

Anti-obesity Effect of Berberine and Germinated Brown Rice in High Fat Diet-induced Obese Rats

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Rationale & Background:

Obesity is a condition where abnormal or excessive fat accumulation in the body. It is often considered to be a major health threat to disorders such as diabetes mellitus, hypertension, dislipidemia and coronary heart disease as well as increasing the risk of mortality. Recently, about 10.0% of world adults male and 14.0% of world adults female were identified as being obese (body mass index, BMI $\geq$ 30). **Berberine (BBR)** is a natural product found in Hydrastis Canadensis, Berberis, and Cortex phellodendr. Recent research has established that berberine activates AMP-activated protein kinase (AMPK) in diabetic mice. It also has been shown to attenuate hyperglycemia and insulin resistance in rats. BBR was shown *in vitro* to inhibit adipocyte differentiation through the PPAR γ pathway and to decrease the expression of adipogenic enzymes and inflammatory molecules in 3T3-L1 cell. Although BBR was demonstrated to have anti-adipogenic effects *in vitro*, its overall performance *in vivo* was poor. On the other hand, **Germinated brown rice (GBR)** is a novel functional food particularly is quite popular in Asia. It is produced by soaking brown rice in water to induce germination with the germ of about 1 mm long. GBR is not only had intact germ and bran layers that are rich in nutrients, but the hydrolytic enzymes inside the seed have also been activated to produce essential compounds and energy for the formation of seedling during germination. For this reason, it is rich in nutrients such as vitamins, minerals, fibers and bioactive components like γ -aminobutyric acid (GABA), γ -oryzanol and ferulic acid that give numerous protective health effects including antioxidants properties, hypocholesterolemic effect, hypoglycemic effect, anti-colon cancer effect.

Aim of the Work

This study was conducted to evaluate and compare the therapeutic effects of **BBR & GBR** as a whole food on diet-induced obese male Sprague-Dawley rats.

Methodology:

- Preparation of GBR:** GBR was soaked in water, water was changed every 24h. this steps was repeated for 3 consecutive days. The GBR obtained was dried, grounded and kept in airtight container at -20°C till demand.
- BBR** was purchased from Sigma Aldrich (St. Louis, MO, USA).
- Estimation of obesity:** 1) the mean body weights of the HFD group rats were compared with the NC group. Rats with more than 10 % body weights than the maximum body weights of normal diet rats were considered as obese .
- 2) The obesity was also confirmed by using Lee index. It was calculated by the cube root of body weight (g)/nose-anal length (cm), for which a value equal to or lower than 0.30 was classified as normal. For value higher than 0.30, the rat was classified as obese .
- 3) Three rats from NC group and HFD groups, respectively, were sacrificed under anesthesia to obtain data on their weight of adipose tissue. The adipose tissue of HFD group rats should weigh 30–45 % more than those of NC group rats .
- Experimental Design:** A total number of **40 adult male Sprague-Dawley rats** were used. All rats were randomly housed in stainless steel cages with constant controlled environments. The animals were divided into **4 groups**; each was composed of **10 rats** as follows:
 - Group I (NC):** Healthy rats were fed with a normal diet .
 - Group II (HFD):** Rats were fed high fat (20% ,W/W) diet.
 - Group III (HFD+BBR):** Rats were fed high fat diet supplemented with single daily oral dose of (0.2 g /kg body weight) .
 - Group IV (HFD+GBR):** Rats were fed high fat diet administrated with 35% GBR.

At the end of experimental period (8-weeks) **rats from each group were sacrificed** after 12 hours fasting with water *ad libitum* for the study of: **Blood & Tissues Sampling :**

- Liver was properly prepared and stored frozen at -20°C until used for **tissue biochemical analyses**.
- Portion of liver & adipose tissue were kept in **10% formalin** & saline for **histopathological examination**

Results:

Biochemical analyses

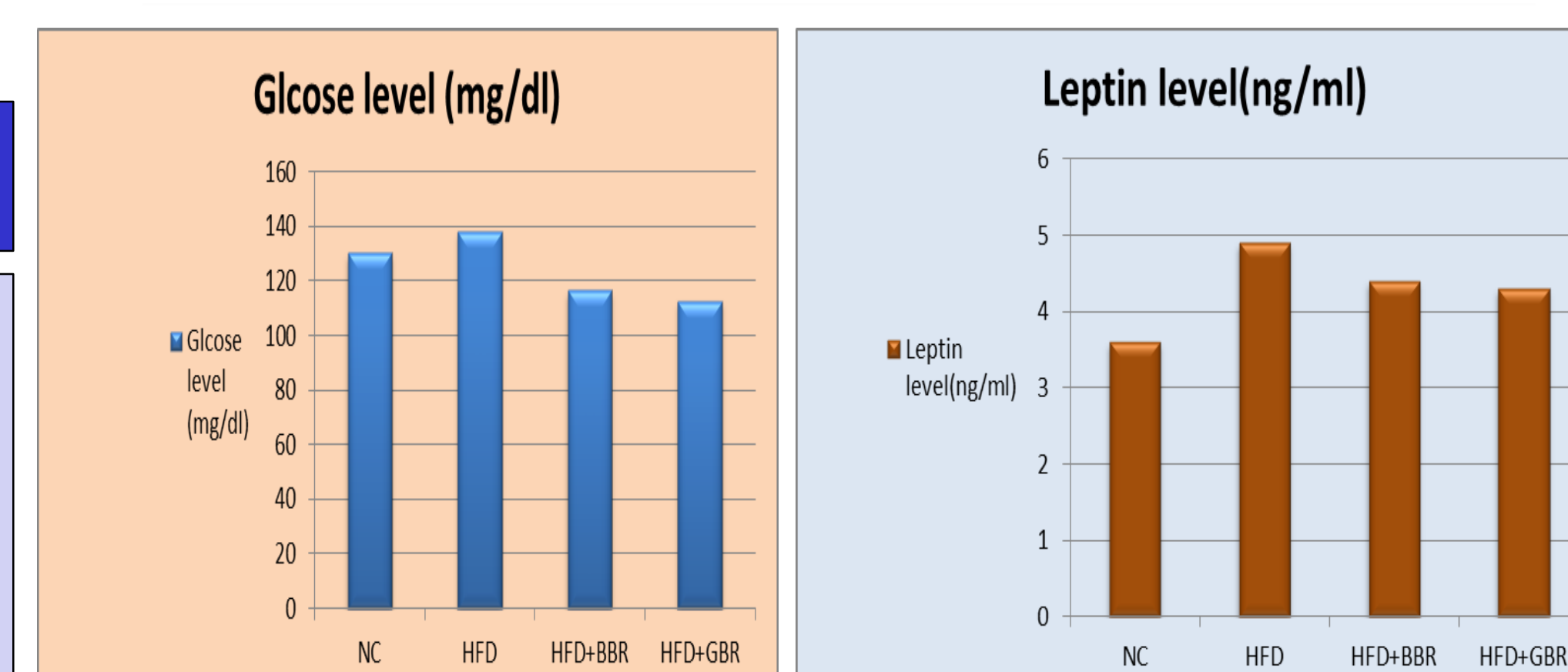
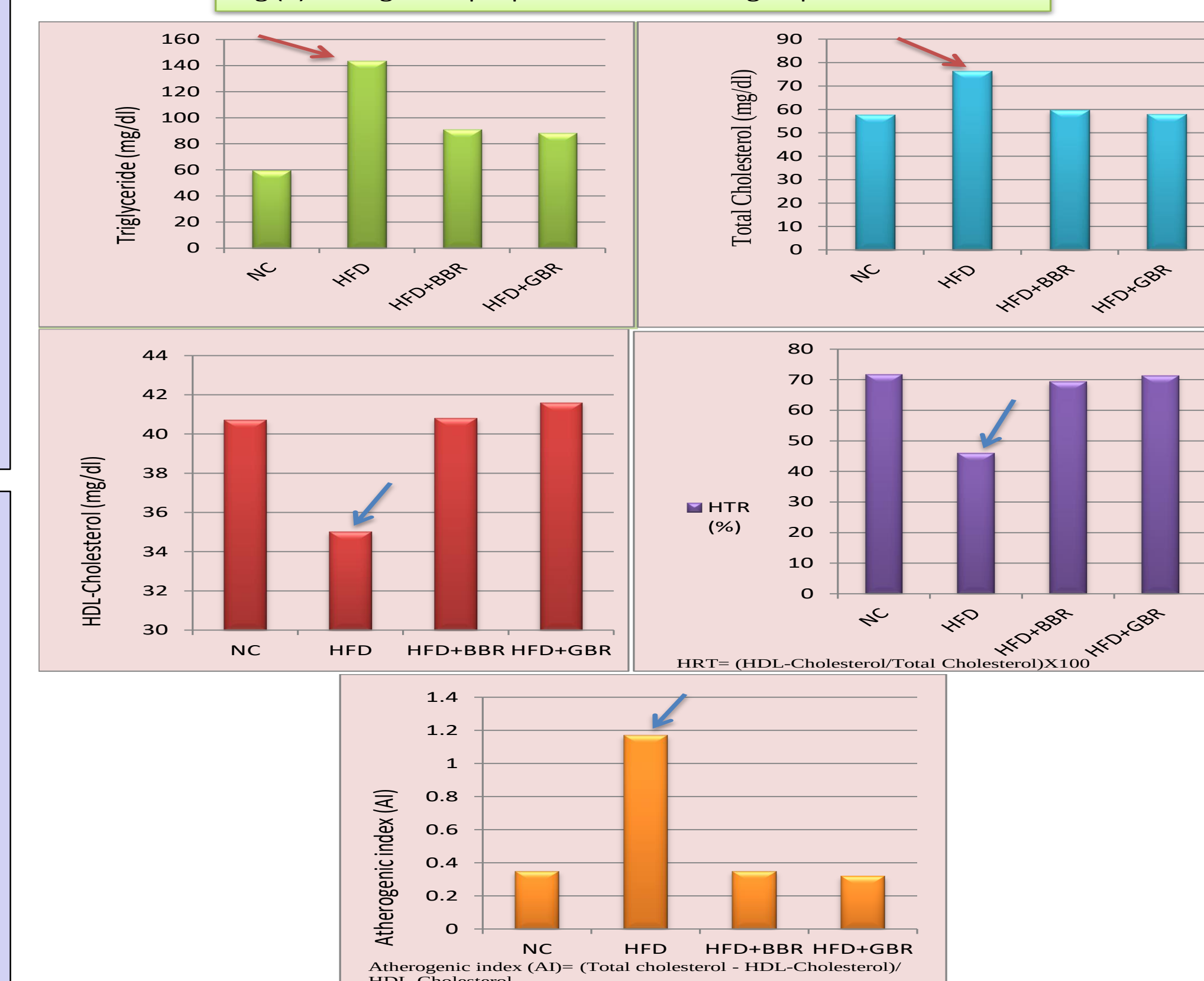
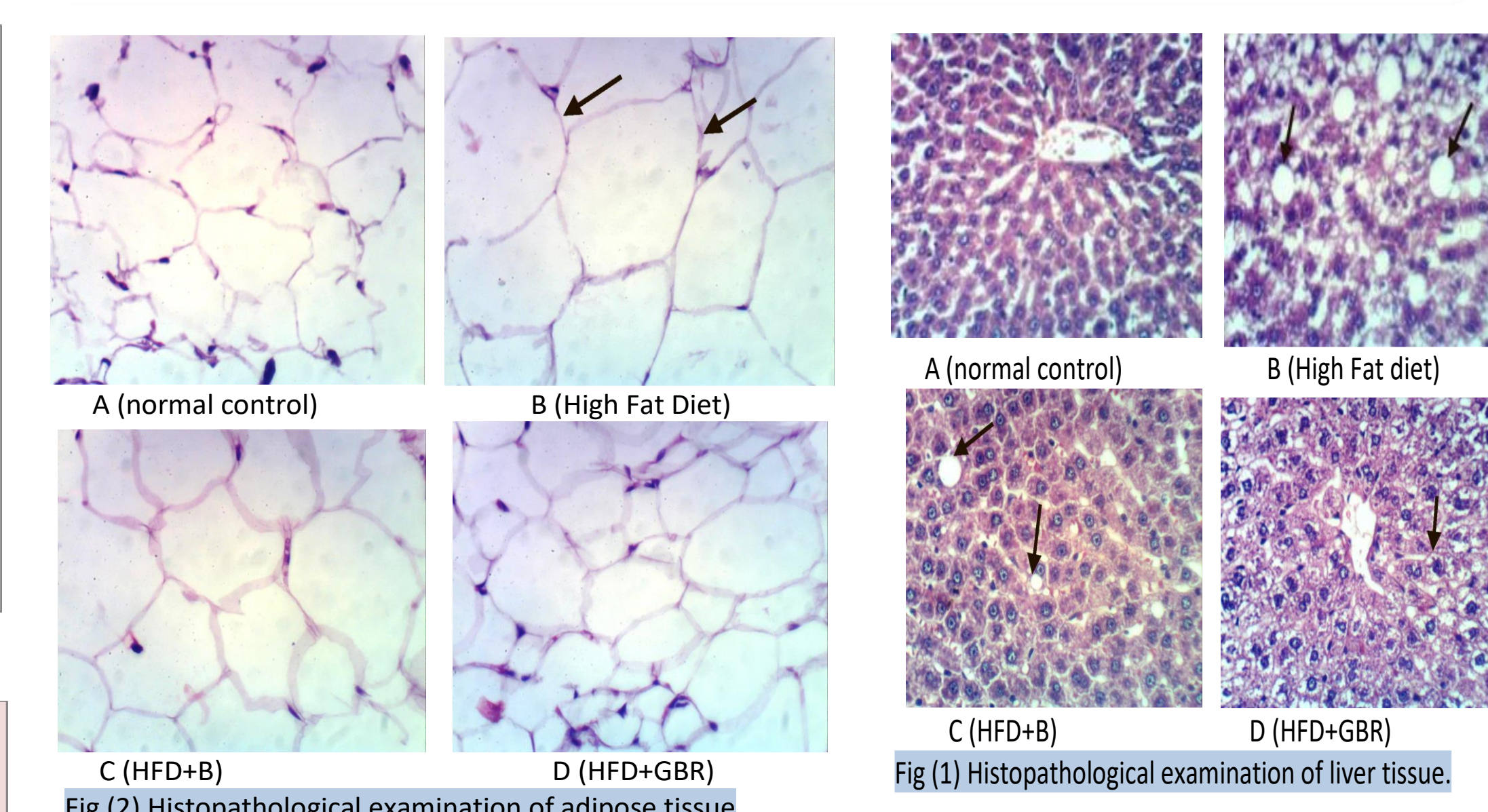


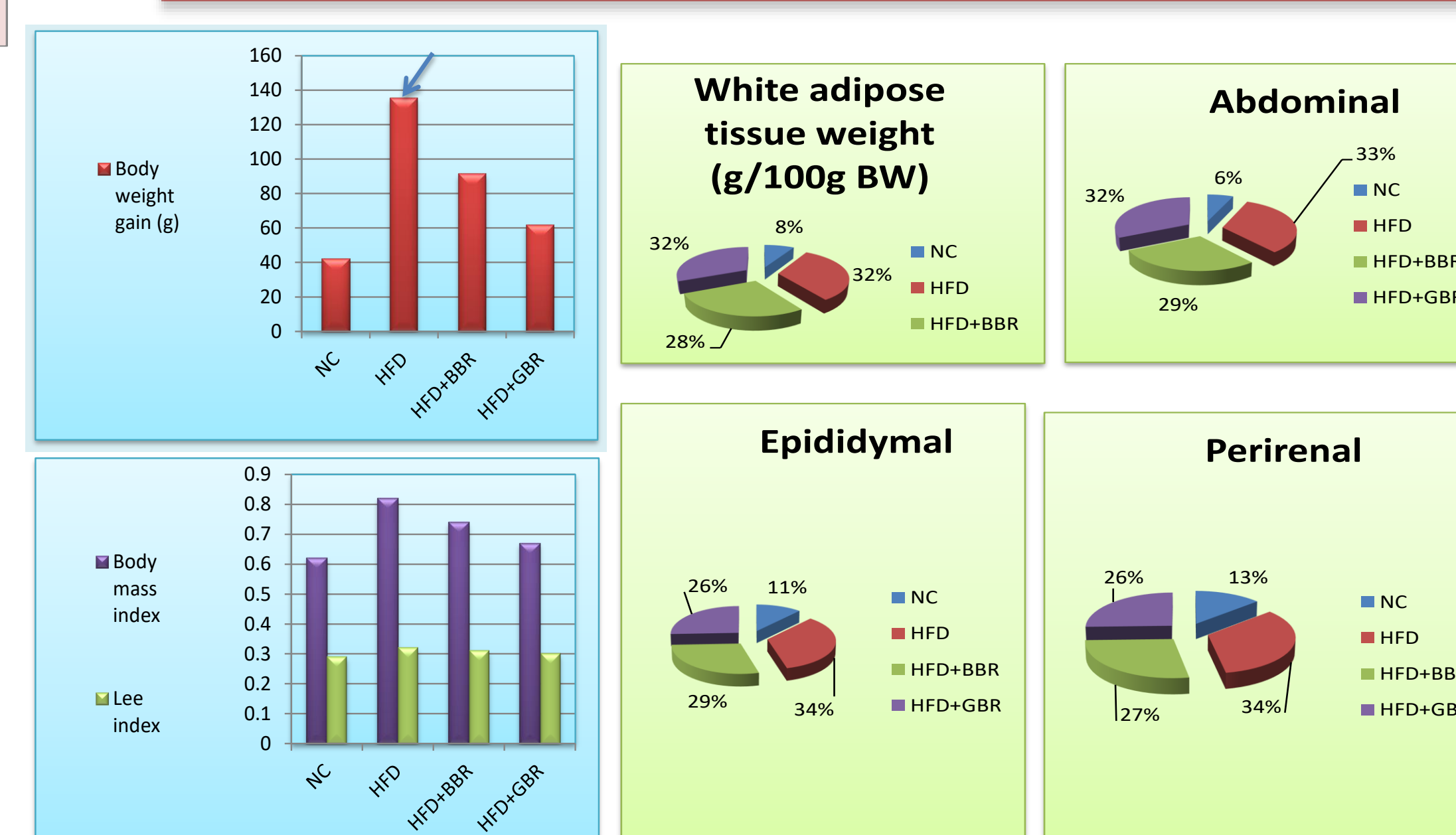
Fig (3): Changes of lipid profile in treatment groups



Histopathological examination



Anthropometric and dietary measurements



Conclusions:

Comprehensively, it is concluded that **BBR & GBR** have relatively similar effects in ameliorative obesity by suppressing body weight gain and lipid accumulation in liver, beneficent lipid profiles and reducing leptin level also white adipose tissue mass in obese rats fed on HFD.