
MLS-82-5875	241	409	30	129	117	80
MLS-82-5875	223	370	27	121	113	81
MLS-82-5875	219	348	34	115	114	79
MWB-82-6035	186	46	33	143	115	117
MWB-82-6035	200	50	33	157	110	126
MWB-82-6035	189	56	35	142	118	118
MWB-82-6035	189	56	36	142	113	116
MWB-82-6035	186	57	38	137	107	109
MWB-82-6035	183	58	34	137	109	112
PJB-43-3639	149	97	32	97	99	79
PJB-43-3639	143	79	31	96	95	74
PJB-43-3639	159	77	35	108	104	79
PJB-43-3639	126	71	32	79	87	64
PJB-43-3639	185	72	41	129	113	89
PJB-43-3639	172	50	42	120	110	81
PJD-13-4775	155	80	29	110	96	88
PJD-13-4775	156	70	29	112	96	88
PJD-13-4775	137	44	26	102	85	76
PJD-13-4775	148	41	30	110	89	81
PJD-13-4775	138	52	26	102	87	77
PJD-13-4775	130	49	27	93	81	72
R_D-70-0888	179	53	45	123	138	84
R_D-70-0888	158	35	45	106	121	73
R_D-70-0888	160	50	49	100	133	71
R_D-70-0888	161	38	45	108	123	73
R_D-70-0888	147	50	57	80	148	57
R_D-70-0888	171	105	50	100	147	77
R_G-92-3746	119	144	21	68	83	71
R_G-92-3746	127	88	26	83	89	69
R_G-92-3746	135	118	30	81	114	73
R_G-92-3746	139	217	28	67	113	74
R_G-92-3746	161	141	32	100	118	88
R_G-92-3746	146	255	31	64	114	75
R_M-92-9942	160	49	42	108	127	74
R_M-92-9942	161	47	44	108	129	75
R_M-92-9942	156	77	37	103	119	76
R_M-92-9942	149	51	40	98	118	70
R_M-92-9942	157	62	40	105	119	75
R_M-92-9942	164	62	41	110	120	75
RAS-47-7434	218	67	43	161	124	115
RAS-47-7434	203	56	45	146	125	105
RAS-47-7434	167	83	40	110	118	88
RAS-47-7434	198	83	41	140	123	105
RAS-47-7434	200	51	48	141	130	99
RAS-47-7434	194	53	43	140	123	98
RAW-58-9624	188	73	32	141	114	99
RAW-58-9624	189	70	34	141	116	100
RAW-58-9624	198	62	37	148	131	105
RAW-58-9624	198	54	38	149	128	106
RAW-58-9624	162	40	33	121	113	91
RAW-58-9624	160	50	33	116	116	88
RDS-94-2909	151	77	29	106	102	81
RDS-94-2909	160	86	26	116	116	88
RDS-94-2909	159	67	36	109	118	81
RDS-94-2909	152	37	38	107	122	78
RDS-94-2909	182	126	34	122	124	102
RDS-94-2909	163	98	32	111	110	87
REJ-42-1333	207	143	25	153	94	93
REJ-42-1333	186	125	24	137	112	109
REJ-42-1333	198	97	31	147	144	139
REJ-42-1333	165	68	28	94	138	132
REJ-42-1333	168	83	33	118	97	107
REJ-42-1333	191	102	30	140	104	110
RLB-90-6883	214	136	39	148	128	124
RLB-90-6883	208	159	37	139	125	121
RLB-90-6883	196	81	40	140	121	114
RLB-90-6883	196	88	39	139	119	114
RLB-90-6883	173	108	41	110	121	94
RLB-90-6883	161	73	42	104	118	85
RPM-35-9363	161	32	32	122	109	90
RPM-35-9363	155	30	31	118	103	90
RPM-35-9363	153	46	27	116	97	90
RPM-35-9363	151	44	25	117	98	91
RPM-35-9363	122	38	33	81	95	84
RPM-35-9363	130	54	24	95	91	78
SAD-00-8872	176	73	43	118	129	89
SAD-00-8872	155	45	41	105	122	78
SAD-00-8872	164	56	41	111	127	83
SAD-00-8872	156	42	47	100	124	76
SAD-00-8872	199	63	48	138	131	101
SAD-00-8872	194	77	45	133	134	99

APPENDIX E
RAW LDL SIZE AND LIPID DATA FOR CHAPTER 5

SubjectID	TC	TG	HDL	LDL	ApoA1	ApoB
SCM-35-5124	214	87	38	158	116	117
SCM-35-5124	185	84	35	133	105	98
SCM-35-5124	219	81	41	161	120	112
SCM-35-5124	219	114	40	156	116	115
SCM-35-5124	193	95	31	142	99	106
SCM-35-5124	189	124	32	132	98	104
SGC-98-6374	152	55	42	99	118	78
SGC-98-6374	134	46	38	87	109	67
SGC-98-6374	130	53	40	79	112	63
SGC-98-6374	120	70	31	75	100	69
SGC-98-6374	156	50	46	100	124	75
SGC-98-6374	141	43	43	89	118	68
SHS-48-1211	211	280	24	131	91	123
SHS-48-1211	205	292	23	124	92	119
SHS-48-1211	227	325	25	136	96	132
SHS-48-1211	196	292	22	115	90	114
SHS-48-1211	221	222	28	148	102	131
SHS-48-1211	202	209	27	132	96	117
SPH-53-4229	170	65	36	121	113	86
SPH-53-4229	166	49	35	121	111	85
SPH-53-4229	156	59	34	110	108	83
SPH-53-4229	144	54	31	101	102	77
SPH-53-4229	154	54	33	110	111	81
SPH-53-4229	141	51	32	98	107	74
SRC-74-4595	211	113	30	158	104	127
SRC-74-4595	191	104	29	141	108	117
SRC-74-4595	212	144	33	150	115	126
SRC-74-4595	195	163	33	129	117	118
SRC-74-4595	209	134	37	145	122	119
SRC-74-4595	207	107	38	147	123	124
TLM-74-2189	181	88	42	121	158	109
TLM-74-2189	159	70	41	104	150	95
TLM-74-2189	174	151	38	106	129	91
TLM-74-2189	189	130	38	124	130	101
TLM-74-2189	201	100	48	133	144	108
TLM-74-2189	192	91	35	138	134	106
TWB-57-9837	174	207	32	100	125	67
TWB-57-9837	162	206	33	87	125	64
TWB-57-9837	169	241	31	89	121	64
TWB-57-9837	158	240	30	80	125	60
TWB-57-9837	159	191	38	83	135	57
TWB-57-9837	166	188	37	91	135	61
V_S-06-8525	167	247	31	87	109	84
V_S-06-8525	175	340	29	78	114	85
V_S-06-8525	178	202	34	103	118	94
V_S-06-8525	177	178	34	107	116	92
V_S-06-8525	180	259	33	95	116	90
V_S-06-8525	174	279	32	86	118	89
W_H-56-8407	206	114	36	146	112	115
W_H-56-8407	200	116	39	138	117	114
W_H-56-8407	212	104	37	154	116	115
W_H-56-8407	225	107	43	160	133	125
W_H-56-8407	204	75	38	151	114	116
W_H-56-8407	215	165	37	145	115	120
WHS-67-7302	130	27	54	70	130	50
WHS-67-7302	137	30	63	67	132	50
WHS-67-7302	138	25	55	78	138	55
WHS-67-7302	139	25	60	73	138	54
WHS-67-7302	154	28	61	88	143	55
WHS-67-7302	151	32	57	87	133	60
WJP-80-2929	223	447	27	107	114	76
WJP-80-2929	204	181	31	137	108	84
WJP-80-2929	206	372	32	99	111	72
WJP-80-2929	223	343	29	125	112	82
WJP-80-2929	183	227	32	105	113	67
WJP-80-2929	225	160	34	159	119	89
Y_S-85-4659	234	130	56	151	136	110
Y_S-85-4659	260	94	60	181	142	122
Y_S-85-4659	233	105	62	150	139	108
Y_S-85-4659	213	108	54	137	128	101
Y_S-85-4659	286	108	64	200	145	134
Y_S-85-4659	279	118	63	192	144	126

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2bML	HDL2aML	HDL3aML	HDL3bML	HDL3cML	HDL2bLT	HDL2aLT	HDL3aLT	HDL3bLT	HDL3cLT
BCF-41-4745	23.72	16.65	21.23	16.96	21.44	41.39	21.85	16.61	10.34	9.80
BCF-41-4745	23.72	16.65	21.23	16.96	21.44	41.39	21.85	16.61	10.34	9.80
BCF-41-4745	23.72	16.65	21.23	16.96	21.44	41.39	21.85	16.61	10.34	9.80
BCF-41-4745	23.72	16.65	21.23	16.96	21.44	41.39	21.85	16.61	10.34	9.80
BCF-41-4745	23.72	16.65	21.23	16.96	21.44	41.39	21.85	16.61	10.34	9.80
BCF-41-4745	23.72	16.65	21.23	16.96	21.44	41.39	21.85	16.61	10.34	9.80
BCG-70-6783	34.41	21.04	17.40	12.74	14.41	49.75	22.81	13.97	7.56	5.90
BCG-70-6783	34.41	21.04	17.40	12.74	14.41	49.75	22.81	13.97	7.56	5.90
BCG-70-6783	34.41	21.04	17.40	12.74	14.41	49.75	22.81	13.97	7.56	5.90
BCG-70-6783	34.41	21.04	17.40	12.74	14.41	49.75	22.81	13.97	7.56	5.90
BCG-70-6783	34.41	21.04	17.40	12.74	14.41	49.75	22.81	13.97	7.56	5.90
BCG-70-6783	34.41	21.04	17.40	12.74	14.41	49.75	22.81	13.97	7.56	5.90
BJC-82-7657	24.52	14.43	19.72	17.20	24.14	49.11	20.43	14.63	7.83	7.99
BJC-82-7657	24.52	14.43	19.72	17.20	24.14	49.11	20.43	14.63	7.83	7.99
BJC-82-7657	24.52	14.43	19.72	17.20	24.14	49.11	20.43	14.63	7.83	7.99
BJC-82-7657	24.52	14.43	19.72	17.20	24.14	49.11	20.43	14.63	7.83	7.99
BJC-82-7657	24.52	14.43	19.72	17.20	24.14	49.11	20.43	14.63	7.83	7.99
BJC-82-7657	24.52	14.43	19.72	17.20	24.14	49.11	20.43	14.63	7.83	7.99
BLB-39-5161	43.08	27.97	21.40	6.47	1.08	63.25	22.01	10.96	3.42	0.35
BLB-39-5161	43.08	27.97	21.40	6.47	1.08	63.25	22.01	10.96	3.42	0.35
BLB-39-5161	43.08	27.97	21.40	6.47	1.08	63.25	22.01	10.96	3.42	0.35
BLB-39-5161	43.08	27.97	21.40	6.47	1.08	63.25	22.01	10.96	3.42	0.35
BLB-39-5161	43.08	27.97	21.40	6.47	1.08	63.25	22.01	10.96	3.42	0.35
BLB-39-5161	43.08	27.97	21.40	6.47	1.08	63.25	22.01	10.96	3.42	0.35
BLM-37-2312	20.54	15.75	20.99	20.52	22.20	38.34	22.83	18.54	11.42	8.87
BLM-37-2312	20.54	15.75	20.99	20.52	22.20	38.34	22.83	18.54	11.42	8.87
BLM-37-2312	20.54	15.75	20.99	20.52	22.20	38.34	22.83	18.54	11.42	8.87
BLM-37-2312	20.54	15.75	20.99	20.52	22.20	38.34	22.83	18.54	11.42	8.87
BLM-37-2312	20.54	15.75	20.99	20.52	22.20	38.34	22.83	18.54	11.42	8.87
BLM-37-2312	20.54	15.75	20.99	20.52	22.20	38.34	22.83	18.54	11.42	8.87
BMB-53-1389	8.57	12.17	12.90	17.70	48.65	45.23	20.36	14.26	10.11	10.05
BMB-53-1389	8.57	12.17	12.90	17.70	48.65	45.23	20.36	14.26	10.11	10.05
BMB-53-1389	8.57	12.17	12.90	17.70	48.65	45.23	20.36	14.26	10.11	10.05
BMB-53-1389	8.57	12.17	12.90	17.70	48.65	45.23	20.36	14.26	10.11	10.05
BMB-53-1389	8.57	12.17	12.90	17.70	48.65	45.23	20.36	14.26	10.11	10.05
BMB-53-1389	8.57	12.17	12.90	17.70	48.65	45.23	20.36	14.26	10.11	10.05
BPF-52-8789	26.18	22.71	21.34	13.27	16.50	43.17	25.85	17.52	7.14	6.33
BPF-52-8789	26.18	22.71	21.34	13.27	16.50	43.17	25.85	17.52	7.14	6.33
BPF-52-8789	26.18	22.71	21.34	13.27	16.50	43.17	25.85	17.52	7.14	6.33
BPF-52-8789	26.18	22.71	21.34	13.27	16.50	43.17	25.85	17.52	7.14	6.33
BPF-52-8789	26.18	22.71	21.34	13.27	16.50	43.17	25.85	17.52	7.14	6.33
BPF-52-8789	26.18	22.71	21.34	13.27	16.50	43.17	25.85	17.52	7.14	6.33
CAV-29-4434	22.15	15.16	21.10	19.82	21.76	45.11	22.16	17.33	9.17	6.23
CAV-29-4434	22.15	15.16	21.10	19.82	21.76	45.11	22.16	17.33	9.17	6.23
CAV-29-4434	22.15	15.16	21.10	19.82	21.76	45.11	22.16	17.33	9.17	6.23
CAV-29-4434	22.15	15.16	21.10	19.82	21.76	45.11	22.16	17.33	9.17	6.23
CAV-29-4434	22.15	15.16	21.10	19.82	21.76	45.11	22.16	17.33	9.17	6.23
CAV-29-4434	22.15	15.16	21.10	19.82	21.76	45.11	22.16	17.33	9.17	6.23
CMB-61-1861	26.33	20.21	20.87	16.76	15.83	45.55	22.90	16.78	7.98	6.79
CMB-61-1861	26.33	20.21	20.87	16.76	15.83	45.55	22.90	16.78	7.98	6.79
CMB-61-1861	26.33	20.21	20.87	16.76	15.83	45.55	22.90	16.78	7.98	6.79
CMB-61-1861	26.33	20.21	20.87	16.76	15.83	45.55	22.90	16.78	7.98	6.79
CMB-61-1861	26.33	20.21	20.87	16.76	15.83	45.55	22.90	16.78	7.98	6.79
CMB-61-1861	26.33	20.21	20.87	16.76	15.83	45.55	22.90	16.78	7.98	6.79
CRR-37-3333	15.25	7.47	12.63	28.17	36.48	34.36	21.70	20.18	14.21	9.54
CRR-37-3333	15.25	7.47	12.63	28.17	36.48	34.36	21.70	20.18	14.21	9.54
CRR-37-3333	15.25	7.47	12.63	28.17	36.48	34.36	21.70	20.18	14.21	9.54
CRR-37-3333	15.25	7.47	12.63	28.17	36.48	34.36	21.70	20.18	14.21	9.54
CRR-37-3333	15.25	7.47	12.63	28.17	36.48	34.36	21.70	20.18	14.21	9.54
CRR-37-3333	15.25	7.47	12.63	28.17	36.48	34.36	21.70	20.18	14.21	9.54
D_H-92-6569	21.65	21.96	23.39	13.58	19.42	46.11	24.68	18.74	7.75	2.71
D_H-92-6569	21.65	21.96	23.39	13.58	19.42	46.11	24.68	18.74	7.75	2.71
D_H-92-6569	21.65	21.96	23.39	13.58	19.42	46.11	24.68	18.74	7.75	2.71
D_H-92-6569	21.65	21.96	23.39	13.58	19.42	46.11	24.68	18.74	7.75	2.71
D_H-92-6569	21.65	21.96	23.39	13.58	19.42	46.11	24.68	18.74	7.75	2.71
D_H-92-6569	21.65	21.96	23.39	13.58	19.42	46.11	24.68	18.74	7.75	2.71
D_L-89-7473	28.11	18.33	18.47	15.90	19.19	43.82	23.67	16.37	8.03	8.11
D_L-89-7473	28.11	18.33	18.47	15.90	19.19	43.82	23.67	16.37	8.03	8.11
D_L-89-7473	28.11	18.33	18.47	15.90	19.19	43.82	23.67	16.37	8.03	8.11
D_L-89-7473	28.11	18.33	18.47	15.90	19.19	43.82	23.67	16.37	8.03	8.11
D_L-89-7473	28.11	18.33	18.47	15.90	19.19	43.82	23.67	16.37	8.03	8.11
D_L-89-7473	28.11	18.33	18.47	15.90	19.19	43.82	23.67	16.37	8.03	8.11

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2bML	HDL2aML	HDL3aML	HDL3bML	HDL3cML	HDL2bLT	HDL2aLT	HDL3aLT	HDL3bLT	HDL3cLT
DCS-04-4041	29.75	21.30	21.57	14.92	12.46	48.77	22.65	15.32	6.90	6.36
DCS-04-4041	29.75	21.30	21.57	14.92	12.46	48.77	22.65	15.32	6.90	6.36
DCS-04-4041	29.75	21.30	21.57	14.92	12.46	48.77	22.65	15.32	6.90	6.36
DCS-04-4041	29.75	21.30	21.57	14.92	12.46	48.77	22.65	15.32	6.90	6.36
DCS-04-4041	29.75	21.30	21.57	14.92	12.46	48.77	22.65	15.32	6.90	6.36
DCS-04-4041	29.75	21.30	21.57	14.92	12.46	48.77	22.65	15.32	6.90	6.36
DDD-35-0736	19.34	16.32	21.66	24.13	18.55	37.54	22.47	17.01	10.97	12.01
DDD-35-0736	19.34	16.32	21.66	24.13	18.55	37.54	22.47	17.01	10.97	12.01
DDD-35-0736	19.34	16.32	21.66	24.13	18.55	37.54	22.47	17.01	10.97	12.01
DDD-35-0736	19.34	16.32	21.66	24.13	18.55	37.54	22.47	17.01	10.97	12.01
DDD-35-0736	19.34	16.32	21.66	24.13	18.55	37.54	22.47	17.01	10.97	12.01
DDD-35-0736	19.34	16.32	21.66	24.13	18.55	37.54	22.47	17.01	10.97	12.01
DDW-27-1270	15.36	12.33	12.94	16.73	42.64	45.08	19.51	14.24	10.32	10.86
DDW-27-1270	15.36	12.33	12.94	16.73	42.64	45.08	19.51	14.24	10.32	10.86
DDW-27-1270	15.36	12.33	12.94	16.73	42.64	45.08	19.51	14.24	10.32	10.86
DDW-27-1270	15.36	12.33	12.94	16.73	42.64	45.08	19.51	14.24	10.32	10.86
DDW-27-1270	15.36	12.33	12.94	16.73	42.64	45.08	19.51	14.24	10.32	10.86
DDW-27-1270	15.36	12.33	12.94	16.73	42.64	45.08	19.51	14.24	10.32	10.86
DJS-29-7999	20.73	15.34	25.33	20.27	18.33	47.67	22.60	17.37	10.23	2.14
DJS-29-7999	20.73	15.34	25.33	20.27	18.33	47.67	22.60	17.37	10.23	2.14
DJS-29-7999	20.73	15.34	25.33	20.27	18.33	47.67	22.60	17.37	10.23	2.14
DJS-29-7999	20.73	15.34	25.33	20.27	18.33	47.67	22.60	17.37	10.23	2.14
DJS-29-7999	20.73	15.34	25.33	20.27	18.33	47.67	22.60	17.37	10.23	2.14
DJS-29-7999	20.73	15.34	25.33	20.27	18.33	47.67	22.60	17.37	10.23	2.14
DLC-08-2664	27.68	15.68	19.31	14.16	23.18	47.47	21.27	14.90	8.86	7.50
DLC-08-2664	27.68	15.68	19.31	14.16	23.18	47.47	21.27	14.90	8.86	7.50
DLC-08-2664	27.68	15.68	19.31	14.16	23.18	47.47	21.27	14.90	8.86	7.50
DLC-08-2664	27.68	15.68	19.31	14.16	23.18	47.47	21.27	14.90	8.86	7.50
DLC-08-2664	27.68	15.68	19.31	14.16	23.18	47.47	21.27	14.90	8.86	7.50
DLC-08-2664	27.68	15.68	19.31	14.16	23.18	47.47	21.27	14.90	8.86	7.50
DPB-64-7804	15.44	10.77	23.27	21.09	29.44	40.82	19.99	17.90	12.55	8.75
DPB-64-7804	15.44	10.77	23.27	21.09	29.44	40.82	19.99	17.90	12.55	8.75
DPB-64-7804	15.44	10.77	23.27	21.09	29.44	40.82	19.99	17.90	12.55	8.75
DPB-64-7804	15.44	10.77	23.27	21.09	29.44	40.82	19.99	17.90	12.55	8.75
DPB-64-7804	15.44	10.77	23.27	21.09	29.44	40.82	19.99	17.90	12.55	8.75
DPB-64-7804	15.44	10.77	23.27	21.09	29.44	40.82	19.99	17.90	12.55	8.75
DRF-37-5270	29.75	15.97	18.46	16.24	19.58	45.59	20.72	15.12	8.63	9.95
DRF-37-5270	29.75	15.97	18.46	16.24	19.58	45.59	20.72	15.12	8.63	9.95
DRF-37-5270	29.75	15.97	18.46	16.24	19.58	45.59	20.72	15.12	8.63	9.95
DRF-37-5270	29.75	15.97	18.46	16.24	19.58	45.59	20.72	15.12	8.63	9.95
DRF-37-5270	29.75	15.97	18.46	16.24	19.58	45.59	20.72	15.12	8.63	9.95
DRF-37-5270	29.75	15.97	18.46	16.24	19.58	45.59	20.72	15.12	8.63	9.95
DWS-98-8742	26.25	19.03	21.62	16.31	16.78	41.26	22.87	16.65	9.13	10.09
DWS-98-8742	26.25	19.03	21.62	16.31	16.78	41.26	22.87	16.65	9.13	10.09
DWS-98-8742	26.25	19.03	21.62	16.31	16.78	41.26	22.87	16.65	9.13	10.09
DWS-98-8742	26.25	19.03	21.62	16.31	16.78	41.26	22.87	16.65	9.13	10.09
DWS-98-8742	26.25	19.03	21.62	16.31	16.78	41.26	22.87	16.65	9.13	10.09
DWS-98-8742	26.25	19.03	21.62	16.31	16.78	41.26	22.87	16.65	9.13	10.09
DYN-54-3286	25.32	18.84	21.51	18.33	16.00	47.55	23.02	15.64	7.50	6.29
DYN-54-3286	25.32	18.84	21.51	18.33	16.00	47.55	23.02	15.64	7.50	6.29
DYN-54-3286	25.32	18.84	21.51	18.33	16.00	47.55	23.02	15.64	7.50	6.29
DYN-54-3286	25.32	18.84	21.51	18.33	16.00	47.55	23.02	15.64	7.50	6.29
DYN-54-3286	25.32	18.84	21.51	18.33	16.00	47.55	23.02	15.64	7.50	6.29
DYN-54-3286	25.32	18.84	21.51	18.33	16.00	47.55	23.02	15.64	7.50	6.29
EAB-57-9471	22.77	20.53	23.09	18.01	15.60	46.20	24.72	16.97	7.55	4.55
EAB-57-9471	22.77	20.53	23.09	18.01	15.60	46.20	24.72	16.97	7.55	4.55
EAB-57-9471	22.77	20.53	23.09	18.01	15.60	46.20	24.72	16.97	7.55	4.55
EAB-57-9471	22.77	20.53	23.09	18.01	15.60	46.20	24.72	16.97	7.55	4.55
EAB-57-9471	22.77	20.53	23.09	18.01	15.60	46.20	24.72	16.97	7.55	4.55
EAB-57-9471	22.77	20.53	23.09	18.01	15.60	46.20	24.72	16.97	7.55	4.55
ECG-56-8967	16.91	16.90	23.17	20.04	22.98	43.49	22.49	16.17	8.71	9.13
ECG-56-8967	16.91	16.90	23.17	20.04	22.98	43.49	22.49	16.17	8.71	9.13
ECG-56-8967	16.91	16.90	23.17	20.04	22.98	43.49	22.49	16.17	8.71	9.13
ECG-56-8967	16.91	16.90	23.17	20.04	22.98	43.49	22.49	16.17	8.71	9.13
ECG-56-8967	16.91	16.90	23.17	20.04	22.98	43.49	22.49	16.17	8.71	9.13
ECG-56-8967	16.91	16.90	23.17	20.04	22.98	43.49	22.49	16.17	8.71	9.13
F_S-82-1006	24.95	15.69	18.66	18.60	22.11	41.76	21.25	17.20	10.99	8.80
F_S-82-1006	24.95	15.69	18.66	18.60	22.11	41.76	21.25	17.20	10.99	8.80
F_S-82-1006	24.95	15.69	18.66	18.60	22.11	41.76	21.25	17.20	10.99	8.80
F_S-82-1006	24.95	15.69	18.66	18.60	22.11	41.76	21.25	17.20	10.99	8.80
F_S-82-1006	24.95	15.69	18.66	18.60	22.11	41.76	21.25	17.20	10.99	8.80
F_S-82-1006	24.95	15.69	18.66	18.60	22.11	41.76	21.25	17.20	10.99	8.80

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2bML	HDL2aML	HDL3aML	HDL3bML	HDL3cML	HDL2bLT	HDL2aLT	HDL3aLT	HDL3bLT	HDL3cLT
G_J-62-5517	24.39	17.61	21.34	17.92	18.73	41.32	22.93	19.21	10.61	5.93
G_J-62-5517	24.39	17.61	21.34	17.92	18.73	41.32	22.93	19.21	10.61	5.93
G_J-62-5517	24.39	17.61	21.34	17.92	18.73	41.32	22.93	19.21	10.61	5.93
G_J-62-5517	24.39	17.61	21.34	17.92	18.73	41.32	22.93	19.21	10.61	5.93
G_J-62-5517	24.39	17.61	21.34	17.92	18.73	41.32	22.93	19.21	10.61	5.93
G_J-62-5517	24.39	17.61	21.34	17.92	18.73	41.32	22.93	19.21	10.61	5.93
GAH-13-6357	22.18	15.77	22.30	15.63	24.12	43.30	20.81	16.93	9.61	9.34
GAH-13-6357	22.18	15.77	22.30	15.63	24.12	43.30	20.81	16.93	9.61	9.34
GAH-13-6357	22.18	15.77	22.30	15.63	24.12	43.30	20.81	16.93	9.61	9.34
GAH-13-6357	22.18	15.77	22.30	15.63	24.12	43.30	20.81	16.93	9.61	9.34
GAH-13-6357	22.18	15.77	22.30	15.63	24.12	43.30	20.81	16.93	9.61	9.34
GAH-13-6357	22.18	15.77	22.30	15.63	24.12	43.30	20.81	16.93	9.61	9.34
GLG-27-2176	30.27	18.65	20.04	14.88	16.16	53.08	21.85	13.54	5.79	5.74
GLG-27-2176	30.27	18.65	20.04	14.88	16.16	53.08	21.85	13.54	5.79	5.74
GLG-27-2176	30.27	18.65	20.04	14.88	16.16	53.08	21.85	13.54	5.79	5.74
GLG-27-2176	30.27	18.65	20.04	14.88	16.16	53.08	21.85	13.54	5.79	5.74
GLG-27-2176	30.27	18.65	20.04	14.88	16.16	53.08	21.85	13.54	5.79	5.74
GLG-27-2176	30.27	18.65	20.04	14.88	16.16	53.08	21.85	13.54	5.79	5.74
GML-84-1785	23.80	16.68	21.27	16.39	21.85	41.38	21.15	17.09	9.78	10.60
GML-84-1785	23.80	16.68	21.27	16.39	21.85	41.38	21.15	17.09	9.78	10.60
GML-84-1785	23.80	16.68	21.27	16.39	21.85	41.38	21.15	17.09	9.78	10.60
GML-84-1785	23.80	16.68	21.27	16.39	21.85	41.38	21.15	17.09	9.78	10.60
GML-84-1785	23.80	16.68	21.27	16.39	21.85	41.38	21.15	17.09	9.78	10.60
GML-84-1785	23.80	16.68	21.27	16.39	21.85	41.38	21.15	17.09	9.78	10.60
GOB-90-9808	23.99	15.43	18.79	17.27	24.51	46.97	25.42	17.07	6.59	3.95
GOB-90-9808	23.99	15.43	18.79	17.27	24.51	46.97	25.42	17.07	6.59	3.95
GOB-90-9808	23.99	15.43	18.79	17.27	24.51	46.97	25.42	17.07	6.59	3.95
GOB-90-9808	23.99	15.43	18.79	17.27	24.51	46.97	25.42	17.07	6.59	3.95
GOB-90-9808	23.99	15.43	18.79	17.27	24.51	46.97	25.42	17.07	6.59	3.95
GOB-90-9808	23.99	15.43	18.79	17.27	24.51	46.97	25.42	17.07	6.59	3.95
GWA-98-6492	22.13	19.47	23.66	17.81	16.92	39.10	21.35	18.40	11.14	10.00
GWA-98-6492	22.13	19.47	23.66	17.81	16.92	39.10	21.35	18.40	11.14	10.00
GWA-98-6492	22.13	19.47	23.66	17.81	16.92	39.10	21.35	18.40	11.14	10.00
GWA-98-6492	22.13	19.47	23.66	17.81	16.92	39.10	21.35	18.40	11.14	10.00
GWA-98-6492	22.13	19.47	23.66	17.81	16.92	39.10	21.35	18.40	11.14	10.00
GWA-98-6492	22.13	19.47	23.66	17.81	16.92	39.10	21.35	18.40	11.14	10.00
H_J-32-0201	18.84	13.98	18.63	21.70	26.84	38.08	21.06	17.91	11.79	11.16
H_J-32-0201	18.84	13.98	18.63	21.70	26.84	38.08	21.06	17.91	11.79	11.16
H_J-32-0201	18.84	13.98	18.63	21.70	26.84	38.08	21.06	17.91	11.79	11.16
H_J-32-0201	18.84	13.98	18.63	21.70	26.84	38.08	21.06	17.91	11.79	11.16
H_J-32-0201	18.84	13.98	18.63	21.70	26.84	38.08	21.06	17.91	11.79	11.16
H_J-32-0201	18.84	13.98	18.63	21.70	26.84	38.08	21.06	17.91	11.79	11.16
HPB-70-2696	23.81	16.31	19.60	15.23	25.05	42.11	19.82	16.49	9.69	11.89
HPB-70-2696	23.81	16.31	19.60	15.23	25.05	42.11	19.82	16.49	9.69	11.89
HPB-70-2696	23.81	16.31	19.60	15.23	25.05	42.11	19.82	16.49	9.69	11.89
HPB-70-2696	23.81	16.31	19.60	15.23	25.05	42.11	19.82	16.49	9.69	11.89
HPB-70-2696	23.81	16.31	19.60	15.23	25.05	42.11	19.82	16.49	9.69	11.89
HPB-70-2696	23.81	16.31	19.60	15.23	25.05	42.11	19.82	16.49	9.69	11.89
IGH-88-3817	30.41	15.53	16.33	17.29	20.44	42.20	20.51	18.81	11.14	7.34
IGH-88-3817	30.41	15.53	16.33	17.29	20.44	42.20	20.51	18.81	11.14	7.34
IGH-88-3817	30.41	15.53	16.33	17.29	20.44	42.20	20.51	18.81	11.14	7.34
IGH-88-3817	30.41	15.53	16.33	17.29	20.44	42.20	20.51	18.81	11.14	7.34
IGH-88-3817	30.41	15.53	16.33	17.29	20.44	42.20	20.51	18.81	11.14	7.34
IGH-88-3817	30.41	15.53	16.33	17.29	20.44	42.20	20.51	18.81	11.14	7.34
JAB-37-6390	25.96	16.44	21.67	17.34	18.59	42.33	25.67	18.29	8.66	5.05
JAB-37-6390	25.96	16.44	21.67	17.34	18.59	42.33	25.67	18.29	8.66	5.05
JAB-37-6390	25.96	16.44	21.67	17.34	18.59	42.33	25.67	18.29	8.66	5.05
JAB-37-6390	25.96	16.44	21.67	17.34	18.59	42.33	25.67	18.29	8.66	5.05
JAB-37-6390	25.96	16.44	21.67	17.34	18.59	42.33	25.67	18.29	8.66	5.05
JAB-37-6390	25.96	16.44	21.67	17.34	18.59	42.33	25.67	18.29	8.66	5.05
JAB-72-0488	25.94	19.93	24.60	17.76	11.77	49.47	23.32	14.76	6.81	5.64
JAB-72-0488	25.94	19.93	24.60	17.76	11.77	49.47	23.32	14.76	6.81	5.64
JAB-72-0488	25.94	19.93	24.60	17.76	11.77	49.47	23.32	14.76	6.81	5.64
JAB-72-0488	25.94	19.93	24.60	17.76	11.77	49.47	23.32	14.76	6.81	5.64
JAB-72-0488	25.94	19.93	24.60	17.76	11.77	49.47	23.32	14.76	6.81	5.64
JAB-72-0488	25.94	19.93	24.60	17.76	11.77	49.47	23.32	14.76	6.81	5.64
JAD-52-9560	26.32	21.24	21.07	16.75	14.62	41.84	20.32	16.36	10.56	10.91
JAD-52-9560	26.32	21.24	21.07	16.75	14.62	41.84	20.32	16.36	10.56	10.91
JAD-52-9560	26.32	21.24	21.07	16.75	14.62	41.84	20.32	16.36	10.56	10.91
JAD-52-9560	26.32	21.24	21.07	16.75	14.62	41.84	20.32	16.36	10.56	10.91
JAD-52-9560	26.32	21.24	21.07	16.75	14.62	41.84	20.32	16.36	10.56	10.91
JAD-52-9560	26.32	21.24	21.07	16.75	14.62	41.84	20.32	16.36	10.56	10.91

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2bML	HDL2aML	HDL3aML	HDL3bML	HDL3cML	HDL2bLT	HDL2aLT	HDL3aLT	HDL3bLT	HDL3cLT
JAL-68-1009	24.73	17.38	21.06	17.63	19.19	42.41	22.23	15.79	9.26	10.31
JAL-68-1009	24.73	17.38	21.06	17.63	19.19	42.41	22.23	15.79	9.26	10.31
JAL-68-1009	24.73	17.38	21.06	17.63	19.19	42.41	22.23	15.79	9.26	10.31
JAL-68-1009	24.73	17.38	21.06	17.63	19.19	42.41	22.23	15.79	9.26	10.31
JAL-68-1009	24.73	17.38	21.06	17.63	19.19	42.41	22.23	15.79	9.26	10.31
JAL-68-1009	24.73	17.38	21.06	17.63	19.19	42.41	22.23	15.79	9.26	10.31
JAM-68-6945	25.23	16.58	19.51	17.53	21.14	45.38	21.64	14.82	9.51	8.66
JAM-68-6945	25.23	16.58	19.51	17.53	21.14	45.38	21.64	14.82	9.51	8.66
JAM-68-6945	25.23	16.58	19.51	17.53	21.14	45.38	21.64	14.82	9.51	8.66
JAM-68-6945	25.23	16.58	19.51	17.53	21.14	45.38	21.64	14.82	9.51	8.66
JAM-68-6945	25.23	16.58	19.51	17.53	21.14	45.38	21.64	14.82	9.51	8.66
JAM-68-6945	25.23	16.58	19.51	17.53	21.14	45.38	21.64	14.82	9.51	8.66
JBG-37-0774	26.48	16.80	20.96	15.28	20.48	44.14	21.76	17.35	8.65	8.10
JBG-37-0774	26.48	16.80	20.96	15.28	20.48	44.14	21.76	17.35	8.65	8.10
JBG-37-0774	26.48	16.80	20.96	15.28	20.48	44.14	21.76	17.35	8.65	8.10
JBG-37-0774	26.48	16.80	20.96	15.28	20.48	44.14	21.76	17.35	8.65	8.10
JBG-37-0774	26.48	16.80	20.96	15.28	20.48	44.14	21.76	17.35	8.65	8.10
JBG-37-0774	26.48	16.80	20.96	15.28	20.48	44.14	21.76	17.35	8.65	8.10
JBT-31-2471	34.92	22.08	19.43	12.76	10.81	48.89	21.47	14.93	8.41	6.31
JBT-31-2471	34.92	22.08	19.43	12.76	10.81	48.89	21.47	14.93	8.41	6.31
JBT-31-2471	34.92	22.08	19.43	12.76	10.81	48.89	21.47	14.93	8.41	6.31
JBT-31-2471	34.92	22.08	19.43	12.76	10.81	48.89	21.47	14.93	8.41	6.31
JBT-31-2471	34.92	22.08	19.43	12.76	10.81	48.89	21.47	14.93	8.41	6.31
JBT-31-2471	34.92	22.08	19.43	12.76	10.81	48.89	21.47	14.93	8.41	6.31
JCK-90-6103	21.89	16.58	20.88	16.39	24.26	39.58	21.20	18.26	11.14	9.82
JCK-90-6103	21.89	16.58	20.88	16.39	24.26	39.58	21.20	18.26	11.14	9.82
JCK-90-6103	21.89	16.58	20.88	16.39	24.26	39.58	21.20	18.26	11.14	9.82
JCK-90-6103	21.89	16.58	20.88	16.39	24.26	39.58	21.20	18.26	11.14	9.82
JCK-90-6103	21.89	16.58	20.88	16.39	24.26	39.58	21.20	18.26	11.14	9.82
JCK-90-6103	21.89	16.58	20.88	16.39	24.26	39.58	21.20	18.26	11.14	9.82
JCR-19-0674	25.52	26.99	33.56	13.23	0.70	58.27	19.66	14.47	6.18	1.42
JCR-19-0674	25.52	26.99	33.56	13.23	0.70	58.27	19.66	14.47	6.18	1.42
JCR-19-0674	25.52	26.99	33.56	13.23	0.70	58.27	19.66	14.47	6.18	1.42
JCR-19-0674	25.52	26.99	33.56	13.23	0.70	58.27	19.66	14.47	6.18	1.42
JCR-19-0674	25.52	26.99	33.56	13.23	0.70	58.27	19.66	14.47	6.18	1.42
JCR-19-0674	25.52	26.99	33.56	13.23	0.70	58.27	19.66	14.47	6.18	1.42
JDL-57-0943	27.02	23.58	23.22	17.78	8.40	45.34	23.45	18.17	8.41	4.63
JDL-57-0943	27.02	23.58	23.22	17.78	8.40	45.34	23.45	18.17	8.41	4.63
JDL-57-0943	27.02	23.58	23.22	17.78	8.40	45.34	23.45	18.17	8.41	4.63
JDL-57-0943	27.02	23.58	23.22	17.78	8.40	45.34	23.45	18.17	8.41	4.63
JDL-57-0943	27.02	23.58	23.22	17.78	8.40	45.34	23.45	18.17	8.41	4.63
JDL-57-0943	27.02	23.58	23.22	17.78	8.40	45.34	23.45	18.17	8.41	4.63
JES-39-1460	7.94	7.03	21.59	22.94	40.51	43.40	20.62	17.50	11.19	7.29
JES-39-1460	7.94	7.03	21.59	22.94	40.51	43.40	20.62	17.50	11.19	7.29
JES-39-1460	7.94	7.03	21.59	22.94	40.51	43.40	20.62	17.50	11.19	7.29
JES-39-1460	7.94	7.03	21.59	22.94	40.51	43.40	20.62	17.50	11.19	7.29
JES-39-1460	7.94	7.03	21.59	22.94	40.51	43.40	20.62	17.50	11.19	7.29
JES-39-1460	7.94	7.03	21.59	22.94	40.51	43.40	20.62	17.50	11.19	7.29
JET-64-1777	33.94	18.64	23.54	14.97	8.91	51.99	23.72	15.70	6.31	2.28
JET-64-1777	33.94	18.64	23.54	14.97	8.91	51.99	23.72	15.70	6.31	2.28
JET-64-1777	33.94	18.64	23.54	14.97	8.91	51.99	23.72	15.70	6.31	2.28
JET-64-1777	33.94	18.64	23.54	14.97	8.91	51.99	23.72	15.70	6.31	2.28
JET-64-1777	33.94	18.64	23.54	14.97	8.91	51.99	23.72	15.70	6.31	2.28
JET-64-1777	33.94	18.64	23.54	14.97	8.91	51.99	23.72	15.70	6.31	2.28
JHW-52-1222	25.22	16.65	21.30	19.09	17.74	40.37	22.97	18.23	10.04	8.40
JHW-52-1222	25.22	16.65	21.30	19.09	17.74	40.37	22.97	18.23	10.04	8.40
JHW-52-1222	25.22	16.65	21.30	19.09	17.74	40.37	22.97	18.23	10.04	8.40
JHW-52-1222	25.22	16.65	21.30	19.09	17.74	40.37	22.97	18.23	10.04	8.40
JHW-52-1222	25.22	16.65	21.30	19.09	17.74	40.37	22.97	18.23	10.04	8.40
JHW-52-1222	25.22	16.65	21.30	19.09	17.74	40.37	22.97	18.23	10.04	8.40
JLD-82-6128	11.57	32.32	30.79	12.32	2.93	38.35	24.79	22.43	12.15	2.28
JLD-82-6128	11.57	32.32	30.79	12.32	2.93	38.35	24.79	22.43	12.15	2.28
JLD-82-6128	11.57	32.32	30.79	12.32	2.93	38.35	24.79	22.43	12.15	2.28
JLD-82-6128	11.57	32.32	30.79	12.32	2.93	38.35	24.79	22.43	12.15	2.28
JLD-82-6128	11.57	32.32	30.79	12.32	2.93	38.35	24.79	22.43	12.15	2.28
JLD-82-6128	11.57	32.32	30.79	12.32	2.93	38.35	24.79	22.43	12.15	2.28
JLK-24-2936	22.83	17.73	21.10	17.37	20.98	42.84	20.54	16.88	10.72	9.02
JLK-24-2936	22.83	17.73	21.10	17.37	20.98	42.84	20.54	16.88	10.72	9.02
JLK-24-2936	22.83	17.73	21.10	17.37	20.98	42.84	20.54	16.88	10.72	9.02
JLK-24-2936	22.83	17.73	21.10	17.37	20.98	42.84	20.54	16.88	10.72	9.02
JLK-24-2936	22.83	17.73	21.10	17.37	20.98	42.84	20.54	16.88	10.72	9.02
JLK-24-2936	22.83	17.73	21.10	17.37	20.98	42.84	20.54	16.88	10.72	9.02

APPENDIX F

RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2bML	HDL2aML	HDL3aML	HDL3bML	HDL3cML	HDL2bLT	HDL2aLT	HDL3aLT	HDL3bLT	HDL3cLT
JMG-24-4026	20.30	16.34	21.34	17.67	24.34	39.21	22.09	18.11	11.43	9.16
JMG-24-4026	20.30	16.34	21.34	17.67	24.34	39.21	22.09	18.11	11.43	9.16
JMG-24-4026	20.30	16.34	21.34	17.67	24.34	39.21	22.09	18.11	11.43	9.16
JMG-24-4026	20.30	16.34	21.34	17.67	24.34	39.21	22.09	18.11	11.43	9.16
JMG-24-4026	20.30	16.34	21.34	17.67	24.34	39.21	22.09	18.11	11.43	9.16
JMG-24-4026	20.30	16.34	21.34	17.67	24.34	39.21	22.09	18.11	11.43	9.16
JMP-04-5284	29.19	18.99	18.93	15.39	17.50	46.54	20.72	15.30	8.42	9.02
JMP-04-5284	29.19	18.99	18.93	15.39	17.50	46.54	20.72	15.30	8.42	9.02
JMP-04-5284	29.19	18.99	18.93	15.39	17.50	46.54	20.72	15.30	8.42	9.02
JMP-04-5284	29.19	18.99	18.93	15.39	17.50	46.54	20.72	15.30	8.42	9.02
JMP-04-5284	29.19	18.99	18.93	15.39	17.50	46.54	20.72	15.30	8.42	9.02
JMP-04-5284	29.19	18.99	18.93	15.39	17.50	46.54	20.72	15.30	8.42	9.02
JTM-15-3065	13.78	11.92	27.81	28.08	18.40	33.49	21.66	20.32	14.92	9.61
JTM-15-3065	13.78	11.92	27.81	28.08	18.40	33.49	21.66	20.32	14.92	9.61
JTM-15-3065	13.78	11.92	27.81	28.08	18.40	33.49	21.66	20.32	14.92	9.61
JTM-15-3065	13.78	11.92	27.81	28.08	18.40	33.49	21.66	20.32	14.92	9.61
JTM-15-3065	13.78	11.92	27.81	28.08	18.40	33.49	21.66	20.32	14.92	9.61
JTM-15-3065	13.78	11.92	27.81	28.08	18.40	33.49	21.66	20.32	14.92	9.61
JWH-27-7128	25.74	18.17	20.37	15.68	20.03	41.47	20.10	16.32	10.94	11.18
JWH-27-7128	25.74	18.17	20.37	15.68	20.03	41.47	20.10	16.32	10.94	11.18
JWH-27-7128	25.74	18.17	20.37	15.68	20.03	41.47	20.10	16.32	10.94	11.18
JWH-27-7128	25.74	18.17	20.37	15.68	20.03	41.47	20.10	16.32	10.94	11.18
JWH-27-7128	25.74	18.17	20.37	15.68	20.03	41.47	20.10	16.32	10.94	11.18
JWH-27-7128	25.74	18.17	20.37	15.68	20.03	41.47	20.10	16.32	10.94	11.18
JWM-84-9528	27.87	17.05	19.64	15.60	19.84	44.35	20.70	16.53	9.67	8.75
JWM-84-9528	27.87	17.05	19.64	15.60	19.84	44.35	20.70	16.53	9.67	8.75
JWM-84-9528	27.87	17.05	19.64	15.60	19.84	44.35	20.70	16.53	9.67	8.75
JWM-84-9528	27.87	17.05	19.64	15.60	19.84	44.35	20.70	16.53	9.67	8.75
JWM-84-9528	27.87	17.05	19.64	15.60	19.84	44.35	20.70	16.53	9.67	8.75
JWM-84-9528	27.87	17.05	19.64	15.60	19.84	44.35	20.70	16.53	9.67	8.75
K_W-02-8695	24.71	15.84	19.68	16.35	23.41	39.15	22.49	17.64	10.05	10.67
K_W-02-8695	24.71	15.84	19.68	16.35	23.41	39.15	22.49	17.64	10.05	10.67
K_W-02-8695	24.71	15.84	19.68	16.35	23.41	39.15	22.49	17.64	10.05	10.67
K_W-02-8695	24.71	15.84	19.68	16.35	23.41	39.15	22.49	17.64	10.05	10.67
K_W-02-8695	24.71	15.84	19.68	16.35	23.41	39.15	22.49	17.64	10.05	10.67
K_W-02-8695	24.71	15.84	19.68	16.35	23.41	39.15	22.49	17.64	10.05	10.67
KFW-35-5107	29.37	20.39	22.68	15.68	11.89	45.76	20.45	15.25	9.80	8.75
KFW-35-5107	29.37	20.39	22.68	15.68	11.89	45.76	20.45	15.25	9.80	8.75
KFW-35-5107	29.37	20.39	22.68	15.68	11.89	45.76	20.45	15.25	9.80	8.75
KFW-35-5107	29.37	20.39	22.68	15.68	11.89	45.76	20.45	15.25	9.80	8.75
KFW-35-5107	29.37	20.39	22.68	15.68	11.89	45.76	20.45	15.25	9.80	8.75
KFW-35-5107	29.37	20.39	22.68	15.68	11.89	45.76	20.45	15.25	9.80	8.75
LBT-66-9014	11.05	17.27	25.59	21.41	24.68	43.05	24.03	18.78	8.10	6.03
LBT-66-9014	11.05	17.27	25.59	21.41	24.68	43.05	24.03	18.78	8.10	6.03
LBT-66-9014	11.05	17.27	25.59	21.41	24.68	43.05	24.03	18.78	8.10	6.03
LBT-66-9014	11.05	17.27	25.59	21.41	24.68	43.05	24.03	18.78	8.10	6.03
LBT-66-9014	11.05	17.27	25.59	21.41	24.68	43.05	24.03	18.78	8.10	6.03
LBT-66-9014	11.05	17.27	25.59	21.41	24.68	43.05	24.03	18.78	8.10	6.03
LCF-94-1044	29.88	25.82	25.26	12.18	6.86	48.00	23.55	15.87	7.40	5.18
LCF-94-1044	29.88	25.82	25.26	12.18	6.86	48.00	23.55	15.87	7.40	5.18
LCF-94-1044	29.88	25.82	25.26	12.18	6.86	48.00	23.55	15.87	7.40	5.18
LCF-94-1044	29.88	25.82	25.26	12.18	6.86	48.00	23.55	15.87	7.40	5.18
LCF-94-1044	29.88	25.82	25.26	12.18	6.86	48.00	23.55	15.87	7.40	5.18
LCF-94-1044	29.88	25.82	25.26	12.18	6.86	48.00	23.55	15.87	7.40	5.18
LCO-51-7401	30.86	19.17	20.66	15.83	13.48	39.18	21.08	17.53	10.97	11.24
LCO-51-7401	30.86	19.17	20.66	15.83	13.48	39.18	21.08	17.53	10.97	11.24
LCO-51-7401	30.86	19.17	20.66	15.83	13.48	39.18	21.08	17.53	10.97	11.24
LCO-51-7401	30.86	19.17	20.66	15.83	13.48	39.18	21.08	17.53	10.97	11.24
LCO-51-7401	30.86	19.17	20.66	15.83	13.48	39.18	21.08	17.53	10.97	11.24
LCO-51-7401	30.86	19.17	20.66	15.83	13.48	39.18	21.08	17.53	10.97	11.24
LJC-76-4231	22.62	16.66	19.79	20.73	20.20	39.02	23.28	18.67	10.98	8.06
LJC-76-4231	22.62	16.66	19.79	20.73	20.20	39.02	23.28	18.67	10.98	8.06
LJC-76-4231	22.62	16.66	19.79	20.73	20.20	39.02	23.28	18.67	10.98	8.06
LJC-76-4231	22.62	16.66	19.79	20.73	20.20	39.02	23.28	18.67	10.98	8.06
LJC-76-4231	22.62	16.66	19.79	20.73	20.20	39.02	23.28	18.67	10.98	8.06
LJC-76-4231	22.62	16.66	19.79	20.73	20.20	39.02	23.28	18.67	10.98	8.06
MJB-02-2375	20.12	16.74	24.11	18.34	20.71	45.19	25.00	15.71	6.43	7.67
MJB-02-2375	20.12	16.74	24.11	18.34	20.71	45.19	25.00	15.71	6.43	7.67
MJB-02-2375	20.12	16.74	24.11	18.34	20.71	45.19	25.00	15.71	6.43	7.67
MJB-02-2375	20.12	16.74	24.11	18.34	20.71	45.19	25.00	15.71	6.43	7.67
MJB-02-2375	20.12	16.74	24.11	18.34	20.71	45.19	25.00	15.71	6.43	7.67
MJB-02-2375	20.12	16.74	24.11	18.34	20.71	45.19	25.00	15.71	6.43	7.67
MLL-68-3135	46.87	22.56	15.88	9.15	5.54	44.54	24.04	15.64	9.39	6.39
MLL-68-3135	46.87	22.56	15.88	9.15	5.54	44.54	24.04	15.64	9.39	6.39
MLL-68-3135	46.87	22.56	15.88	9.15	5.54	44.54	24.04	15.64	9.39	6.39
MLL-68-3135	46.87	22.56	15.88	9.15	5.54	44.54	24.04	15.64	9.39	6.39
MLL-68-3135	46.87	22.56	15.88	9.15	5.54	44.54	24.04	15.64	9.39	6.39
MLL-68-3135	46.87	22.56	15.88	9.15	5.54	44.54	24.04	15.64	9.39	6.39
MLS-82-5875	27.10	15.51	15.07	16.15	26.16	38.82	21.16	18.62	13.07	8.33
MLS-82-5875	27.10	15.51	15.07	16.15	26.16	38.82	21.16	18.62	13.07	8.33
MLS-82-5875	27.10	15.51	15.07	16.15	26.16	38.82	21.16	18.62	13.07	8.33
MLS-82-5875	27.10	15.51	15.07	16.15	26.16	38.82	21.16	18.62	13.07	8.33

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RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

MLS-82-5875	27.10	15.51	15.07	16.15	26.16	38.82	21.16	18.62	13.07	8.33
MLS-82-5875	27.10	15.51	15.07	16.15	26.16	38.82	21.16	18.62	13.07	8.33

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2bML	HDL2aML	HDL3aML	HDL3bML	HDL3cML	HDL2bLT	HDL2aLT	HDL3aLT	HDL3bLT	HDL3cLT
MWB-82-6035	23.91	17.55	20.17	16.17	22.19	40.89	21.23	17.73	10.80	9.35
MWB-82-6035	23.91	17.55	20.17	16.17	22.19	40.89	21.23	17.73	10.80	9.35
MWB-82-6035	23.91	17.55	20.17	16.17	22.19	40.89	21.23	17.73	10.80	9.35
MWB-82-6035	23.91	17.55	20.17	16.17	22.19	40.89	21.23	17.73	10.80	9.35
MWB-82-6035	23.91	17.55	20.17	16.17	22.19	40.89	21.23	17.73	10.80	9.35
MWB-82-6035	23.91	17.55	20.17	16.17	22.19	40.89	21.23	17.73	10.80	9.35
PJB-43-3639	26.35	19.15	22.15	17.48	14.86	47.20	24.18	16.71	7.02	4.90
PJB-43-3639	26.35	19.15	22.15	17.48	14.86	47.20	24.18	16.71	7.02	4.90
PJB-43-3639	26.35	19.15	22.15	17.48	14.86	47.20	24.18	16.71	7.02	4.90
PJB-43-3639	26.35	19.15	22.15	17.48	14.86	47.20	24.18	16.71	7.02	4.90
PJB-43-3639	26.35	19.15	22.15	17.48	14.86	47.20	24.18	16.71	7.02	4.90
PJB-43-3639	26.35	19.15	22.15	17.48	14.86	47.20	24.18	16.71	7.02	4.90
PJD-13-4775	25.57	17.98	21.88	18.13	16.43	47.41	24.12	17.13	7.78	3.56
PJD-13-4775	25.57	17.98	21.88	18.13	16.43	47.41	24.12	17.13	7.78	3.56
PJD-13-4775	25.57	17.98	21.88	18.13	16.43	47.41	24.12	17.13	7.78	3.56
PJD-13-4775	25.57	17.98	21.88	18.13	16.43	47.41	24.12	17.13	7.78	3.56
PJD-13-4775	25.57	17.98	21.88	18.13	16.43	47.41	24.12	17.13	7.78	3.56
PJD-13-4775	25.57	17.98	21.88	18.13	16.43	47.41	24.12	17.13	7.78	3.56
R_D-70-0888	27.89	19.18	23.42	16.75	12.75	45.54	21.41	14.57	7.90	10.57
R_D-70-0888	27.89	19.18	23.42	16.75	12.75	45.54	21.41	14.57	7.90	10.57
R_D-70-0888	27.89	19.18	23.42	16.75	12.75	45.54	21.41	14.57	7.90	10.57
R_D-70-0888	27.89	19.18	23.42	16.75	12.75	45.54	21.41	14.57	7.90	10.57
R_D-70-0888	27.89	19.18	23.42	16.75	12.75	45.54	21.41	14.57	7.90	10.57
R_D-70-0888	27.89	19.18	23.42	16.75	12.75	45.54	21.41	14.57	7.90	10.57
R_G-92-3746	21.97	17.00	20.95	19.01	21.08	43.07	21.67	16.17	9.81	9.29
R_G-92-3746	21.97	17.00	20.95	19.01	21.08	43.07	21.67	16.17	9.81	9.29
R_G-92-3746	21.97	17.00	20.95	19.01	21.08	43.07	21.67	16.17	9.81	9.29
R_G-92-3746	21.97	17.00	20.95	19.01	21.08	43.07	21.67	16.17	9.81	9.29
R_G-92-3746	21.97	17.00	20.95	19.01	21.08	43.07	21.67	16.17	9.81	9.29
R_G-92-3746	21.97	17.00	20.95	19.01	21.08	43.07	21.67	16.17	9.81	9.29
R_M-92-9942	32.61	16.69	20.48	12.95	17.27	45.10	22.75	14.06	6.31	11.76
R_M-92-9942	32.61	16.69	20.48	12.95	17.27	45.10	22.75	14.06	6.31	11.76
R_M-92-9942	32.61	16.69	20.48	12.95	17.27	45.10	22.75	14.06	6.31	11.76
R_M-92-9942	32.61	16.69	20.48	12.95	17.27	45.10	22.75	14.06	6.31	11.76
R_M-92-9942	32.61	16.69	20.48	12.95	17.27	45.10	22.75	14.06	6.31	11.76
R_M-92-9942	32.61	16.69	20.48	12.95	17.27	45.10	22.75	14.06	6.31	11.76
RAS-47-7434	17.10	14.22	23.76	22.90	22.02	40.43	22.94	17.84	10.40	8.39
RAS-47-7434	17.10	14.22	23.76	22.90	22.02	40.43	22.94	17.84	10.40	8.39
RAS-47-7434	17.10	14.22	23.76	22.90	22.02	40.43	22.94	17.84	10.40	8.39
RAS-47-7434	17.10	14.22	23.76	22.90	22.02	40.43	22.94	17.84	10.40	8.39
RAS-47-7434	17.10	14.22	23.76	22.90	22.02	40.43	22.94	17.84	10.40	8.39
RAS-47-7434	17.10	14.22	23.76	22.90	22.02	40.43	22.94	17.84	10.40	8.39
RAW-58-9624	15.45	16.98	24.71	22.04	20.82	40.44	21.42	17.86	10.21	10.07
RAW-58-9624	15.45	16.98	24.71	22.04	20.82	40.44	21.42	17.86	10.21	10.07
RAW-58-9624	15.45	16.98	24.71	22.04	20.82	40.44	21.42	17.86	10.21	10.07
RAW-58-9624	15.45	16.98	24.71	22.04	20.82	40.44	21.42	17.86	10.21	10.07
RAW-58-9624	15.45	16.98	24.71	22.04	20.82	40.44	21.42	17.86	10.21	10.07
RAW-58-9624	15.45	16.98	24.71	22.04	20.82	40.44	21.42	17.86	10.21	10.07
RDS-94-2909	7.95	15.06	29.34	23.90	23.75	40.68	24.34	19.32	11.68	3.97
RDS-94-2909	7.95	15.06	29.34	23.90	23.75	40.68	24.34	19.32	11.68	3.97
RDS-94-2909	7.95	15.06	29.34	23.90	23.75	40.68	24.34	19.32	11.68	3.97
RDS-94-2909	7.95	15.06	29.34	23.90	23.75	40.68	24.34	19.32	11.68	3.97
RDS-94-2909	7.95	15.06	29.34	23.90	23.75	40.68	24.34	19.32	11.68	3.97
RDS-94-2909	7.95	15.06	29.34	23.90	23.75	40.68	24.34	19.32	11.68	3.97
REJ-42-1333	26.48	20.45	23.54	16.85	12.67	42.90	24.75	18.06	8.07	6.22
REJ-42-1333	26.48	20.45	23.54	16.85	12.67	42.90	24.75	18.06	8.07	6.22
REJ-42-1333	26.48	20.45	23.54	16.85	12.67	42.90	24.75	18.06	8.07	6.22
REJ-42-1333	26.48	20.45	23.54	16.85	12.67	42.90	24.75	18.06	8.07	6.22
REJ-42-1333	26.48	20.45	23.54	16.85	12.67	42.90	24.75	18.06	8.07	6.22
REJ-42-1333	26.48	20.45	23.54	16.85	12.67	42.90	24.75	18.06	8.07	6.22
RLB-90-6883	33.53	18.72	20.97	16.68	10.10	55.93	16.50	11.21	6.39	9.98
RLB-90-6883	33.53	18.72	20.97	16.68	10.10	55.93	16.50	11.21	6.39	9.98
RLB-90-6883	33.53	18.72	20.97	16.68	10.10	55.93	16.50	11.21	6.39	9.98
RLB-90-6883	33.53	18.72	20.97	16.68	10.10	55.93	16.50	11.21	6.39	9.98
RLB-90-6883	33.53	18.72	20.97	16.68	10.10	55.93	16.50	11.21	6.39	9.98
RLB-90-6883	33.53	18.72	20.97	16.68	10.10	55.93	16.50	11.21	6.39	9.98
RPM-35-9363	12.26	4.49	30.54	34.88	17.84	42.78	23.40	20.63	11.44	1.75
RPM-35-9363	12.26	4.49	30.54	34.88	17.84	42.78	23.40	20.63	11.44	1.75
RPM-35-9363	12.26	4.49	30.54	34.88	17.84	42.78	23.40	20.63	11.44	1.75
RPM-35-9363	12.26	4.49	30.54	34.88	17.84	42.78	23.40	20.63	11.44	1.75
RPM-35-9363	12.26	4.49	30.54	34.88	17.84	42.78	23.40	20.63	11.44	1.75
RPM-35-9363	12.26	4.49	30.54	34.88	17.84	42.78	23.40	20.63	11.44	1.75

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2bML	HDL2aML	HDL3aML	HDL3bML	HDL3cML	HDL2bLT	HDL2aLT	HDL3aLT	HDL3bLT	HDL3cLT
SAD-00-8872	25.39	16.72	20.00	18.83	19.05	48.30	21.41	14.07	8.22	8.00
SAD-00-8872	25.39	16.72	20.00	18.83	19.05	48.30	21.41	14.07	8.22	8.00
SAD-00-8872	25.39	16.72	20.00	18.83	19.05	48.30	21.41	14.07	8.22	8.00
SAD-00-8872	25.39	16.72	20.00	18.83	19.05	48.30	21.41	14.07	8.22	8.00
SAD-00-8872	25.39	16.72	20.00	18.83	19.05	48.30	21.41	14.07	8.22	8.00
SAD-00-8872	25.39	16.72	20.00	18.83	19.05	48.30	21.41	14.07	8.22	8.00
SCM-35-5124	27.25	21.45	22.35	16.66	12.29	47.66	24.18	16.47	7.85	3.84
SCM-35-5124	27.25	21.45	22.35	16.66	12.29	47.66	24.18	16.47	7.85	3.84
SCM-35-5124	27.25	21.45	22.35	16.66	12.29	47.66	24.18	16.47	7.85	3.84
SCM-35-5124	27.25	21.45	22.35	16.66	12.29	47.66	24.18	16.47	7.85	3.84
SCM-35-5124	27.25	21.45	22.35	16.66	12.29	47.66	24.18	16.47	7.85	3.84
SCM-35-5124	27.25	21.45	22.35	16.66	12.29	47.66	24.18	16.47	7.85	3.84
SGC-98-6374	21.16	18.59	21.87	17.96	20.42	48.76	24.76	14.83	6.11	5.55
SGC-98-6374	21.16	18.59	21.87	17.96	20.42	48.76	24.76	14.83	6.11	5.55
SGC-98-6374	21.16	18.59	21.87	17.96	20.42	48.76	24.76	14.83	6.11	5.55
SGC-98-6374	21.16	18.59	21.87	17.96	20.42	48.76	24.76	14.83	6.11	5.55
SGC-98-6374	21.16	18.59	21.87	17.96	20.42	48.76	24.76	14.83	6.11	5.55
SGC-98-6374	21.16	18.59	21.87	17.96	20.42	48.76	24.76	14.83	6.11	5.55
SHS-48-1211	17.80	15.52	20.54	18.47	27.67	36.04	22.95	19.02	10.87	11.13
SHS-48-1211	17.80	15.52	20.54	18.47	27.67	36.04	22.95	19.02	10.87	11.13
SHS-48-1211	17.80	15.52	20.54	18.47	27.67	36.04	22.95	19.02	10.87	11.13
SHS-48-1211	17.80	15.52	20.54	18.47	27.67	36.04	22.95	19.02	10.87	11.13
SHS-48-1211	17.80	15.52	20.54	18.47	27.67	36.04	22.95	19.02	10.87	11.13
SHS-48-1211	17.80	15.52	20.54	18.47	27.67	36.04	22.95	19.02	10.87	11.13
SPH-53-4229	22.28	16.61	21.55	19.08	20.47	35.88	20.26	19.62	13.70	10.53
SPH-53-4229	22.28	16.61	21.55	19.08	20.47	35.88	20.26	19.62	13.70	10.53
SPH-53-4229	22.28	16.61	21.55	19.08	20.47	35.88	20.26	19.62	13.70	10.53
SPH-53-4229	22.28	16.61	21.55	19.08	20.47	35.88	20.26	19.62	13.70	10.53
SPH-53-4229	22.28	16.61	21.55	19.08	20.47	35.88	20.26	19.62	13.70	10.53
SPH-53-4229	22.28	16.61	21.55	19.08	20.47	35.88	20.26	19.62	13.70	10.53
SRC-74-4595	26.25	17.55	21.26	15.28	19.66	43.22	22.41	18.45	9.38	6.54
SRC-74-4595	26.25	17.55	21.26	15.28	19.66	43.22	22.41	18.45	9.38	6.54
SRC-74-4595	26.25	17.55	21.26	15.28	19.66	43.22	22.41	18.45	9.38	6.54
SRC-74-4595	26.25	17.55	21.26	15.28	19.66	43.22	22.41	18.45	9.38	6.54
SRC-74-4595	26.25	17.55	21.26	15.28	19.66	43.22	22.41	18.45	9.38	6.54
SRC-74-4595	26.25	17.55	21.26	15.28	19.66	43.22	22.41	18.45	9.38	6.54
TLM-74-2189	9.30	13.09	27.32	22.90	27.39	46.52	26.24	18.85	8.34	0.04
TLM-74-2189	9.30	13.09	27.32	22.90	27.39	46.52	26.24	18.85	8.34	0.04
TLM-74-2189	9.30	13.09	27.32	22.90	27.39	46.52	26.24	18.85	8.34	0.04
TLM-74-2189	9.30	13.09	27.32	22.90	27.39	46.52	26.24	18.85	8.34	0.04
TLM-74-2189	9.30	13.09	27.32	22.90	27.39	46.52	26.24	18.85	8.34	0.04
TLM-74-2189	9.30	13.09	27.32	22.90	27.39	46.52	26.24	18.85	8.34	0.04
TWB-57-9837	33.31	19.51	18.04	13.05	16.10	41.20	19.98	16.59	11.50	10.73
TWB-57-9837	33.31	19.51	18.04	13.05	16.10	41.20	19.98	16.59	11.50	10.73
TWB-57-9837	33.31	19.51	18.04	13.05	16.10	41.20	19.98	16.59	11.50	10.73
TWB-57-9837	33.31	19.51	18.04	13.05	16.10	41.20	19.98	16.59	11.50	10.73
TWB-57-9837	33.31	19.51	18.04	13.05	16.10	41.20	19.98	16.59	11.50	10.73
TWB-57-9837	33.31	19.51	18.04	13.05	16.10	41.20	19.98	16.59	11.50	10.73
V_S-06-8525	22.18	13.40	20.16	18.17	26.09	37.95	16.43	18.31	13.80	13.50
V_S-06-8525	22.18	13.40	20.16	18.17	26.09	37.95	16.43	18.31	13.80	13.50
V_S-06-8525	22.18	13.40	20.16	18.17	26.09	37.95	16.43	18.31	13.80	13.50
V_S-06-8525	22.18	13.40	20.16	18.17	26.09	37.95	16.43	18.31	13.80	13.50
V_S-06-8525	22.18	13.40	20.16	18.17	26.09	37.95	16.43	18.31	13.80	13.50
V_S-06-8525	22.18	13.40	20.16	18.17	26.09	37.95	16.43	18.31	13.80	13.50
W_H-56-8407	18.14	10.17	32.78	22.89	16.02	44.48	23.80	17.75	9.82	4.15
W_H-56-8407	18.14	10.17	32.78	22.89	16.02	44.48	23.80	17.75	9.82	4.15
W_H-56-8407	18.14	10.17	32.78	22.89	16.02	44.48	23.80	17.75	9.82	4.15
W_H-56-8407	18.14	10.17	32.78	22.89	16.02	44.48	23.80	17.75	9.82	4.15
W_H-56-8407	18.14	10.17	32.78	22.89	16.02	44.48	23.80	17.75	9.82	4.15
W_H-56-8407	18.14	10.17	32.78	22.89	16.02	44.48	23.80	17.75	9.82	4.15
WHS-67-7302	27.88	19.26	22.13	14.91	15.82	45.58	21.65	16.12	8.07	8.57
WHS-67-7302	27.88	19.26	22.13	14.91	15.82	45.58	21.65	16.12	8.07	8.57
WHS-67-7302	27.88	19.26	22.13	14.91	15.82	45.58	21.65	16.12	8.07	8.57
WHS-67-7302	27.88	19.26	22.13	14.91	15.82	45.58	21.65	16.12	8.07	8.57
WHS-67-7302	27.88	19.26	22.13	14.91	15.82	45.58	21.65	16.12	8.07	8.57
WHS-67-7302	27.88	19.26	22.13	14.91	15.82	45.58	21.65	16.12	8.07	8.57
WJP-80-2929	14.96	10.24	27.25	29.71	17.84	45.29	22.20	19.91	10.82	1.78
WJP-80-2929	14.96	10.24	27.25	29.71	17.84	45.29	22.20	19.91	10.82	1.78
WJP-80-2929	14.96	10.24	27.25	29.71	17.84	45.29	22.20	19.91	10.82	1.78
WJP-80-2929	14.96	10.24	27.25	29.71	17.84	45.29	22.20	19.91	10.82	1.78
WJP-80-2929	14.96	10.24	27.25	29.71	17.84	45.29	22.20	19.91	10.82	1.78
WJP-80-2929	14.96	10.24	27.25	29.71	17.84	45.29	22.20	19.91	10.82	1.78
Y_S-85-4659	29.00	23.09	23.14	13.61	11.17	47.83	23.81	15.75	7.42	5.19
Y_S-85-4659	29.00	23.09	23.14	13.61	11.17	47.83	23.81	15.75	7.42	5.19
Y_S-85-4659	29.00	23.09	23.14	13.61	11.17	47.83	23.81	15.75	7.42	5.19
Y_S-85-4659	29.00	23.09	23.14	13.61	11.17	47.83	23.81	15.75	7.42	5.19
Y_S-85-4659	29.00	23.09	23.14	13.61	11.17	47.83	23.81	15.75	7.42	5.19
Y_S-85-4659	29.00	23.09	23.14	13.61	11.17	47.83	23.81	15.75	7.42	5.19

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2b	HDL2a	HDL3a	HDL 3b	HDL 3c	Lagtime	Rate	Max	paraox
BCF-41-4745	32.00	18.78	17.15	15.14	16.93	.	.	.	76.45
BCF-41-4745	30.52	18.21	17.04	15.48	18.75	57	0.011646	0.5784	80.45
BCF-41-4745	29.89	19.93	18.24	14.14	17.80	.	.	.	84.54
BCF-41-4745	29.89	19.93	18.24	14.14	17.80	59	0.009198	0.489	85.17
BCF-41-4745	30.28	18.81	18.95	15.22	16.75	.	.	.	79.78
BCF-41-4745	28.16	17.07	20.58	16.77	17.43	58	0.01176	0.6693	80.33
BCG-70-6783	32.99	20.33	21.09	13.58	12.02	.	.	.	74.79
BCG-70-6783	28.28	21.58	20.77	16.43	12.94	63.9	0.004664	0.3078	87.22
BCG-70-6783	29.20	23.69	18.23	16.07	12.80	.	.	.	94.89
BCG-70-6783	39.04	24.90	15.95	11.12	8.98	77.46	0.00676	0.5109	89.92
BCG-70-6783	35.66	25.84	18.82	12.66	7.02	.	.	.	94.41
BCG-70-6783	32.77	22.53	19.92	15.20	9.59	98.85	0.006518	0.4357	89.73
BJC-82-7657	41.88	16.93	14.53	11.50	15.17	.	.	.	72.88
BJC-82-7657	38.57	16.59	16.34	12.32	16.18	33	0.018424	0.9312	72.76
BJC-82-7657	32.66	18.21	18.56	14.14	16.43	.	.	.	75.05
BJC-82-7657	32.58	17.69	17.64	14.39	17.70	12	0.016932	0.7453	74.84
BJC-82-7657	34.14	17.81	16.29	14.01	17.74	.	.	.	76.40
BJC-82-7657	35.29	18.07	15.76	13.57	17.30	15	0.01473	0.7079	71.67
BLB-39-5161	37.27	28.97	21.48	9.43	2.86	.	.	.	58.78
BLB-39-5161	27.76	29.97	24.14	12.35	5.78	145.9	0.003281	0.2758	63.34
BLB-39-5161	28.43	30.38	24.35	12.90	3.94	.	.	.	59.32
BLB-39-5161	29.32	28.24	22.93	13.09	6.43	.	.	.	67.08
BLB-39-5161	25.27	25.12	23.97	16.03	9.62	.	.	.	51.81
BLB-39-5161	24.21	25.43	26.97	17.74	5.65	92.1	0.002034	0.1708	65.01
BLM-37-2312	25.36	17.88	19.25	19.60	17.91	.	.	.	89.26
BLM-37-2312	23.83	16.86	19.16	21.09	19.05	78	0.013058	0.7075	90.75
BLM-37-2312	23.04	16.19	18.00	19.49	23.29	.	.	.	102.87
BLM-37-2312	25.31	16.34	18.75	19.11	20.50	95	0.010056	0.6219	96.02
BLM-37-2312	24.12	16.40	18.91	21.85	18.72	.	.	.	100.16
BLM-37-2312	21.29	13.08	17.49	20.70	27.43	89	0.01152	0.6477	92.47
BMB-53-1389	8.27	13.07	13.31	17.44	47.91	.	.	.	91.11
BMB-53-1389	21.06	17.09	22.48	19.08	20.28	70	0.010312	0.6174	89.35
BMB-53-1389	2.82	8.70	10.26	17.08	61.14	.	.	.	86.16
BMB-53-1389	4.32	9.12	9.60	17.29	59.67	76	0.0091	0.6546	83.04
BMB-53-1389	3.19	10.80	11.68	16.16	58.18	.	.	.	78.90
BMB-53-1389	17.87	14.05	21.16	19.35	27.57	76	0.006786	0.48	78.49
BPF-52-8789	24.74	18.69	27.72	14.19	14.66	.	.	.	82.97
BPF-52-8789	28.19	18.23	26.38	16.93	10.28	55	0.0156	0.8201	74.90
BPF-52-8789	22.50	15.83	22.10	16.35	23.22	.	.	.	76.17
BPF-52-8789	21.40	16.06	25.84	16.74	19.96	58	0.016096	0.8589	79.85
BPF-52-8789	22.21	18.51	27.08	15.79	16.42	.	.	.	92.29
BPF-52-8789	27.14	16.25	23.20	14.85	18.56	77	0.010814	0.5951	84.17
CAV-29-4434	29.87	19.78	22.64	14.90	12.81	.	.	.	91.94
CAV-29-4434	26.33	19.11	24.20	16.24	14.12	10	0.01507	0.6825	93.35
CAV-29-4434	26.89	19.60	23.74	15.93	13.84	.	.	.	91.93
CAV-29-4434	29.21	18.44	23.16	16.67	12.52	27	0.017674	0.8297	.
CAV-29-4434	26.00	19.44	23.34	18.16	13.06	.	.	.	89.33
CAV-29-4434	26.98	18.99	24.48	15.59	13.96	19	0.017646	0.7925	93.76
CMB-61-1861	32.28	22.52	20.25	12.36	12.59	.	.	.	129.17
CMB-61-1861	26.93	21.81	21.46	14.46	15.34	62	0.020026	0.76	136.45
CMB-61-1861	23.52	18.98	21.88	16.51	19.11	.	.	.	140.98
CMB-61-1861	22.31	19.44	23.02	16.82	18.41	68	0.014904	0.8156	134.58
CMB-61-1861	23.13	18.04	22.26	16.62	19.95	.	.	.	147.96
CMB-61-1861	22.44	17.49	22.60	16.62	20.87	79	0.014286	0.8214	133.16
CRR-37-3333	6.64	5.63	3.82	19.95	63.95	.	.	.	62.62
CRR-37-3333	5.66	5.73	2.47	19.78	66.37	79	0.012804	0.7397	65.59
CRR-37-3333	3.13	6.44	2.58	16.77	71.08	.	.	.	68.95
CRR-37-3333	7.12	8.44	6.35	17.40	60.69	85	0.014248	0.8341	69.35
CRR-37-3333	6.40	4.91	3.45	17.69	67.56	.	.	.	68.72
CRR-37-3333	2.72	6.71	8.37	17.43	64.78	89	0.010672	0.9134	72.37
D_H-92-6569	35.53	17.05	16.00	14.84	16.58	.	.	.	45.52
D_H-92-6569	36.80	18.55	16.64	14.08	13.92	68.05	0.001752	0.1519	41.45
D_H-92-6569	35.05	20.36	16.80	12.62	15.16	.	.	.	41.31
D_H-92-6569	34.52	20.12	17.52	12.72	15.12	71.52	0.002052	0.1478	40.73
D_H-92-6569	30.42	19.29	16.47	15.56	18.27	.	.	.	48.56
D_H-92-6569	31.21	18.28	18.61	15.53	16.37	84.79	0.002464	0.179	43.90
D_L-89-7473	42.54	20.23	17.42	9.93	9.87	.	.	.	83.09
D_L-89-7473	38.12	20.23	19.46	11.54	10.65	74.3	0.008	0.49	79.81
D_L-89-7473	37.09	20.58	18.85	11.53	11.95	.	.	.	81.61
D_L-89-7473	36.58	20.82	20.46	11.48	10.65	100	0.003	0.244	83.68
D_L-89-7473	34.61	20.75	19.53	12.08	13.03	.	.	.	84.96
D_L-89-7473	33.28	20.75	19.99	12.53	13.45	70	0.003	0.142	79.32

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2b	HDL2a	HDL3a	HDL 3b	HDL 3c	Lagtime	Rate	Max	paraox
DCS-04-4041	37.36	22.26	19.42	11.11	9.85	.	.	.	111.29
DCS-04-4041	34.43	26.76	21.35	11.21	6.25	110	0.001108	0.114	88.88
DCS-04-4041	34.36	22.17	20.80	12.77	9.90	.	.	.	75.06
DCS-04-4041	33.11	18.39	18.94	14.18	15.39	45.84	0.001256	0.086	80.98
DCS-04-4041	25.52	12.63	15.16	16.92	29.77	.	.	.	87.80
DCS-04-4041	33.36	21.77	21.10	13.05	10.72	76.6	0.006054	0.3601	80.98
DDD-35-0736	27.59	23.33	21.87	12.70	14.51	.	.	.	89.61
DDD-35-0736	27.95	20.93	20.52	13.31	17.30	44.34	0.003252	0.1854	91.30
DDD-35-0736	27.11	22.15	21.77	12.95	16.02	.	.	.	106.78
DDD-35-0736	31.10	26.04	19.52	12.10	11.24	49.2	0.005182	0.2776	104.29
DDD-35-0736	28.76	24.84	20.21	12.89	13.30	.	.	.	86.70
DDD-35-0736	22.56	28.24	25.55	15.78	7.88	94.72	0.005494	0.4023	112.61
DDW-27-1270	17.69	6.64	13.66	18.76	43.25	.	.	.	102.77
DDW-27-1270	16.88	6.66	14.18	19.40	42.89	66	0.012736	0.7304	94.52
DDW-27-1270	18.83	15.20	13.67	16.06	36.23	.	.	.	102.79
DDW-27-1270	16.00	13.45	12.91	18.66	38.98	68	0.01134	0.6402	102.61
DDW-27-1270	14.58	17.01	13.81	16.98	37.62	.	.	.	113.76
DDW-27-1270	37.91	19.80	20.43	13.89	7.97	62	0.012856	0.7007	103.48
DJS-29-7999	46.48	21.63	19.65	11.00	1.23	.	.	.	61.23
DJS-29-7999	43.31	18.81	18.08	14.34	5.45	81	0.00873	0.5252	55.55
DJS-29-7999	41.40	18.98	24.11	13.01	2.49	.	.	.	64.32
DJS-29-7999	33.32	18.85	26.49	18.27	3.07	95	0.00492	0.3149	53.76
DJS-29-7999	47.28	20.57	20.33	10.46	1.37	.	.	.	70.43
DJS-29-7999	29.71	16.38	21.48	22.16	10.27	83	0.005548	0.302	66.43
DLC-08-2664	21.07	12.30	13.19	17.48	35.95	.	.	.	109.93
DLC-08-2664	13.92	13.95	13.09	18.80	40.24	69	0.013168	0.7034	107.95
DLC-08-2664	20.20	12.30	16.22	17.97	33.31	.	.	.	104.60
DLC-08-2664	17.09	9.55	15.34	19.68	38.34	82	0.009928	0.6068	112.58
DLC-08-2664	27.47	4.76	11.89	17.86	38.02	.	.	.	106.07
DLC-08-2664	23.35	6.19	13.46	18.80	38.20	54	0.014972	0.9339	102.61
DPB-64-7804	33.35	14.52	18.11	18.75	15.27	.	.	.	91.51
DPB-64-7804	29.43	13.87	19.45	21.39	15.86	18	0.011602	0.6438	96.60
DPB-64-7804	38.04	14.99	18.18	18.77	10.02	.	.	.	88.71
DPB-64-7804	34.70	14.85	16.74	18.37	15.35	36	0.015516	0.7688	96.57
DPB-64-7804	29.40	13.37	17.33	21.01	18.88	.	.	.	90.07
DPB-64-7804	27.68	13.38	17.17	21.77	19.99	17	0.01695	0.7718	107.08
DRF-37-5270	36.65	20.89	18.35	10.70	13.40	.	.	.	101.37
DRF-37-5270	31.04	22.17	20.79	12.73	13.26	80	0.009844	0.563	116.00
DRF-37-5270	29.62	22.53	21.57	13.79	12.49	.	.	.	119.89
DRF-37-5270	32.28	23.55	19.75	12.29	12.12	65	0.011618	0.6984	118.20
DRF-37-5270	35.03	19.87	19.29	12.79	13.02	.	.	.	123.94
DRF-37-5270	26.33	20.68	21.35	14.23	17.42	62	0.011942	0.6843	126.86
DWS-98-8742	27.34	20.75	21.42	13.54	16.95	.	.	.	84.36
DWS-98-8742	23.09	19.42	23.26	17.20	17.02	79	0.006626	0.4289	104.48
DWS-98-8742	22.34	20.57	23.81	16.88	16.40	.	.	.	116.89
DWS-98-8742	19.77	21.80	23.71	16.35	18.38	77	0.006218	0.3457	120.60
DWS-98-8742	21.44	18.36	22.52	16.56	21.12	.	.	.	104.23
DWS-98-8742	23.85	18.99	22.66	16.09	18.42	73	0.007564	0.4279	112.57
DYN-54-3286	29.90	23.03	22.02	13.67	11.38	.	.	.	83.72
DYN-54-3286	24.02	23.89	24.93	15.43	11.73	64	0.00988	0.5268	83.38
DYN-54-3286	26.71	22.45	22.10	14.43	14.31	.	.	.	87.09
DYN-54-3286	26.85	21.46	20.68	14.89	16.12	115	0.010624	0.6384	79.97
DYN-54-3286	22.80	21.99	23.78	16.91	14.53	.	.	.	79.84
DYN-54-3286	24.04	19.69	24.75	17.91	13.62	81	0.01116	0.6328	78.28
EAB-57-9471	32.68	25.67	21.47	11.80	8.38	.	.	.	90.42
EAB-57-9471	29.23	27.01	21.89	12.45	9.42	78	0.011124	0.6722	89.98
EAB-57-9471	32.51	24.78	20.26	12.27	10.18	.	.	.	106.61
EAB-57-9471	24.11	24.12	25.12	15.97	10.68	90	0.009252	0.5914	100.13
EAB-57-9471	25.64	25.71	23.66	13.95	11.05	.	.	.	101.80
EAB-57-9471	21.74	25.88	25.36	15.07	11.95	80	0.013724	0.8208	98.61
ECG-56-8967	28.73	20.03	22.25	15.28	13.71	.	.	.	112.56
ECG-56-8967	24.57	18.99	25.61	19.25	11.58	55	0.008074	0.4382	124.25
ECG-56-8967	17.83	15.51	26.22	24.00	16.45	.	.	.	122.02
ECG-56-8967	20.36	16.64	26.55	20.73	15.72	58	0.006572	0.3553	123.61
ECG-56-8967	18.58	13.51	26.65	23.48	17.77	.	.	.	103.17
ECG-56-8967	14.72	12.44	23.78	24.04	25.01	59	0.009346	0.5051	107.09
F_S-82-1006	30.58	19.22	19.49	15.34	15.38	.	.	.	126.60
F_S-82-1006	25.31	15.97	18.05	18.97	21.70	25	0.016926	0.6163	125.56
F_S-82-1006	25.51	15.72	18.15	18.86	21.77	.	.	.	123.89
F_S-82-1006	23.08	14.97	19.49	17.96	24.51	54	0.008184	0.5371	121.13
F_S-82-1006	23.81	15.80	19.43	18.39	22.56	.	.	.	116.10
F_S-82-1006	21.15	12.46	16.12	18.35	31.91	62	0.01035	1.0969	121.17

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2b	HDL2a	HDL3a	HDL 3b	HDL 3c	Lagtime	Rate	Max	paraox
G_J-62-5517	23.50	17.61	22.21	18.73	17.94	.	.	.	77.79
G_J-62-5517	32.28	16.24	19.41	14.77	17.30	74	0.013546	0.7009	60.38
G_J-62-5517	32.13	15.97	19.90	15.13	16.87	.	.	.	61.70
G_J-62-5517	33.23	15.63	20.33	14.42	16.39	89	0.010252	0.7647	56.90
G_J-62-5517	30.71	14.83	19.23	15.09	20.13	.	.	.	65.21
G_J-62-5517	24.33	15.02	20.65	17.32	22.68	43	0.012716	0.6258	64.09
GAH-13-6357	31.47	16.29	17.05	16.08	19.11	.	.	.	126.81
GAH-13-6357	29.03	16.37	15.12	16.78	22.71	90	0.009546	0.5679	121.10
GAH-13-6357	26.26	16.55	17.67	16.33	23.19	.	.	.	130.20
GAH-13-6357	25.71	15.36	18.14	16.61	24.18	60	0.012508	0.7096	125.53
GAH-13-6357	23.72	14.89	18.14	17.72	25.54	.	.	.	139.22
GAH-13-6357	23.98	15.20	18.05	17.65	25.13	49	0.011378	0.6163	140.63
GLG-27-2176	39.95	20.86	19.44	10.35	9.40	.	.	.	99.66
GLG-27-2176	39.04	22.25	19.85	10.19	8.66	116	0.01347	0.794	106.66
GLG-27-2176	33.48	23.83	21.75	11.43	9.51	.	.	.	109.44
GLG-27-2176	34.47	23.06	20.02	11.64	10.81	95	0.011378	0.7668	110.67
GLG-27-2176	40.09	23.78	18.32	10.88	6.92	.	.	.	102.76
GLG-27-2176	29.07	26.08	22.08	13.75	9.01	60	0.015972	0.8956	100.08
GML-84-1785	25.20	15.16	18.12	17.41	24.12	.	.	.	73.04
GML-84-1785	21.83	15.97	19.19	18.19	24.82	83	0.012832	0.7062	80.18
GML-84-1785	23.77	16.36	18.77	17.57	23.53	.	.	.	80.96
GML-84-1785	21.59	17.13	19.86	17.48	23.93	77	0.012774	0.7352	74.26
GML-84-1785	18.54	16.12	21.87	18.36	25.11	.	.	.	85.23
GML-84-1785	20.46	16.31	21.40	18.67	23.17	69	0.011528	0.7031	77.87
GOB-90-9808	32.33	14.04	17.23	16.38	20.03	.	.	.	90.30
GOB-90-9808	22.38	15.82	19.40	18.91	23.49	66	0.005354	0.3116	85.07
GOB-90-9808	25.23	14.64	20.15	20.13	19.85	.	.	.	91.59
GOB-90-9808	21.92	16.97	21.62	19.59	19.91	75	0.010704	0.564	77.96
GOB-90-9808	18.03	23.06	25.65	18.67	14.59	.	.	.	87.93
GOB-90-9808	21.36	21.56	26.83	18.34	11.91	68	0.009952	0.5648	94.16
GWA-98-6492	24.75	18.64	20.00	16.37	20.23	.	.	.	67.33
GWA-98-6492	23.41	18.17	20.07	15.96	22.39	55	0.0156	0.8201	61.50
GWA-98-6492	21.68	17.74	20.38	16.44	23.76	.	.	.	69.89
GWA-98-6492	22.68	17.06	19.88	16.54	23.84	58	0.016096	0.8589	65.55
GWA-98-6492	22.49	17.74	19.48	16.07	24.22	.	.	.	65.62
GWA-98-6492	19.43	18.43	20.75	17.17	24.22	77	0.010842	0.5951	64.01
H_J-32-0201	20.19	13.99	16.87	20.95	28.00	.	.	.	.
H_J-32-0201	18.04	13.27	19.26	21.81	27.61	79	0.015	0.843	.
H_J-32-0201	15.09	12.47	18.99	21.36	32.10	.	.	.	.
H_J-32-0201	15.07	11.85	18.97	20.90	33.21	710	0.0082	0.559	.
H_J-32-0201	15.14	12.56	21.13	20.46	30.70	.	.	.	.
H_J-32-0201	14.94	12.54	21.29	20.36	30.87	113	0.011	0.736	.
HPB-70-2696	23.02	14.79	16.18	18.00	28.00	.	.	.	74.06
HPB-70-2696	18.46	14.69	19.23	20.95	26.67	133	0.011694	0.9397	.
HPB-70-2696	15.14	12.00	19.95	20.65	32.25	.	.	.	70.42
HPB-70-2696	13.56	13.30	19.86	20.99	32.29	105	0.01301	0.8339	70.80
HPB-70-2696	15.41	13.58	22.33	20.43	28.25	.	.	.	67.41
HPB-70-2696	16.35	12.86	22.39	22.86	25.54	104	0.013758	0.7677	65.57
IGH-88-3817	38.23	15.53	20.61	15.78	9.86	.	.	.	114.07
IGH-88-3817	34.74	17.31	21.35	15.10	11.49	51	0.013671	0.7882	107.80
IGH-88-3817	33.94	17.48	19.26	16.08	13.24	.	.	.	110.91
IGH-88-3817	38.06	16.93	19.13	14.17	11.71	77	0.014634	0.8796	109.54
IGH-88-3817	35.60	16.19	20.50	14.96	12.76	.	.	.	116.17
IGH-88-3817	41.59	16.89	19.47	12.32	9.73	55	0.015747	0.8579	113.30
JAB-37-6390	26.68	17.93	20.74	16.89	17.77	.	.	.	80.73
JAB-37-6390	24.98	16.46	20.79	18.09	19.68	76	0.00977	0.6384	78.79
JAB-37-6390	23.30	17.96	18.94	17.28	22.51	.	.	.	87.48
JAB-37-6390	24.22	14.23	18.73	20.69	22.13	83	0.013402	0.7122	56.95
JAB-37-6390	26.31	14.86	16.85	17.24	24.74	.	.	.	77.39
JAB-37-6390	29.37	13.43	17.33	17.36	22.52	71	0.010992	0.6338	70.83
JAB-72-0488	31.45	24.71	20.42	14.06	9.36	.	.	.	.
JAB-72-0488	26.96	26.97	21.08	14.76	10.22	107.3	0.002312	0.1967	.
JAB-72-0488	23.73	23.18	20.68	18.59	13.82	.	.	.	.
JAB-72-0488	32.33	21.88	19.84	14.16	11.80	90.94	0.002354	0.1895	.
JAB-72-0488	27.90	24.09	21.24	18.55	8.21	.	.	.	.
JAB-72-0488	28.09	25.47	21.49	16.47	8.49	213.8	0.002047	0.2555	.
JAD-52-9560	27.85	16.34	17.69	18.00	20.11	.	.	.	94.43
JAD-52-9560	25.84	15.99	17.54	18.90	21.73	147	0.014742	0.7448	92.13
JAD-52-9560	25.17	15.81	19.36	18.51	21.16	.	.	.	103.95
JAD-52-9560	25.41	16.46	21.60	18.05	18.48	105	0.012538	0.7921	99.34
JAD-52-9560	21.79	15.33	21.19	19.79	21.90	.	.	.	99.98
JAD-52-9560	18.78	15.33	21.91	20.89	23.09	85	0.014514	1.206	107.53

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2b	HDL2a	HDL3a	HDL 3b	HDL 3c	Lagtime	Rate	Max	paraox
JAL-68-1009	35.99	21.08	19.65	11.90	11.38	.	.	.	70.23
JAL-68-1009	29.48	19.08	20.74	13.33	17.37	.	.	.	73.12
JAL-68-1009	29.67	23.07	24.31	12.21	10.74	.	.	.	65.19
JAL-68-1009	32.67	24.08	23.52	12.56	7.17	.	.	.	78.39
JAL-68-1009	30.39	19.59	20.31	12.58	17.14	.	.	.	81.31
JAL-68-1009	27.10	16.61	19.24	14.74	22.31	.	.	.	81.96
JAM-68-6945	29.30	21.50	20.47	12.80	15.94	.	.	.	.
JAM-68-6945	18.89	18.84	23.79	15.84	22.64	82.14	0.005868	0.3145	.
JAM-68-6945	25.39	20.86	21.77	15.17	16.81	.	.	.	61.71
JAM-68-6945	28.63	22.62	24.38	12.85	11.53	75.54	0.00433	0.2526	76.60
JAM-68-6945	26.00	22.30	23.20	14.26	14.24	.	.	.	.
JAM-68-6945	29.82	19.24	21.24	11.88	17.81	94.8	0.004724	0.3257	.
JBG-37-0774	26.41	17.69	20.52	15.57	19.82	.	.	.	98.45
JBG-37-0774	23.82	16.64	21.01	17.34	21.20	53	0.007292	0.5848	90.78
JBG-37-0774	21.66	18.22	21.31	17.42	21.39	.	.	.	103.68
JBG-37-0774	19.90	15.89	19.24	18.76	26.21	76	0.010604	0.6379	94.66
JBG-37-0774	24.15	15.47	20.06	18.93	21.39	.	.	.	101.97
JBG-37-0774	25.28	15.73	19.11	18.22	21.66	75	0.006984	0.4066	107.62
JBT-31-2471	31.47	18.94	22.32	16.23	11.04	.	.	.	96.55
JBT-31-2471	24.39	17.55	22.10	17.30	18.66	.	.	.	91.61
JBT-31-2471	25.53	17.74	21.13	16.97	18.62	.	.	.	119.42
JBT-31-2471	31.24	18.77	20.60	15.16	14.23	73.74	0.005148	0.3185	102.48
JBT-31-2471	30.36	17.38	20.10	17.50	14.66	.	.	.	111.26
JBT-31-2471	26.06	14.93	21.38	18.32	19.30	70.62	0.00164	0.1336	115.53
JCK-90-6103	25.76	19.58	22.89	15.78	15.99	.	.	.	109.33
JCK-90-6103	20.88	18.95	21.50	18.26	20.42	80	0.0095	0.661	124.11
JCK-90-6103	20.01	19.51	24.53	17.03	18.92	.	.	.	132.00
JCK-90-6103	20.86	21.16	25.57	17.37	15.04	51	0.01042	0.633	130.63
JCK-90-6103	23.28	21.38	23.34	16.08	15.91	.	.	.	139.39
JCK-90-6103	25.49	22.45	23.86	14.97	13.23	56	0.010562	0.6268	98.16
JCR-19-0674	40.96	19.33	20.18	14.78	4.75	.	.	.	.
JCR-19-0674	44.27	19.49	19.26	12.72	4.26	196	0.0235	0.26	.
JCR-19-0674	40.07	19.28	20.57	14.09	5.99	.	.	.	.
JCR-19-0674	36.59	21.34	19.17	15.09	7.82	209	0.0099	1.04	.
JCR-19-0674	.	.	.	.	.	.	.	.	.
JCR-19-0674	.	.	.	.	.	.	.	.	.
JDL-57-0943	30.98	21.21	21.72	13.60	12.50	.	.	.	111.02
JDL-57-0943	35.27	20.17	19.58	14.15	10.84	75	0.011302	0.6829	113.76
JDL-57-0943	24.93	19.68	24.09	18.10	13.21	.	.	.	110.16
JDL-57-0943	28.94	20.64	22.05	15.47	12.91	82	0.010956	0.6573	109.51
JDL-57-0943	33.66	20.51	20.44	14.13	11.27	.	.	.	108.89
JDL-57-0943	23.16	19.58	21.73	17.75	17.77	71	0.00835	0.4821	110.51
JES-39-1460	43.38	16.37	15.97	14.66	9.62	.	.	.	99.87
JES-39-1460	50.14	16.32	15.68	16.12	1.74	68	0.008086	0.4316	97.79
JES-39-1460	48.96	18.93	17.92	13.68	0.51	.	.	.	97.39
JES-39-1460	45.04	19.14	19.25	14.97	1.59	93	0.009202	0.5743	97.91
JES-39-1460	40.52	17.42	18.14	14.65	9.28	.	.	.	104.97
JES-39-1460	42.50	18.04	18.05	13.48	7.93	78	0.011442	0.7444	92.56
JET-64-1777	36.45	19.32	22.52	12.42	9.30	.	.	.	71.62
JET-64-1777	30.59	20.32	25.97	14.16	8.96	192	0.014248	0.8186	70.89
JET-64-1777	33.35	24.22	24.15	12.08	6.20	.	.	.	70.50
JET-64-1777	33.47	24.93	22.66	11.86	7.09	86	0.01357	0.8272	77.23
JET-64-1777	24.51	23.54	28.24	15.82	7.89	.	.	.	81.91
JET-64-1777	31.78	22.22	26.37	13.90	5.73	86	0.013302	0.7823	81.24
JHW-52-1222	24.39	17.38	21.83	18.75	17.65	.	.	.	105.75
JHW-52-1222	20.64	15.58	22.85	19.75	21.17	66	0.009124	0.5369	108.28
JHW-52-1222	15.47	14.54	25.42	25.01	19.57	.	.	.	109.54
JHW-52-1222	16.32	15.71	25.37	23.96	18.64	89	0.009856	0.5786	117.80
JHW-52-1222	19.26	14.95	24.78	22.53	18.48	.	.	.	107.75
JHW-52-1222	12.58	15.11	25.98	25.65	20.68	62	0.010644	0.645	99.04
JLD-82-6128	25.45	24.82	31.49	14.80	3.44	.	.	.	110.00
JLD-82-6128	9.09	12.97	36.97	31.15	9.82	53	0.01197	0.7419	111.93
JLD-82-6128	7.85	13.52	37.12	30.07	11.44	.	.	.	120.94
JLD-82-6128	7.97	13.05	35.65	30.49	12.84	66	0.01036	0.6879	115.47
JLD-82-6128	9.82	14.68	33.84	28.54	13.11	.	.	.	106.73
JLD-82-6128	11.28	12.65	36.65	29.36	10.06	150	0.005248	1.0061	108.77
JLK-24-2936	22.46	16.27	17.81	18.09	25.37	.	.	.	96.33
JLK-24-2936	19.82	14.50	18.25	19.37	28.06	84	0.00949	0.6618	102.27
JLK-24-2936	19.21	14.85	18.30	18.64	29.00	.	.	.	102.81
JLK-24-2936	19.28	14.62	18.58	18.39	29.13	88	0.012058	0.6935	90.93
JLK-24-2936	25.21	16.86	19.88	17.70	20.35	.	.	.	97.96
JLK-24-2936	22.58	16.76	19.81	18.64	22.20	73	0.011756	0.6862	.

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2b	HDL2a	HDL3a	HDL 3b	HDL 3c	Lagtime	Rate	Max	paraox
JMG-24-4026	25.93	16.68	20.89	18.86	17.64	.	.	.	140.85
JMG-24-4026	14.66	15.16	21.59	22.53	26.07	56	0.007938	0.5072	141.50
JMG-24-4026	13.28	13.04	20.45	22.37	30.86	.	.	.	150.05
JMG-24-4026	13.58	14.00	20.75	20.56	31.12	52	0.00787	0.5404	147.47
JMG-24-4026	15.51	14.07	22.38	21.63	26.41	.	.	.	149.37
JMG-24-4026	11.95	13.49	22.80	22.68	29.08	82	0.010496	1.0718	128.33
JMP-04-5284	32.64	19.57	19.12	14.47	14.20	.	.	.	110.34
JMP-04-5284	31.38	19.88	19.30	14.28	15.16	79	0.007686	0.5577	110.23
JMP-04-5284	31.32	19.96	18.50	13.76	16.46	.	.	.	114.35
JMP-04-5284	30.21	21.77	19.51	14.36	14.15	66	0.009584	0.6442	115.22
JMP-04-5284	25.48	21.40	22.83	15.94	14.35	.	.	.	117.44
JMP-04-5284	25.72	24.13	23.84	13.63	12.67	59	0.010892	0.6224	117.50
JTM-15-3065	12.89	14.06	30.06	26.12	16.88	.	.	.	98.34
JTM-15-3065	17.07	13.20	24.10	25.43	20.20	52	0.016974	0.8377	95.42
JTM-15-3065	14.60	12.02	27.62	26.53	19.25	.	.	.	91.10
JTM-15-3065	11.92	11.44	29.96	29.52	17.16	60	0.013864	0.7311	89.21
JTM-15-3065	15.69	10.90	26.55	27.37	19.50	.	.	.	92.38
JTM-15-3065	16.80	12.46	26.27	25.48	18.98	75	0.014406	0.7623	93.93
JWH-27-7128	25.63	19.03	20.83	16.57	17.95	.	.	.	97.60
JWH-27-7128	25.77	18.36	21.31	17.23	17.33	81	0.010008	0.5819	98.66
JWH-27-7128	29.42	19.30	19.00	15.52	16.75	.	.	.	104.28
JWH-27-7128	30.40	20.18	20.22	15.04	14.16	67	0.01051	0.5194	99.67
JWH-27-7128	27.67	18.39	20.68	16.04	17.22	.	.	.	109.00
JWH-27-7128	29.55	17.40	20.98	16.01	16.07	70	0.01051	0.5752	100.65
JWM-84-9528	45.41	18.83	15.14	9.23	11.39	.	.	.	110.52
JWM-84-9528	47.12	18.58	14.62	8.62	11.07	95	0.009538	0.5995	106.44
JWM-84-9528	51.22	18.05	13.18	8.06	9.49	.	.	.	108.53
JWM-84-9528	46.20	18.90	15.05	9.33	10.53	120	0.008572	0.7467	112.62
JWM-84-9528	48.17	18.40	15.15	8.61	9.68	.	.	.	99.97
JWM-84-9528	46.24	18.58	15.36	9.01	10.81	134	0.007076	0.6146	95.66
K_W-02-8695	28.31	19.06	19.95	14.95	17.73	.	.	.	84.92
K_W-02-8695	25.89	16.33	18.14	17.01	22.63	50	0.01018	0.6624	111.06
K_W-02-8695	22.21	14.96	18.51	17.84	26.48	.	.	.	102.23
K_W-02-8695	20.05	14.06	17.80	18.76	29.32	81	0.008628	0.4813	92.48
K_W-02-8695	18.11	11.92	15.98	20.68	33.30	.	.	.	98.14
K_W-02-8695	18.16	11.92	14.53	18.20	37.18	82	0.010184	0.5898	106.36
KFW-35-5107	33.11	20.55	19.65	11.25	15.43	.	.	.	62.77
KFW-35-5107	33.85	20.58	21.99	11.44	12.13	122	0.011	0.86	83.45
KFW-35-5107	33.12	20.81	21.88	11.25	12.93	.	.	.	80.53
KFW-35-5107	34.12	19.52	20.13	12.72	13.50	75	0.007	0.399	75.07
KFW-35-5107	36.60	18.15	19.70	12.32	13.23	.	.	.	61.30
KFW-35-5107	39.04	19.65	18.71	10.05	12.56	114	0.009	0.628	69.77
LBT-66-9014	34.56	23.65	21.39	12.02	8.38	.	.	.	126.97
LBT-66-9014	14.43	20.27	28.40	22.17	14.74	103	0.009222	0.6712	129.96
LBT-66-9014	18.12	19.53	23.35	20.83	18.18	.	.	.	127.12
LBT-66-9014	14.63	17.61	25.03	20.30	22.44	75	0.01428	0.9447	137.26
LBT-66-9014	8.49	15.73	26.37	24.98	24.42	.	.	.	127.64
LBT-66-9014	14.49	17.09	29.02	23.38	16.04	149	0.009096	0.7742	129.40
LCF-94-1044	33.75	21.03	18.59	14.05	12.58	.	.	.	76.03
LCF-94-1044	28.66	21.18	19.60	16.05	14.52	63	0.0076	0.493	79.37
LCF-94-1044	31.21	20.92	18.70	15.32	13.85	.	.	.	90.32
LCF-94-1044	33.41	21.21	18.06	16.56	10.76	63	0.0087	0.525	97.19
LCF-94-1044	24.63	19.91	20.86	18.83	15.77	.	.	.	83.30
LCF-94-1044	24.81	20.90	21.24	20.32	12.73	81.5	0.0052	0.343	92.47
LCO-51-7401	25.50	18.28	21.74	17.75	16.73	.	.	.	97.08
LCO-51-7401	23.95	16.25	21.68	18.59	19.52	89	0.008422	0.5386	106.80
LCO-51-7401	21.51	15.19	21.30	20.53	21.48	.	.	.	98.28
LCO-51-7401	23.70	15.72	18.60	18.94	23.04	140	0.005034	0.359	90.93
LCO-51-7401	21.08	15.52	19.33	19.04	25.04	.	.	.	100.80
LCO-51-7401	19.36	16.03	20.73	21.58	22.30	100	0.003132	0.2272	102.58
LJC-76-4231	24.32	17.76	22.35	19.85	15.71	.	.	.	61.28
LJC-76-4231	24.43	16.25	21.56	20.63	17.14	194.7	0.0016	0.1404	76.05
LJC-76-4231	26.32	17.25	21.23	19.45	15.76	.	.	.	72.08
LJC-76-4231	27.97	16.53	20.30	20.43	14.77	187.6	0.01	0.614	65.54
LJC-76-4231	28.93	16.83	20.06	19.46	14.72	.	.	.	66.45
LJC-76-4231	30.75	18.56	21.74	16.95	12.00	282.8	0.009	0.461	66.02
MJB-02-2375	36.69	18.84	20.09	12.67	11.71	.	.	.	70.75
MJB-02-2375	29.79	17.13	20.26	15.86	16.95	103	0.007348	0.5393	71.28
MJB-02-2375	24.15	16.81	23.49	18.11	17.44	.	.	.	73.30
MJB-02-2375	28.34	18.41	22.77	16.96	13.52	86	0.007116	0.4492	74.41
MJB-02-2375	17.07	14.05	22.82	25.28	20.78	.	.	.	73.37
MJB-02-2375	20.78	16.18	25.02	21.78	16.24	81	0.008062	0.4998	69.32
MLL-68-3135	47.67	25.36	14.97	8.22	3.79	.	.	.	72.74
MLL-68-3135	43.28	26.18	16.56	9.14	4.83	247.9	0.005	0.506	74.63
MLL-68-3135	45.48	21.23	16.22	9.03	8.04	.	.	.	82.11
MLL-68-3135	49.98	24.97	14.97	7.05	3.03	399.8	0.005	0.431	89.50
MLL-68-3135	53.14	22.04	11.98	8.83	4.01	.	.	.	70.68
MLL-68-3135	48.56	27.68	14.95	6.58	2.23	161.2	0.005	0.414	70.10
MLS-82-5875	36.39	20.46	19.71	15.52	7.92	.	.	.	70.60
MLS-82-5875	32.11	17.84	17.26	15.06	17.73	.	.	.	72.79
MLS-82-5875	31.71	18.04	17.34	15.51	17.40	.	.	.	73.92
MLS-82-5875	31.41	17.93	17.80	15.38	17.47	149	0.012336	0.8832	71.98

APPENDIX F
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MLS-82-5875	28.12	17.94	19.83	17.95	16.15	.	.	.	79.87
MLS-82-5875	21.73	17.44	21.47	21.17	18.19	90	0.0114	0.8522	77.51

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2b	HDL2a	HDL3a	HDL 3b	HDL 3c	Lagtime	Rate	Max	paraox
MWB-82-6035	27.59	17.22	20.49	15.68	19.02	.	.	.	122.84
MWB-82-6035	26.06	18.81	22.21	15.56	17.38	71	0.014164	0.8207	.
MWB-82-6035	33.26	23.69	19.66	13.34	10.05	.	.	.	121.83
MWB-82-6035	32.49	25.15	20.61	13.28	8.47	66	0.012054	0.7921	124.32
MWB-82-6035	33.12	24.64	20.40	13.16	8.68	.	.	.	132.49
MWB-82-6035	32.83	21.59	20.19	14.75	10.64	91	0.011518	0.7292	123.92
PJB-43-3639	27.39	20.16	21.95	15.75	14.74	.	.	.	84.76
PJB-43-3639	24.24	19.56	22.80	17.23	16.17	40	0.01485	0.7385	83.56
PJB-43-3639	24.91	27.86	26.03	13.25	7.95	.	.	.	85.83
PJB-43-3639	21.95	24.23	25.62	15.51	12.70	56	0.009692	0.536	88.23
PJB-43-3639	23.37	24.21	25.07	15.14	12.21	.	.	.	89.07
PJB-43-3639	22.50	23.94	25.06	15.61	12.89	45	0.013862	0.7195	89.51
PJD-13-4775	28.37	19.69	22.58	15.88	13.48	.	.	.	100.77
PJD-13-4775	25.90	19.54	22.92	17.05	14.58	30	0.015074	0.6575	91.24
PJD-13-4775	25.95	20.33	22.16	16.60	14.96	.	.	.	91.73
PJD-13-4775	26.97	20.40	24.81	15.45	12.36	42	0.011882	0.6133	86.44
PJD-13-4775	23.81	19.13	24.28	16.35	16.43	.	.	.	84.81
PJD-13-4775	30.64	17.69	22.91	15.15	13.61	36	0.01365	0.6686	82.57
R_D-70-0888	39.97	23.25	18.11	8.72	9.96	.	.	.	65.77
R_D-70-0888	30.65	20.93	15.85	11.89	20.68	134	0.00741	0.634	61.57
R_D-70-0888	33.55	19.71	19.17	11.17	16.40	.	.	.	77.73
R_D-70-0888	51.03	21.22	18.36	5.08	4.32	238	0.0075	0.543	81.02
R_D-70-0888	44.50	22.54	19.39	8.96	4.61	.	.	.	59.39
R_D-70-0888	45.92	24.29	16.29	8.11	5.39	905	0.0039	0.281	77.58
R_G-92-3746	23.70	19.84	23.47	18.35	14.64	.	.	.	47.31
R_G-92-3746	9.57	15.82	24.19	24.89	25.53	122.4	0.0027	0.096	46.00
R_G-92-3746	18.52	16.92	24.19	20.61	19.77	.	.	.	49.20
R_G-92-3746	20.16	19.73	23.70	19.24	17.17	102.97	0.0024	0.361	48.38
R_G-92-3746	14.82	14.19	23.74	23.56	23.70	.	.	.	54.08
R_G-92-3746	11.44	14.19	28.59	24.56	21.22	103.4	0.01	0.526	52.66
R_M-92-9942	33.29	21.74	19.55	10.38	15.04	.	.	.	60.75
R_M-92-9942	20.48	23.60	25.41	15.99	14.52	61.5	0.0092	0.45	42.43
R_M-92-9942	28.89	26.51	21.42	11.61	11.57	.	.	.	69.39
R_M-92-9942	37.44	29.79	23.86	3.10	5.80	53.4	0.009	0.542	76.90
R_M-92-9942	34.55	25.59	30.12	6.60	3.14	.	.	.	87.22
R_M-92-9942	33.37	21.47	22.53	7.15	15.48	43.84	0.0062	0.3852	72.77
RAS-47-7434	34.91	21.90	21.62	12.03	9.53	.	.	.	122.31
RAS-47-7434	29.03	20.37	22.77	14.02	13.80	71	0.01154	0.6263	110.32
RAS-47-7434	28.21	20.54	25.72	15.99	9.55	.	.	.	126.55
RAS-47-7434	24.91	18.93	23.70	17.85	14.61	81	0.009938	0.6113	121.11
RAS-47-7434	28.60	18.55	22.69	17.29	12.87	.	.	.	124.97
RAS-47-7434	27.31	20.22	22.03	15.29	15.15	107	0.008322	0.5164	144.09
RAW-58-9624	25.13	16.88	21.31	16.68	20.00	.	.	.	89.42
RAW-58-9624	23.17	17.65	23.00	16.71	19.48	63	0.013942	0.7884	85.32
RAW-58-9624	21.58	16.47	21.73	17.27	22.95	.	.	.	89.08
RAW-58-9624	23.45	17.36	22.11	16.19	20.90	62	0.014568	0.8011	86.23
RAW-58-9624	23.89	19.10	22.53	15.75	18.73	.	.	.	78.18
RAW-58-9624	25.63	17.57	22.39	16.07	18.34	71	0.01154	0.6726	74.94
RDS-94-2909	16.77	8.81	24.39	25.33	24.69	.	.	.	63.25
RDS-94-2909	18.64	7.95	23.89	24.05	25.47	84	0.01134	0.6432	72.41
RDS-94-2909	25.45	12.99	19.72	19.43	22.40	.	.	.	83.01
RDS-94-2909	20.33	14.47	20.17	19.75	25.28	71	0.016494	0.8651	83.96
RDS-94-2909	17.94	7.06	19.57	27.39	28.04	.	.	.	89.89
RDS-94-2909	13.44	2.47	17.32	33.24	33.52	68	0.016646	0.9624	80.15
REJ-42-1333	24.56	20.15	23.76	17.20	14.33	.	.	.	105.21
REJ-42-1333	17.07	20.06	24.75	19.81	18.31	171	0.005814	0.7257	118.77
REJ-42-1333	14.26	20.59	26.09	20.80	18.27	.	.	.	122.11
REJ-42-1333	14.93	18.93	25.98	21.00	19.15	183	0.006372	0.8693	109.37
REJ-42-1333	17.88	20.38	27.15	19.91	14.67	.	.	.	110.72
REJ-42-1333	16.88	19.48	26.97	20.10	16.57	218	0.00504	0.7243	109.12
RLB-90-6883	44.34	15.55	15.30	10.04	14.76	.	.	.	86.97
RLB-90-6883	37.37	19.25	16.37	10.51	16.49	82	0.01311	0.6688	.
RLB-90-6883	33.81	17.79	19.02	11.90	17.47	.	.	.	84.12
RLB-90-6883	34.53	17.38	19.01	11.59	17.49	80	0.010634	0.7287	83.78
RLB-90-6883	34.96	18.90	19.44	10.47	16.23	.	.	.	89.94
RLB-90-6883	39.23	16.91	17.25	10.27	16.35	72	0.012206	0.823	96.16
RPM-35-9363	11.97	4.81	24.52	36.60	22.10	.	.	.	88.31
RPM-35-9363	11.64	4.54	22.22	35.58	26.03	205	0.005162	0.7716	86.33
RPM-35-9363	9.10	5.73	23.80	36.52	24.85	.	.	.	90.90
RPM-35-9363	9.02	6.36	21.17	36.84	26.62	214	0.005976	0.8917	88.02
RPM-35-9363	10.77	5.92	19.49	35.18	28.63	.	.	.	80.54
RPM-35-9363	12.32	6.10	22.01	32.65	26.92	243	0.003934	0.6113	73.01

APPENDIX F
RAW OXIDATION AND HDL SIZE DATA FOR CHAPTER 5

SubjectID	HDL2b	HDL2a	HDL3a	HDL 3b	HDL 3c	Lagtime	Rate	Max	paraox
SAD-00-8872	46.45	17.89	13.85	10.73	11.08	.	.	.	71.91
SAD-00-8872	36.94	20.77	17.13	12.92	12.24	77	0.013228	0.7825	67.52
SAD-00-8872	38.13	20.23	17.48	12.44	11.73	.	.	.	73.47
SAD-00-8872	47.73	20.41	13.94	9.79	8.13	65	0.01594	0.8568	71.67
SAD-00-8872	40.46	20.39	16.87	11.98	10.29	.	.	.	94.40
SAD-00-8872	31.06	21.06	20.48	16.01	11.39	65	0.017094	0.9627	96.85
SCM-35-5124	27.10	22.70	22.46	14.68	13.05	.	.	.	119.27
SCM-35-5124	23.19	24.16	26.64	16.31	9.70	52	0.015826	0.8808	110.54
SCM-35-5124	18.45	23.53	28.07	17.48	12.47	.	.	.	111.55
SCM-35-5124	16.76	24.32	28.29	17.48	13.16	58	0.014112	0.7847	109.17
SCM-35-5124	17.87	21.34	25.91	18.29	16.58	.	.	.	107.35
SCM-35-5124	18.12	20.58	26.51	19.19	15.60	91	0.01132	0.6231	106.06
SGC-98-6374	39.04	29.74	20.09	8.17	2.95	.	.	.	91.38
SGC-98-6374	29.07	27.01	25.55	13.68	4.69	63	0.008918	0.7668	82.93
SGC-98-6374	22.44	16.05	26.06	20.09	15.35	.	.	.	83.01
SGC-98-6374	13.89	8.65	9.90	16.04	51.52	132	0.00833	0.465	84.78
SGC-98-6374	25.48	13.50	11.56	12.75	36.71	.	.	.	89.30
SGC-98-6374	24.12	14.30	12.19	14.63	34.76	80.5	0.007538	0.4405	95.95
SHS-48-1211	21.50	16.97	18.52	17.23	25.78	.	.	.	81.90
SHS-48-1211	17.85	15.78	19.64	18.34	28.39	75	0.010195	0.5965	77.64
SHS-48-1211	20.87	15.82	17.81	17.06	28.44	.	.	.	80.31
SHS-48-1211	12.57	15.26	19.74	19.85	32.58	78	0.00902	0.5742	76.02
SHS-48-1211	19.50	16.90	17.13	18.30	28.17	.	.	.	76.60
SHS-48-1211	15.14	13.60	18.12	21.44	31.70	76	0.009088	0.5905	74.07
SPH-53-4229	33.14	20.43	19.95	13.87	12.61	.	.	.	56.58
SPH-53-4229	30.37	17.67	19.11	16.79	16.06	242	0.002	0.339	53.93
SPH-53-4229	30.80	19.05	19.51	17.10	13.54	.	.	.	66.61
SPH-53-4229	29.27	17.43	20.05	16.62	16.64	174	0.005	0.351	54.12
SPH-53-4229	27.18	17.35	20.39	17.22	17.86	.	.	.	46.08
SPH-53-4229	15.28	18.87	23.28	19.67	22.90	124	0.005	0.369	57.51
SRC-74-4595	25.38	15.85	17.04	15.98	25.75	.	.	.	78.27
SRC-74-4595	22.66	14.51	17.82	17.46	27.54	58	0.012014	0.6476	75.14
SRC-74-4595	19.35	14.36	17.31	19.82	29.16	.	.	.	84.96
SRC-74-4595	17.70	14.96	18.85	19.45	29.04	46	0.01318	0.5597	84.56
SRC-74-4595	22.68	15.38	17.68	18.28	25.97	.	.	.	89.00
SRC-74-4595	20.68	14.41	18.66	18.92	27.32	60	0.009066	0.5098	88.90
TLM-74-2189	20.21	17.68	29.55	21.30	11.27	.	.	.	77.18
TLM-74-2189	14.43	12.28	35.94	24.32	13.03	56	0.016006	0.8444	74.49
TLM-74-2189	16.12	14.49	24.73	25.67	19.00	.	.	.	82.68
TLM-74-2189	10.17	12.14	28.95	26.33	22.40	50	0.015592	0.8512	81.45
TLM-74-2189	18.59	13.46	23.76	22.70	21.50	.	.	.	72.17
TLM-74-2189	22.20	14.33	26.67	20.63	16.17	71	0.013866	0.8145	68.07
TWB-57-9837	29.14	17.43	17.80	16.31	19.32	.	.	.	100.11
TWB-57-9837	22.81	16.41	20.60	20.12	20.06	70	0.010312	0.6174	92.78
TWB-57-9837	24.69	19.32	19.33	17.04	19.61	.	.	.	113.54
TWB-57-9837	24.82	18.51	18.82	17.03	20.82	78	0.00939	0.6546	101.44
TWB-57-9837	30.46	17.43	16.92	15.65	19.53	.	.	.	104.49
TWB-57-9837	23.29	16.38	18.41	17.20	24.71	77	0.00698	0.48	107.54
V_S-06-8525	27.89	15.45	19.05	14.57	23.04	.	.	.	94.39
V_S-06-8525	14.73	12.30	20.27	16.27	36.44	84	0.011196	0.6587	96.77
V_S-06-8525	20.17	13.79	18.86	14.95	32.23	.	.	.	97.47
V_S-06-8525	23.43	15.08	17.84	15.36	28.29	80	0.01041	0.617	103.68
V_S-06-8525	18.64	22.08	16.75	13.16	29.36	.	.	.	95.83
V_S-06-8525	22.25	18.01	20.45	12.35	26.94	83	0.009742	0.6089	89.18
W_H-56-8407	16.81	12.54	21.30	26.79	22.56	.	.	.	63.46
W_H-56-8407	18.77	11.79	19.74	26.65	23.05	.	.	.	66.09
W_H-56-8407	17.92	13.73	18.74	26.16	23.45	.	.	.	57.04
W_H-56-8407	18.12	13.52	18.27	26.73	23.36	.	.	.	63.26
W_H-56-8407	15.16	12.54	19.49	28.04	24.77	.	.	.	54.85
W_H-56-8407	16.16	11.14	20.78	28.40	23.52	.	.	.	65.50
WHS-67-7302	46.57	16.63	14.05	11.27	11.48	.	.	.	34.89
WHS-67-7302	47.54	16.55	15.12	10.35	10.45	92.8	0.0056	0.491	39.79
WHS-67-7302	45.86	16.49	14.96	10.33	12.35	.	.	.	35.65
WHS-67-7302	48.96	17.61	14.58	9.06	9.79	98.96	0.0099	0.661	39.86
WHS-67-7302	44.87	20.21	14.87	9.76	10.29	.	.	.	41.61
WHS-67-7302	47.76	18.54	13.80	8.96	10.94	69.7	0.0098	0.472	40.83
WJP-80-2929	19.46	19.74	40.59	17.53	2.67	.	.	.	129.66
WJP-80-2929	12.57	14.38	42.05	25.30	5.69	77	0.009694	0.626	114.23
WJP-80-2929	9.40	17.66	49.65	21.01	2.27	.	.	.	138.16
WJP-80-2929	12.67	16.40	44.30	22.36	4.26	87	0.009096	0.6529	134.36
WJP-80-2929	20.55	15.05	36.33	21.66	6.41	.	.	.	128.79
WJP-80-2929	15.94	12.48	40.19	26.05	5.33	70	0.3958	0.006092	134.73
Y_S-85-4659	43.65	20.44	17.45	10.70	7.76	.	.	.	81.96
Y_S-85-4659	39.46	19.42	17.25	13.05	10.82	17	0.016946	0.8292	91.45
Y_S-85-4659	41.52	21.84	18.41	11.19	7.04	.	.	.	84.05
Y_S-85-4659	37.87	20.37	18.40	13.29	10.08	46	0.019926	1.0536	82.20
Y_S-85-4659	35.85	23.63	19.20	12.94	8.38	.	.	.	93.76
Y_S-85-4659	38.03	22.12	19.69	11.90	8.26	17	0.017874	0.8827	88.54

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