Effect of rosuvastatin on obesity-induced cardiac oxidative stress in Wistar rats—A preliminary study

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The prevalence of obesity has been rising alarmingly and it has now become a global concern causing enormous economic burden on the health care system. Obesity is generally linked to complications in lipid metabolism and oxidative stress. The aim of the present study was to investigate the effect of rosuvastatin (10 mg/kg, po) on obesity-induced oxidative stress in high fat-fed Wistar rats. Oral administration of rosuvastatin (10 mg/kg) for 21 days along with high fat diet brought about significant elevation in serum high density lipoprotein and cardiac antioxidant enzymes levels (superoxide dismutase, catalase, glutathione, glutathione peroxidase, glutathione peroxidase-, glutathione reductase- and glutathione-S-transferase) while decreasing in serum lactate dehydrogenase, apolipoprotein-B, lipids (triglycerides, total cholesterol, low density lipoprotein-cholesterol, very low density lipoprotein-cholesterol and atherogenic index) and cardiac thiobarbituric acid reactive substances levels. The results were comparable with orlistat, a standard antiobesity drug. These preliminary results for the first time demonstrate that administration of rosuvastatin can be beneficial for the suppression of obesity-induced oxidative stress and dyslipidemia in high fat-fed Wistar rats.

Keywords: Antioxidants, Apo-B, High fat diet, LDH, Lipid peroxides, Obesity

The prevalence of obesity has been rising alarmingly and it has now become a global concern causing severe burden on health care systems, with readily available effective therapies or preventive measures in demand. In conjunction with alarming rise in obesity to epidemic proportions, related complications such as insulin resistance, oxidative stress and inflammation represent a major risk factor for a number of chronic diseases including type-2 diabetes, cardiovascular diseases and cancer1.

Oxidative stress is an imbalance between tissue free radicals, reactive oxygen species (ROS) and antioxidants, and may be a key mechanism underlying obesity-related co-morbidities. Obesity-related sequelae can be a major cause for morbidity and premature mortality among obese persons. Oxidative stress is concerned in these sequelae and can be a potential target for clinical interventions2. Obesity has been shown to be one of the conditions that reduce antioxidant capacity by lowering the levels of antioxidant enzymes predominantly catalase, glutathione peroxidase (GPx) and glutathione reductase (GR)3.

Pharmacological agents are often used in the treatment of obesity. At present, there are only two Food and Drug Administration (FDA)—approved long-term-use antiobesity drugs viz. orlistat and sibutramine. Their use is often associated with gastrointestinal or cardiovascular and central nervous system side effects (elevated blood pressure, dry mouth, constipation, headache and insomnia)4,5. Thus, there is a need for the discovery and development of novel, safe, and effective drugs for the control and treatment of obesity.

Statins, inhibitors of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-Co A) reductase, are the most commonly used drugs for the management of hypercholesterolemia and have become standard medical remedy in the armamentarium available for the prevention and management of cardiovascular disease. Statins were first developed in order to lower total serum cholesterol and improve the lipid profile but have consequently been shown to put forth a variety of beneficial, ’pleiotropic’ effects, particularly related to cardiovascular disease, including improved endothelial function, reduced oxidative stress, less platelet adhesion and atherosclerotic plaque stabilisation6. The stability of tissues against oxidative stress in cardiovascular and lipid metabolic disorders

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is however improved by statins\textsuperscript{7}. Rosuvastatin (RSV), one of the newest agents in the statin class, seems to be the most potent in terms of LDL-C-lowering capacity and exhibits a substantial triglyceride-lowering effect as well\textsuperscript{8}. RSV has been reported to have antioxidant property in management of diabetes and cardio vascular disease\textsuperscript{2}. The effects of RSV on lipid metabolic disorders, predominantly hyperlipidemia and cardiovascular disorders have been reported in various research studies\textsuperscript{8}.

Antioxidants have been reported to play an important role in enhancement of antioxidant defense mechanisms in the obese rodent model\textsuperscript{5}. However, the effect of RSV on HFD-induced oxidative stress in obese rats has not yet been investigated.

The purpose of the present study is to investigate the effect of rosuvastatin on HFD-induced oxidative stress in Wistar rats. Further, the results have been compared with orlistat, a standard antiobesity drug.

Materials and Methods

**Animals**—After approval from the Institutional Animal Ethics Committee (IAEC) for conducting the study the guidelines of committee for the purpose of control and supervision of experiments on animals (CPCSEA), Govt. of India were followed. Wistar female albino rats (150–200 g) were procured from Central Animal House Facility, Hamdard University, New Delhi and housed in standard polypropylene cages (5 in each cage) and maintained under controlled room temperature (25°±2°C) and relative humidity (50 ± 15%) with 12 h/12 h light/dark (day/night) cycle. All the rats were provided with commercially available normal pellet diet (Amrut Rat Feed, manufactured by Nav Maharashtra Chakan Oil Mills Ltd., Delhi, India) and water \textit{ad libitum}, prior to the dietary manipulation.

**Baseline characteristics of obesity induced by high fat diet (HFD) in Wistar rats**—Rats were maintained on normal pellet diet (NPD) for one week before the commencement of experiment. After one week, rats were randomly assigned into normal and obese groups and fed with NPD and HFD \textit{ad libitum}, respectively, for 1 week.

The food intake, body weight, BMI and biochemical estimations (serum insulin, blood glucose, total cholesterol, triglycerides and high density lipoprotein) were carried out on day 8 of dietary manipulation to assess the baseline characteristics of obesity induced by HFD in Wistar rats.

**Administration modality**—All the rats were divided randomly into following 6 groups of 10 animals each: Group-I (normal control)-rats were fed with normal pellet diet for 28 days; Group-II (high fat diet, HFD control)- rats were fed with HFD (\textit{ad libitum}) for 28 days orally\textsuperscript{10}; Group-III (HFD + RSV)-rats were fed with HFD for a period of 28 days + from 8\textsuperscript{th} day RSV 10 mg/kg orally to 28\textsuperscript{th} day; Group-IV (HFD + orlistat)-rats were fed with HFD for a period of 28 days + from 8\textsuperscript{th} day orlistat (10 mg/kg, po) to 28\textsuperscript{th} day; Group-V (RSV \textit{per se})-rats were treated with normal pellet diet for a period of 28 days + from 8\textsuperscript{th} day, RSV 10 mg/kg to 28\textsuperscript{th} day orally; Group-VI (orlistat \textit{per se})-rats were treated with normal pellet diet for a period of 28 days + from 8\textsuperscript{th} day, orlistat 10 mg/kg to 28\textsuperscript{th} day orally.

The designed and standardized HFD containing\textsuperscript{9} (g/kg) (casein-342, L-cystine-3, starch-172, sucrose-172, cellulose-50, ground nut oil-25, tallow-190, AIN salt mix-35 and AIN vitamin mix-10) was procured from National Centre for Laboratory Animal Sciences (NCLAS), National Institute of Nutrition (NIN), Hyderabad, India. All other chemicals used were of analytical grade. Double distilled water was used for all biochemical assays.

**Assessment of biochemical parameters in serum**—Blood was collected from the retro-orbital plexus of overnight fasted rats using micro capillary tubes on 29\textsuperscript{th} day and serum was separated by centrifugation at 3000 rpm for 15 min. The rats were then sacrificed by cervical dislocation; heart tissues were dissected out, weighed and kept at −80°C.

The serum concentrations were measured with commercial kits; serum insulin-(Alpco Diagnostics, Salem, USA), blood glucose-(KEE GAD Biogen Pvt. Ltd, New Delhi, India), lactate dehydrogenase (LDH)-Reckon Diagnostics Pvt. Ltd., Baroda, Gujarat, India; apolipoprotein-B (Apo-B)-immunoturbidimetric immunoassay kit (Randox Laboratories Ltd., Antrim, UK); triglycerides (TGs) and total cholesterol (TC)-Span Diagnostics Ltd, Surat, Gujarat, India and high-density lipoprotein-cholesterol (HDL-C)-Reckon Diagnostics Pvt. Ltd., Baroda, Gujarat, India.

**Assessment of cardiac lipid peroxides (TBARS) contents**—Cardiac tissues were weighed and minced. Homogenates (10%) were prepared; in 0.15 M ice cold KCl for lipid peroxides and protein estimation; in 0.02 M EDTA for glutathione estimation; and in phosphate buffer (pH 7.4) for superoxide dismutase (SOD) and catalase (CAT) estimation in Teflon tissue
Lipid peroxides values were determined with spectrophotometric measurement of the amount of malondialdehyde equivalents with thiobarbituric acid and was expressed as thiobarbituric acid reactive substances (TBARS; nmol malondialdehyde/mg protein). Assumption of cardiac antioxidant enzymes contents—Antioxidant enzymes activities were determined in cardiac tissues homogenized with phosphate buffer saline at a pH of 7.4. Catalase (CAT), superoxide dismutase (SOD), glutathione (GSH), glutathione peroxidase (GPx), glutathione reductase (GR) and glutathione-S-transferase (GST) activities were estimated respectively.

Statistical analysis—Statistical analysis was carried out using Graphpad Prism 3.0 (Graphpad software; San Diego, CA). All the values were expressed as mean±SE (n=10). Groups of data were compared with the analysis of variance (ANOVA) followed by Dunnett’s test for multiple comparison of the two treatment groups with the control. Values were considered statistically significant when P<0.01.

Table 1—Effect of high fat diet on food intake, body weight gain, BMI, and biochemical parameters on day 8 after a 24-h fasting in Wistar rats
[Values are mean ± SE from 10 animals in each group]

<table>
<thead>
<tr>
<th>Group</th>
<th>NPD control</th>
<th>HFD control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food intake (g)</td>
<td>14.23 ± 0.87</td>
<td>15.60 ± 0.60</td>
</tr>
<tr>
<td>Body weight gain (g)</td>
<td>16.00 ± 0.95</td>
<td>34.00 ± 2.3*</td>
</tr>
<tr>
<td>Body mass index (BMI, Kg/m²)</td>
<td>4.13 ± 0.22</td>
<td>5.78 ± 0.35*</td>
</tr>
<tr>
<td>Insulin (µU/ml)</td>
<td>40.01 ± 2.40</td>
<td>60.14 ± 4.12*</td>
</tr>
<tr>
<td>Blood glucose (mg/dl)</td>
<td>118.16 ± 2.21</td>
<td>158.45 ± 1.34*</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>94.10 ± 1.85</td>
<td>112.98 ± 4.63*</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>72.00 ± 1.62</td>
<td>101.74 ± 2.14*</td>
</tr>
<tr>
<td>High density lipoprotein (mg/dl)</td>
<td>38.21 ± 1.91</td>
<td>30.76 ± 1.24*</td>
</tr>
</tbody>
</table>

NPD: normal pellet diet, HFD: high fat diet Unpaired Student’s t-test
*P<0.05 HFD vs. NPD control

Table 2—Effect of rosuvastatin (10 mg/kg, po) on serum LDH, Apo-B, TGs, TC and HDL-C levels in high fat-fed rats
[Values are mean ± SE from 10 animals in each group]

<table>
<thead>
<tr>
<th>Group</th>
<th>LDH (IU/l)</th>
<th>Apo-B (mg/dl)</th>
<th>TGs (mg/dl)</th>
<th>TC (mg/dl)</th>
<th>HDL-C (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gr.I (Normal control)</td>
<td>21.60 ± 3.47</td>
<td>4.65 ± 0.22</td>
<td>70.35 ± 1.32</td>
<td>93.66 ± 1.94</td>
<td>39.60 ± 1.83</td>
</tr>
<tr>
<td>Gr.II (HFD control)</td>
<td>52.34 ± 4.28*</td>
<td>20.13 ± 1.93*</td>
<td>156.06 ± 4.63*</td>
<td>167.06 ± 4.74*</td>
<td>23.28 ± 1.94*</td>
</tr>
<tr>
<td>Gr.III (HFD + RSV)</td>
<td>24.68 ± 2.90*</td>
<td>6.33 ± 0.83*</td>
<td>78.59 ± 2.83*</td>
<td>103.20 ± 2.18*</td>
<td>37.51 ± 2.41*</td>
</tr>
<tr>
<td>Gr.IV (HFD + orlistat)</td>
<td>22.95 ± 2.90*</td>
<td>5.85 ± 0.95*</td>
<td>72.96 ± 1.57*</td>
<td>96.96 ± 1.93*</td>
<td>38.74 ± 2.48*</td>
</tr>
<tr>
<td>Gr.V (RSV per se)</td>
<td>20.30 ± 4.26</td>
<td>4.38 ± 0.13*</td>
<td>64.20 ± 2.63</td>
<td>88.46 ± 1.88</td>
<td>42.66 ± 2.84</td>
</tr>
<tr>
<td>Gr.VI (Orlistat per se)</td>
<td>17.28 ± 2.52</td>
<td>4.08 ± 0.66</td>
<td>58.27 ± 4.11</td>
<td>83.80 ± 1.07</td>
<td>46.43 ± 3.55</td>
</tr>
</tbody>
</table>

P<0.01, as compared to *normal control group; †HFD control group ANOVA followed by Dunnett-test
and TC levels in Gr. III as well as Gr. IV were significantly decreased as compared with those in Gr. II \((P < 0.01)\), but there were no significant differences in Gr. V and VI as compared to Gr. I \((P > 0.05)\).

Effect of RSV on LDL-C, VLDL-C, and atherogenic index levels — The LDL-C, VLDL-C and atherogenic index levels in Gr. II were significantly increased as compared with those in Gr. I \((P < 0.01)\). The LDL-C, VLDL-C and atherogenic index levels in Gr. III as well as Gr. IV were significantly decreased as compared to Gr. II \((P < 0.01)\). Gr. V and VI did not show any significant change in values as compared to Gr. I \((P > 0.05)\) (Table 3).

Effect of RSV on cardiac lipid peroxides (TBARS) content — Gr. II showed a significant increase in lipid peroxides (TBARS) contents in the cardiac tissues of rats with obesity-induced by a HFD as compared with those in Gr. I \((P < 0.01)\). The TBARS contents in Gr. III and IV were significantly decreased as compared with that of Gr. II \((P < 0.01)\). There were no significant changes in cardiac TBARS contents in Gr. V and VI as compared to Gr. I \((P > 0.05)\) (Table 4). Effect of RSV on cardiac antioxidant enzymes contents — Gr. II showed a significant reduction in CAT and SOD contents in the cardiac tissues \((P < 0.01)\). The CAT and SOD contents in Gr. III as well as Gr. IV were significantly increased as compared with that of Gr. II \((P < 0.01)\). The CAT and SOD contents were not significantly differ in Gr. V and Gr. VI as compared to Gr. I \((P > 0.05)\) (Table 4).

Gr. II showed a significant reduction in GSH content \((P < 0.01)\) in cardiac tissues (Table 4). The GSH content in Gr. III as well as Gr. IV were significantly increased as compared with that of Gr. II \((P < 0.01)\). The GSH-dependent antioxidant enzymes activities GPx, GR and GST in Gr. III as well as Gr. IV group were significantly increased as compared with those in Gr. II (Table 4) \((P < 0.01)\). There were no significant differences in cardiac GSH, GPx, GR and GST contents in Gr. V and VI compared to Gr. I \((P > 0.05)\).

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**Table 3**—Effect of rosuvastatin \((10 \text{ mg/kg, po})\) on levels of LDL-C, VLDL-C and atherogenic index in high fat-fed rats  
[Values are mean ± SE from 10 animals in each group]

<table>
<thead>
<tr>
<th>Group</th>
<th>LDL-C (mg/dl)</th>
<th>VLDL-C (mg/dl)</th>
<th>TC/HDL-C</th>
<th>LDL-C/HDL-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gr.I (Normal control)</td>
<td>39.99 ± 1.83</td>
<td>14.07 ± 0.26</td>
<td>2.36 ± 0.24</td>
<td>1.01 ± 0.08</td>
</tr>
<tr>
<td>Gr.II (HFD control)</td>
<td>112.58 ± 4.27</td>
<td>31.20 ± 0.81</td>
<td>7.17 ± 0.16</td>
<td>4.83 ± 0.19</td>
</tr>
<tr>
<td>Gr.III (HFD + RSV)</td>
<td>49.97 ± 1.87*</td>
<td>15.72 ± 0.28*</td>
<td>2.75 ± 0.18*</td>
<td>1.33 ± 0.07*</td>
</tr>
<tr>
<td>Gr.IV (HFD + orlistat)</td>
<td>43.62 ± 4.18*</td>
<td>14.59 ± 0.32*</td>
<td>2.50 ± 0.28*</td>
<td>1.12 ± 0.24*</td>
</tr>
<tr>
<td>Gr.V (RSV per se)</td>
<td>39.96 ± 5.20</td>
<td>12.84 ± 0.53</td>
<td>2.07 ± 0.14</td>
<td>0.77 ± 0.14</td>
</tr>
<tr>
<td>Gr.VI (Orlistat per se)</td>
<td>25.72 ± 4.86</td>
<td>11.65 ± 1.20</td>
<td>1.80 ± 0.14</td>
<td>0.55 ± 0.12</td>
</tr>
</tbody>
</table>

LDL = low density lipoprotein, VLDL = very low density lipoprotein, TC = total cholesterol, HDL = high density lipoprotein \(P < 0.01\), as compared to *normal control group; HFD control group ANOVA followed by Dunnett-test

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**Table 4**—Effect of rosuvastatin \((10 \text{ mg/kg, po})\) on cardiac TBARS, GSH, CAT, SOD, GPx, GR and GST levels in high fat-fed rats  
[Values are mean ± SE from 10 animals in each group]

<table>
<thead>
<tr>
<th>Group</th>
<th>TBARS (nmol MDA/mg protein)</th>
<th>GSH (nmol of P liberated/min/mg protein)</th>
<th>CAT (nmol of H2O2 consumed/min/mg protein)</th>
<th>SOD (IU/mg protein)</th>
<th>GPx (nmol NADPH oxidised/min/mg protein)</th>
<th>GR (nmol NADPH oxidised/min/mg protein)</th>
<th>GST (nmol CDNB conjugate formed/min/mg protein)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gr.I (Normal control)</td>
<td>0.23 ± 0.01</td>
<td>30.07 ± 3.86</td>
<td>57.53 ± 6.19</td>
<td>2.48 ± 0.03</td>
<td>194.04 ± 4.49</td>
<td>34.00 ± 1.53</td>
<td>461.65 ± 10.66</td>
</tr>
<tr>
<td>Gr.II (HFD control)</td>
<td>1.01 ± 0.04*</td>
<td>12.26 ± 1.28*</td>
<td>23.85 ± 1.21*</td>
<td>1.22 ± 0.32*</td>
<td>120.56 ± 3.13*</td>
<td>18.02 ± 0.24*</td>
<td>241.12 ± 2.12*</td>
</tr>
<tr>
<td>Gr.III (HFD + RSV)</td>
<td>0.24 ± 0.02*</td>
<td>28.14 ± 1.88*</td>
<td>51.85 ± 5.80*</td>
<td>2.40 ± 0.02*</td>
<td>190.33 ± 2.34*</td>
<td>30.26 ± 1.65*</td>
<td>446.54 ± 11.12*</td>
</tr>
<tr>
<td>Gr.IV (HFD + orlistat)</td>
<td>0.20 ± 0.01*</td>
<td>28.67 ± 2.14*</td>
<td>54.95 ± 3.09*</td>
<td>2.45 ± 0.01*</td>
<td>192.50 ± 9.18*</td>
<td>33.53 ± 3.45*</td>
<td>453.21 ± 13.26*</td>
</tr>
<tr>
<td>Gr.V (RSV per se)</td>
<td>0.17 ± 0.02</td>
<td>32.77 ± 1.59</td>
<td>60.49 ± 4.31</td>
<td>2.52 ± 0.04</td>
<td>204.81 ± 8.48</td>
<td>35.97 ± 2.86</td>
<td>485.51 ± 9.28*</td>
</tr>
<tr>
<td>Gr.VI (Orlistat per se)</td>
<td>0.14 ± 0.01</td>
<td>36.21 ± 2.53</td>
<td>62.83 ± 5.88</td>
<td>2.56 ± 0.06</td>
<td>211.60 ± 6.47</td>
<td>37.25 ± 2.57</td>
<td>490.14 ± 8.49*</td>
</tr>
</tbody>
</table>

TBARS = thiobarbituric acid reactive substances, GSH = glutathione, CAT = catase, SOD = superoxide dismutase, GPx = glutathione peroxidase, GR = glutathione reductase, GST = glutathione-S-transferase. \(P < 0.01\), as compared to *normal control group; HFD control group ANOVA followed by Dunnett-test
**Discussion**

The present study focussed on the antioxidant effect of RSV on obesity-induced oxidative stress in high fat-fed rats and found that administration of RSV suppressed significantly increase serum Apo-B, LDH, TGs, TC, and elevated the decreases in serum HDL and antioxidant enzymes (CAT, SOD, GSH, GPx, GR and GST) by HFD.

Model of HFD-induced obesity in Wistar rats has many features common with human obesity. A number of studies have demonstrated that the antioxidants may act as a regulator of obesity in mice or rats with high fat-diets (HFD).

In animal and human studies, obesity is connected with a decrease in tissue or plasma antioxidant capacity. In order to investigate if oxidative stress was increased in the high fat-fed rats, lipid peroxidation (TBARS) as marker of oxidative injury was measured. The elevated cardiac TBARS content was an indication of oxidative stress in the HFD control group. This content was markedly reduced by RSV as well as orlistat ($P < 0.01$) (Table 4). In support of these results, increased lipid peroxidation in obesity has been repeatedly observed in different human studies. The enzymatic antioxidants such as SOD, CAT or GPx, can scavenge reactive oxygen species and free radicals or stop their formation. The superoxide anion ($O_2^-$) is a key peroxidative molecule. The chief scavenger of superoxide anions is the cellular antioxidant enzyme, SOD which catalyzes the dismutation of superoxide to hydrogen peroxide that in turn is removed by another antioxidant enzyme, GPx. The present study showed that RSV as well as orlistat significantly increase the SOD contents ($P < 0.01$). One elucidation for this finding is that elevated SOD in obese subjects represents a compensatory adaptation to oxidative stress (Table 4).

GSH represents the first line of defense against free radicals and is also responsible for the maintenance of protein thiols and acts as a substrate for GPx and GST. GPx activity is considered to symbolize the initial protective response required for adjusting the $H_2O_2$ concentration under physiological condition as well as after oxidative insult. The present data indicate that GSH content was depleted in the rats fed with HFD and were restored by RSV and orlistat. The present study showed that cardiac antioxidant enzyme activities (GPx, GR and GST) were significantly decreased in HFD control group and significantly increased in HFD + RSV as well as HFD + orlistat groups ($P < 0.01$) (Table 4).

Blood lactate concentration enhances in many physiological and pathological conditions, such as physical exercise, fasting, type 2 diabetes, obesity, and hypertension. The present study showed a significant increased serum LDH levels in HFD control group as compared to normal control group ($P < 0.01$) which parallels the earlier reports. Both HFD + RSV and HFD + orlistat groups showed a significant decrease in serum LDH levels as compared to HFD control group ($P < 0.01$) (Table 2).

Modifications of lipid and lipoprotein metabolism have been demonstrated in obese subjects who are probably related to the greater risk of cardiovascular diseases. A noticeable increased serum Apo-B levels in HFD control group than their normal control group ($P < 0.01$) were found in the present study. HFD + ROS as well as HFD + orlistat groups showed a significant decline in serum Apo-B levels as compared to HFD control group ($P < 0.01$) (Table 2). Thus, it would appear that RSV decrease the Apo-B levels in obesity as reported by Ooi et al.

Abnormal lipid metabolism is a chief cause of dyslipidemia, which is a major risk factor for cardiovascular disease, obesity, cholestasis and overall mortality. A range of findings demonstrated the efficacy of RSV in improving the atherogenic lipid profile and dyslipidemia in patients with the metabolic syndrome. A significant increase in the serum TGs, TC, LDL-C, VLDL-C and atherogenic index while decrease in serum HDL-C levels in the HFD control group as compared to the normal control group ($P < 0.01$) were found. RSV has been associated with the greatest reductions in cholesterol, as well as reductions of up to 30% in triglycerides (TG). It has been found that the RSV and orlistat significantly reduced the serum TGs, TC, LDL-C, VLDL-C and atherogenic index and a marked increase in serum HDL-C as compared to the normal control group ($P < 0.01$) in the present study also (Tables 2 and 3). Significant increases in TC/HDL-C and LDL/HDL-C ratios were found in high fat-fed rats that has an effect on cardiovascular diseases.

Liou et al. have shown that hyperlipidaemia decreases the strength of the antioxidative defense system. Thus, the present study hypothesize that the possible explanation for reducing obesity following the administration of RSV is a reduction in oxidative stress in rats fed with HFD.
In conclusion, data of the present study demonstrate that the rosuvastatin as well as orlistat when given orally, were able to target the cardiac tissues, and found to decrease lipid peroxides contents and elevates the antioxidant enzymes levels, apart from improvement in lipid metabolism, in high fat-fed Wistar rats. These results present initial evidence that rosuvastatin may be useful for the treatment of obesity by enhancing the antioxidant defense mechanism.

References

