Paleolithic Diet is Associated With Unfavorable Changes to Blood Lipids in Healthy Subjects

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Abstract

PURPOSE: To examine the influence of a Paleolithic (Paleo) diet on blood lipids including high density lipoprotein (HDL), low density lipoprotein (LDL), non-HDL cholesterol, triglycerides (TG), total cholesterol (TC) and the ratio between TC and HDL (TC/HDL) in a healthy population.

METHODS: Subjects of both sexes (n=43) with no history of diabetes, heart disease, dyslipidemia, or other metabolic disease ate an *ad libitum* Paleo diet consisting of meat, fruit, vegetables, eggs, and nuts for 10 weeks. Throughout the intervention subjects participated in a circuit training program. At the outset, body fat percentage (BF%), maximal oxygen consumption (VO_2max), TC, TG, and HDL were measured, while LDL was estimated using the Friedewald equation. All measurements were repeated at week 10.

RESULTS: Following 10 weeks of a Paleo diet, there was a significant increase in n-HDL (107.1 ± 6.0 mg/dL to 120.2 ± 6.5 mg/dL; $P < 0.01$), LDL (93.1 ± 5.4 mg/dL to 105.6 ± 6.1 mg/dL; $P < 0.01$), and TC (168.8 ± 5.4 mg/dL to 178.9 ± 6.6 mg/dL; $P < 0.05$). When stratified into groups based on initial blood lipid levels, deleterious changes were found in those with optimal HDL (82.1 ± 3.2 mg/dL to 68.6 ± 4.8 mg/dL; $P < 0.05$), n-HDL (86.6 ± 3.9 mg/dL to 101.4 ± 4.8 mg/dL; $P < 0.01$), TC/HDL (2.5 ± 0.1 to 2.7 ± 0.1; $P < 0.05$), and LDL (69.1 ± 3.1 mg/dL to 83.5 ± 4.1 mg/dL; $P < 0.01$). Subjects within sub-optimal stratifications showed no significant changes. Further, BF % decreased significantly (24.32 ± 7.63 % to 20.65 ± 7.99 %; $P < 0.01$), and VO_2 max increased significantly (39.82 ± 7.72 mL/kg/min to 44.90 ± 8.20 mL/kg/min; $P < 0.01$).

CONCLUSION: Our results demonstrate an *ad libitum* Paleo diet intervention is associated with deleterious changes to blood lipids in healthy subjects, even as subjects simultaneously improved body composition and VO_2max. Future research should determine recommendations that embrace the metabolic benefits associated with the Paleo diet without detrimentally affecting blood lipids.

References

1. Friedewald WT, Levy RI, and Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clinical Chemistry* 18: 499-502, 1972.
2. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation* 106: 3143-3421, 2002.

Results

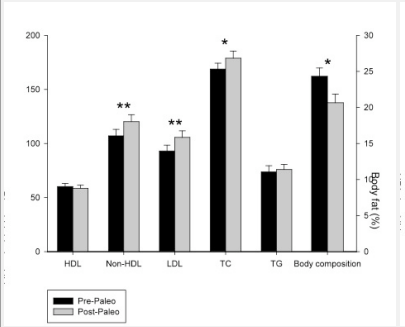

Figure 1. After 10 weeks of Paleo, non-high density lipoprotein (n-HDL), low density lipoprotein (LDL) and total cholesterol (TC) increased significantly from baseline. No changes were observed with regard to high density lipoprotein (HDL) and triglycerides (TG). A significant decrease in body composition was observed compared to baseline. * $P < 0.05$; ** $P < 0.01$.

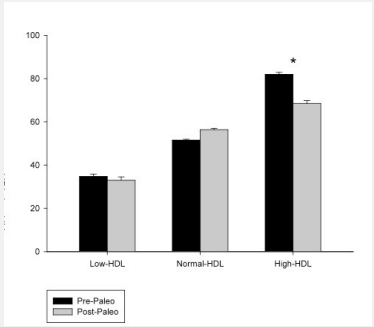

Figure 2. High density lipoprotein (HDL) levels in healthy volunteers before and following a 10 week Paleolithic dietary intervention. When stratified by initial HDL levels, only subjects who presented with "High-HDL" were observed to have a significant decrease in HDL following a Paleolithic diet. *$P < 0.05$ between groups.

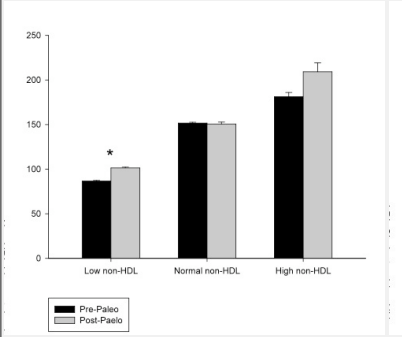

Figure 3. Non- high density lipoprotein (n-HDL) prior to and following a Paleolithic dietary intervention. When stratified by initial levels of n-HDL, only subjects with n-HDL considered to be "low" were measured to have a significant increase of n-HDL following 10 weeks of a Paleolithic diet. * $P < 0.05$.

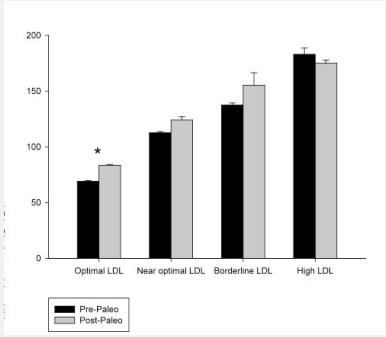

Figure 4. Low density lipoprotein (LDL) levels prior to and following a Paleolithic dietary intervention. When stratified by initial levels of LDL, only subjects with optimal LDL were measured to have a significant increase of LDL following 10 weeks of a Paleolithic diet. * $P < 0.05$.

Methods

- Body composition was assessed via air-displacement plethysmography
- Point of care device was used to directly measure HDL, TC, and TG
- LDL was estimated using the Friedewald equation[1]
- Subjects stratified according to NCEP ATP III[2]
- VO_2max assessed via Bruce Protocol
- 10-week dietary intervention consisting of *ad libitum* consumption of meat, fruit, vegetables, eggs, and nuts
- Subjects participated in circuit training program throughout intervention
- All measures taken before and following 10-week intervention

Results

Changes observed after 10-Week Paleo Intervention

	Relative VO_2max (mL/kg/min)	Absolute VO_2max (L/min)	Body Fat (%)	TC (mg/dL)	LDL (mg/dL)	n-HDL (mg/dL)
Pre-test	39.82 ± 7.72	3.18 ± 0.14	24.32 ± 7.63	168.8 ± 5.4	93.1 ± 5.4	107.1 ± 6.0
Post-test	44.90 ± 8.20**	3.46 ± 0.15**	20.65 ± 7.99**	178.9 ± 6.6*	105.6 ± 6.1**	120.2 ± 6.5**

VO_2max = maximal oxygen consumption; TC = total cholesterol; LDL = low density lipoprotein; n-HDL = non-high density lipoprotein. * $P < 0.05$, ** $P < 0.01$.

Conclusions

- An *ad libitum* Paleolithic diet is associated with unfavorable blood lipid changes
- Deleterious effects appear to be more pronounced in subjects with more ideal initial blood lipid values
- Detrimental impact of an *ad libitum* Paleolithic diet is substantial enough to induce negative blood lipid changes despite concurrent improvements in body composition and cardiorespiratory fitness

Acknowledgments

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