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Booklets

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Title: Food intake and biomedical serum indicators in mice adults exposed high fat diet for a short term

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Topic explanation and why it is important.

High fat diet (HFD) represents "*the western*" diet, which is associated with the development of metabolic disorders such as obesity and metabolic syndrome (Myles, 2014).

Being exposed to HFD influences eating behaviors (Villamil et al., 2018).

It is interesting to understand the effect of the consumption for short term of isocaloric diets with different proportions of macronutrients on the possible changes in serum biomarkers, that are associated with development of chronic diseases.

https://miradorsalud.com/sobre-patrones-alimentarios/

https://www.eltiempo.com/archivo/documento/CMS-15497037

Problem and central hypothesis

Adult mice exposed for short term to an isocaloric HFD, disturb the food intake, glucose in serum levels and develops signs of liver steatosis.

Introduction

- ✓ High fat diet (HFD) represents "*western diet*", which is associated with the development of metabolic disorders such as obesity and mellitus diabetes (Myles, 2014).
- ✓ Being exposed to HFD influences eating behaviors(Villamil et al., 2018).
- ✓ In a recent study in rats exposed to a long-term HFD induced impairments in glucose tolerance (la Fleur et al., 2011).
- ✓ The western diet and HFD intake also has been showed to modify the biochemical composition and function of high-density lipoproteins (HDL) in mice (Lewis et al., 2004; Mirmiran et al., 2014).
- ✓ little evidence evaluating short-term consequences of isocaloric HFD intake and its relationship with peripheral markers such as glucose, triglycerides and cholesterol. During development of obesity and changes in insulin levels, the liver can suffer modifications that are marked by the deposition of triglycerides in macro and microvesicular fat.
- ✓ Moreover, hypercaloric diet intake increases lipolysis in adipose tissue, modifying triglyceride levels (Blundell et al., 1995).

- ✓ Studies suggest that exposure to high-fat diets can produce behavioral changes before excessive weight gain occurs, mainly affecting food efficiency control mechanisms (Melhorn et al., 2010).
- ✓ Studies show that the intake of high fat diets are related to changes in insulin, with a consequent increase in the score for feeling of hunger and prospective desire to consume food, contributing to increased hyperphagia (Labayen et al., 1999).
- ✓ In this work, adult mice were exposed for short term to an isocaloric diet with HFD, LFD and a standard diet in order to evaluate food intake and development of damage signals at the hepatic level.

Description of the method

Group	Diet	Registration of food intake	Decapitation
1 (n=10)	Standard		
2 (n=10)	HFD		
3 (n=10)	LFD		
Length of study **Scheduled** **registration of food intake and water (every 12 hours dark-light cycle)**		35days 7am (dark) 7pm (light)	Tissue samples from the hippocampus and liver were obtained in order to determine the genetic expression of the insulin receptor in the hippocampus and for the histological analysis of the liver

- Its experimental and longitudinal study
- where a total of 30 mices (10 per group)
- following groups and treated during 5 weeks: standard diet (SD) group, HFD group and low fat diet (LFD) group
- food and water intake, serum triglycerides, cholesterol and glucose were determined. In addition, liver was histologically evaluated

Diets composition

Diet	Kcal/gr	Macronutrients		
		Carbohydrates	Fats	Proteins
Standard	4.07	57.99%	13.49%	28.50%
High Fat Diet (HFD) (D12492) Research diet	4.07	26%	34.9%	26%
Low Fat Diet (LFD) (D12450B2) Research diet	4.07	63.3%	19.3%	4.3%

	Standard Diet %	HFD (D12492)g	LFD (D12450B)g
Casein		200	200
L Cystine		3	3
Corn Starch	31.9%	0	315
Maltrodextrin		125	35
Sucrose	3.7%	68.8	350
Cellulose		50	50
Soybean Oil		25	25
Lard		245	20
Mineral Mix	9.05%	10	10
Calcium Phosphate	0.95%	13	13
Calcium Carbonate		5.5	5.5
Potassium Citrate	1.18%	16.5	16.5
Vitamin Mix	293ppm	10	10
Choline Bitartrate	2250ppm	2	2
Cholesterol (mg/kg)	200ppm	300.8	51.6
Glucose	0.22%		
Fructose	0.30%		
Sucrose	3.70%		
Lactose	2.01%		
Fatty Acids	1.60%		

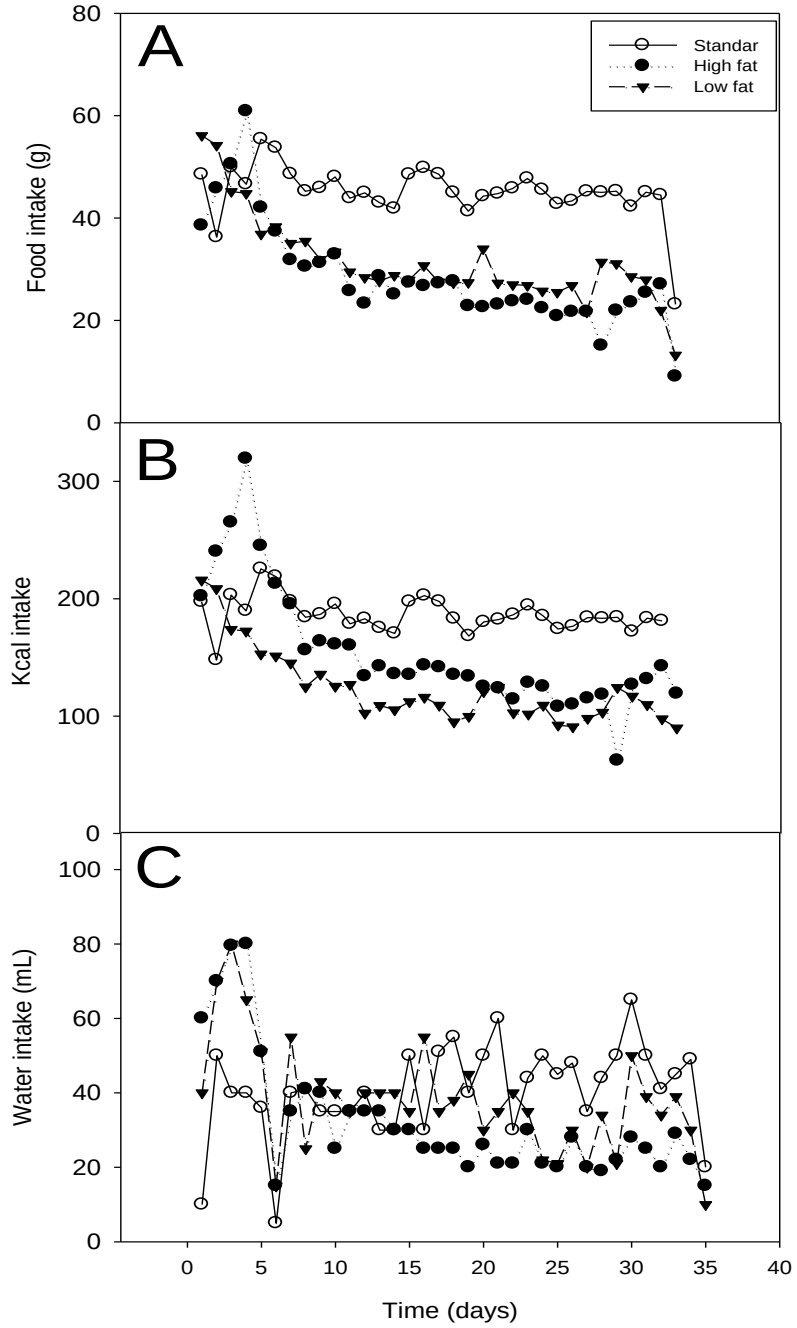

Figure 1. Food and water intake. The food intake observed in groups. HFD group showed a reduction in food intake and kcal intake (A and B). A p value of <0.05 was considered statistically significant. C) Water intake, the study groups, no significant differences were.

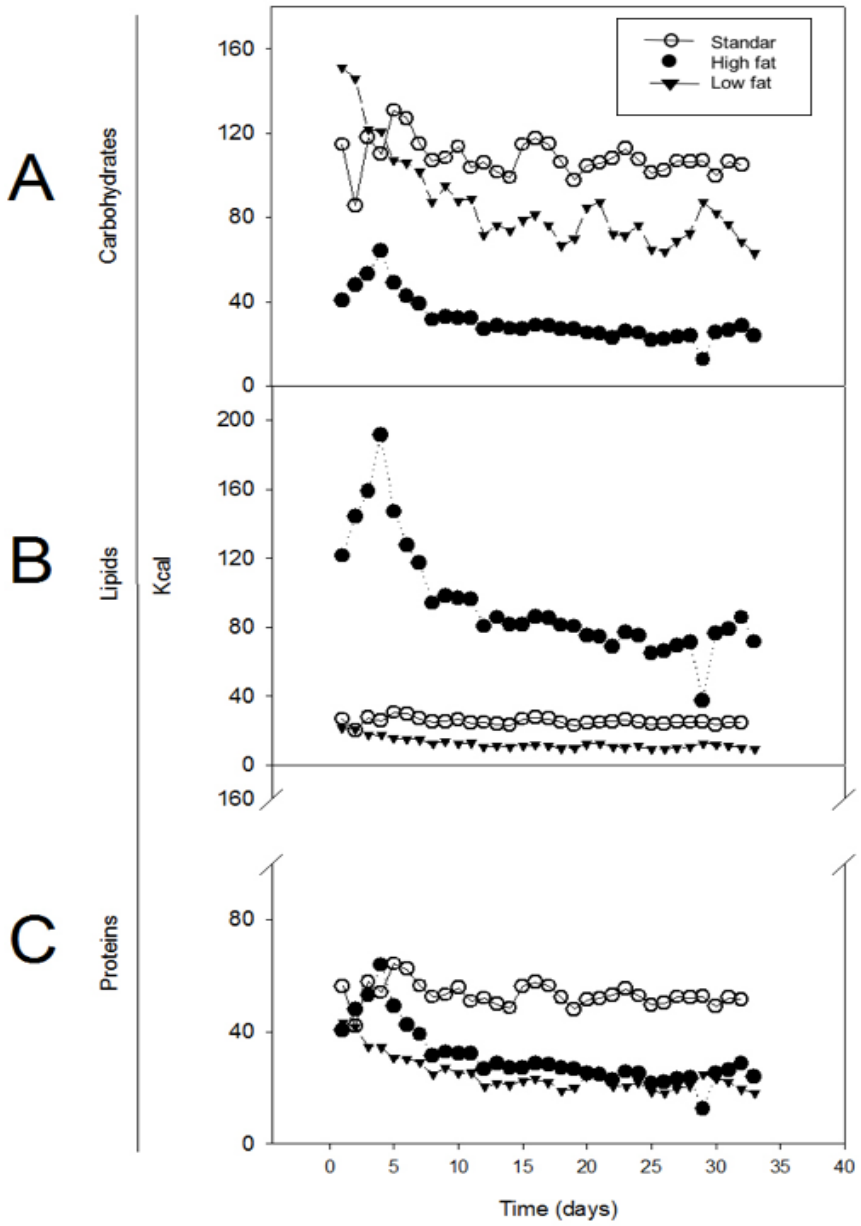

Figure 2. Kilocalorie, food and macronutrient intake (carbohydrates, lipids and proteins). The study group exposed to a high fat content diet showed a lower consumption of kilocaries from carbohydrates with respect to the study group exposed to a low fat content diet and the standard diet group. The group exposed to a HFD also showed a lower intake of kilocalories from lipids with respect to the group exposed to a LFD group and the standard diet group, as well as a lower kilocalorie consumption from proteins with respect to the group exposed to a LFD and the group exposed to the standard diet p value of <0.05 was considered statistically significant.

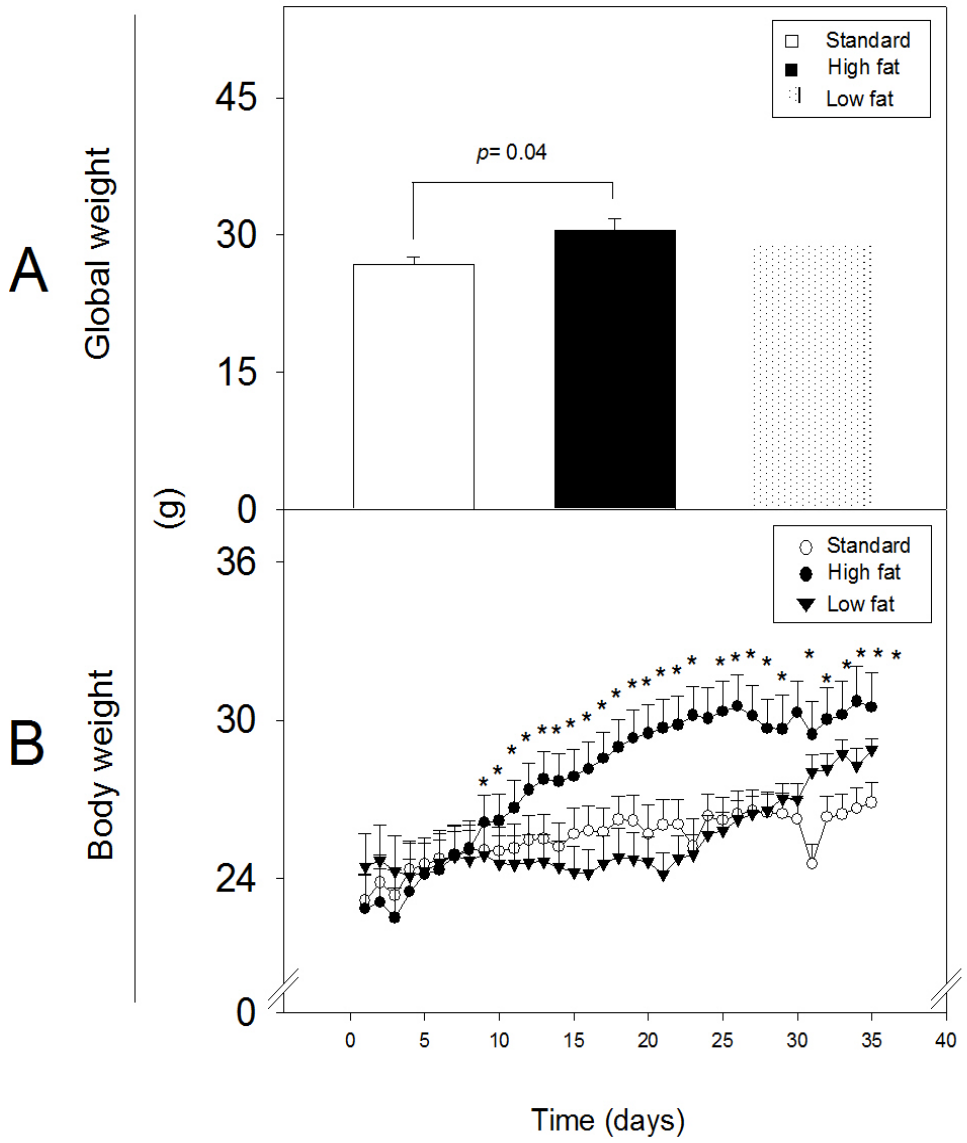

Figure 3. Body weight. The high fat diet (Group 2) compared to the standard diet group (Group1); and the low fat diet (group 3). Increase of body weight in HFD group in comparison with and LFD and diet group and standard group. Data are expressed as mean ± standard deviation. *p* value of <0.05 was considered statistically significant.

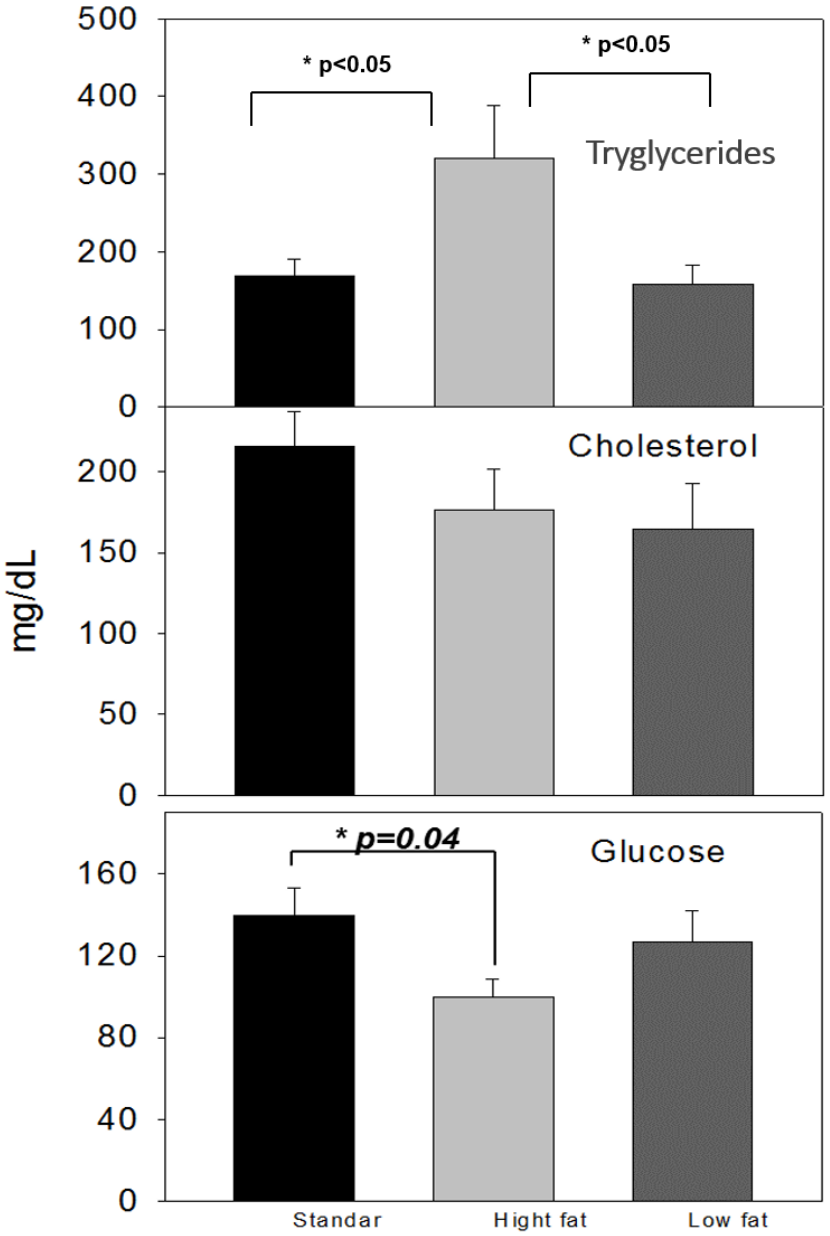

Figure 4. Differences between groups in triglycerides, cholesterol and glucose serum levels. The highest concentration of triglycerides founded in the group exposed to a HFD group compared to LFD group and the standard group and the lowest concentration of glucose. Serum cholesterol values for each group. p value of <0.05 was considered statistically significant.

Histologic liver injury scores

	Score			
	1	2	3	4
Micro-vesicular fat	Presented in less than 5% of the hepatocytes	5-33% of the hepatocytes	33-66% of the hepatocytes	>67% of the hepatocytes
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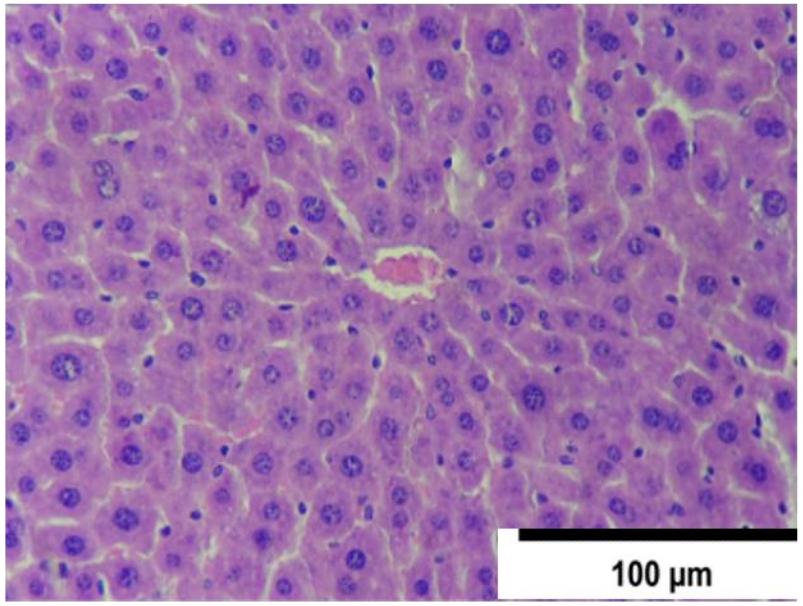
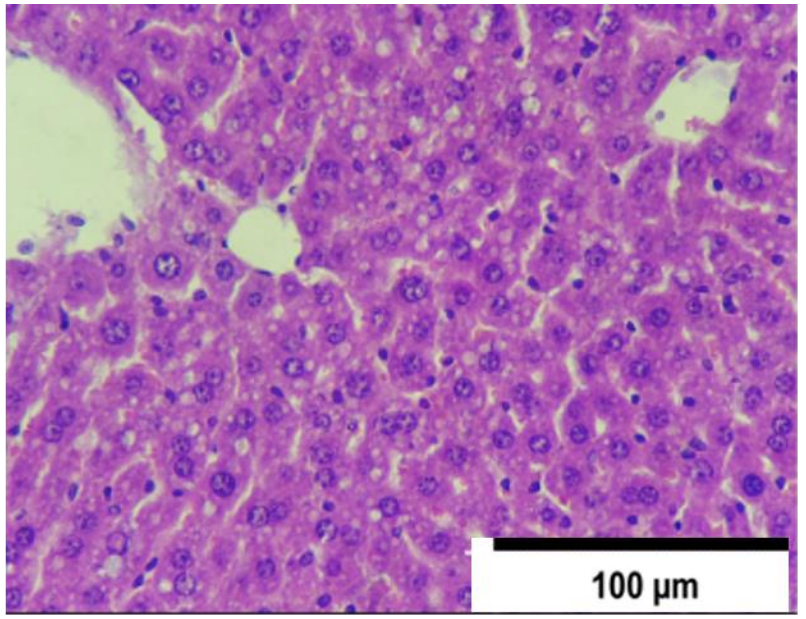
Necrosis	1characteristic per layer	2-3 characteristics per layer	4-5 characteristics per layer	>5 characteristics per layer
Inflammation	1-2 characteristics per layer	3-4 characteristics per layer	5-8 characteristics per layer	>8 characteristics per layer

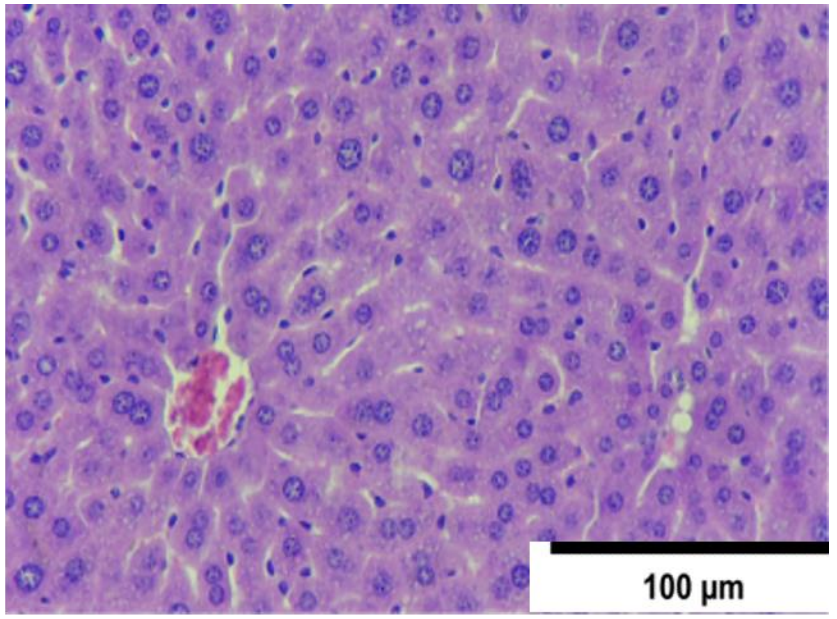
	Standard Diet				HFD				LFD				
Score	1	2	3	4	1	2	3	4	1	2	3	4	*p*=
Microvesicular fat (%)	2	7	1	0	1	0	2	7	4	1	5	0	0.001
Macrovesicular fat(%)	10	0	0	0	6	3	1	0	10	0	0	0	0.056
Necrosis(%)	9	1	0	0	5	4	0	0	8	2	0	0	0.269
Inflammation (%)	9	1	0	0	6	4	0	0	8	2	0	0	0.271



Standar Diet



HFD



LFD

Conclusions

- ✓ The content and quality of macronutrients in the diet is highlighted, despite the fact that those consumed by the mice in this research were isocaloric, exposure to HFD for a short period, evidenced a reduction in food intake and blood glucose and hepatic steatosis.
- ✓ This experimental model could be used to evaluate to effect an isocaloric HFD on development of hepatic steatosis and changes in eating behavior in short period of time.
- ✓ Assessing the intake of a HFD could provide a better understanding of the metabolic mechanisms that are connected to the development of chronic diseases. However, in the field of eating behavior, more research is required, related to physiological and biochemical-molecular behavioral aspects.

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