Adipocyte Diameter and Adipose Inflammation in Swine

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Abstract

In recent years, obesity has been recognized as an epidemic in both human and veterinary medicine. In obesity-associated chronic inflammation, the mechanisms behind the cytokine mediated immune response are largely unknown. However, chronic inflammation is characterized by macrophage infiltration of adipose tissue. The macrophages are believed to locally mediate release of pro-inflammatory cytokines that propagate a cycle of macrophage recruitment. Studies have demonstrated that visceral adipose tissue releases more immune mediating cytokines than subcutaneous adipose tissue. The type of adipose tissue and its physical characteristics are thought to be significant in the immune response. It is hypothesized that periadventitial fat acts as visceral adipose tissue in obesity-associated chronic inflammation, and the associated macrophage recruitment contributes to atherosclerosis. Tissue samples were taken from subcutaneous, visceral, and periadventitial adipose tissue in seven hypercholesterolemic pigs. Immunohistochemistry is to be performed, and the samples stained for scavenger receptor A (SRA), inducible nitric oxide synthase (iNOS), resistin, monocyte chemoattractant protein-1 (MCP-1), omentin, and CD3. The diameter of the adipocytes will also be histologically measured to determine if there is a critical size for initiation of inflammation. Since there appears to be a difference in the activity between the fat sample locations, the physical properties and cytokine activity should give insight into the mechanism of obesity-associated inflammation and other diseases concerning veterinary and human medicine.

Introduction

Due to the health implications, adipocyte inflammation is being recognized as an emerging area of biomedical research. Since there appears to be a difference in activity between subcutaneous, visceral, and periadventitial adipose tissue, the physical properties and cytokine activity should give insight into the mechanism of obesity-associated inflammation and other diseases impacting veterinary and human medicine.

Research Methods

Tissue samples were collected from seven familial hypercholesterolemic pigs, two of the pigs were fed a high fat diet the others were fed a normal lab diet. Samples were taken from three different adipose tissue locations in each pig. Subcutaneous adipose tissue was collected from the hip region, visceral adipose tissue was collected from perisplenic fat, and periadventitial adipose tissue was collected from around coronary arteries. The samples were placed on slides for immunohistochemistry. The slides were stained for scavenger receptor A (SRA), CD3, inducible nitric oxide synthase (iNOS), resistin, monocyte chemoattractant protein-1 (MCP-1), and omentin. Samples from each location were also stained with hematoxylin and eosin and the average adipocyte diameter was measured.

Results

Table 1: Average Adipocyte Diameter in Microns

		Adipocyte Location		
		Splenic	Subcutaneous	Periadventitial
Pig Number	9054*	106.575	107.759	51.698
	9056*	115.534	115.235	55.553
	9896	86.055	92.284	39.935
	9925	79.579	116.435	57.192
	9933	90.012	106.276	52.345
	9936	78.542	86.235	52.996
	9937	80.344	82.661	51.946
	Mean	90.949	100.983	51.667
	STDEV	14.544	13.812	5.561

* Indicates pig was fed a High Fat Diet

Results

Immunohistochemistry

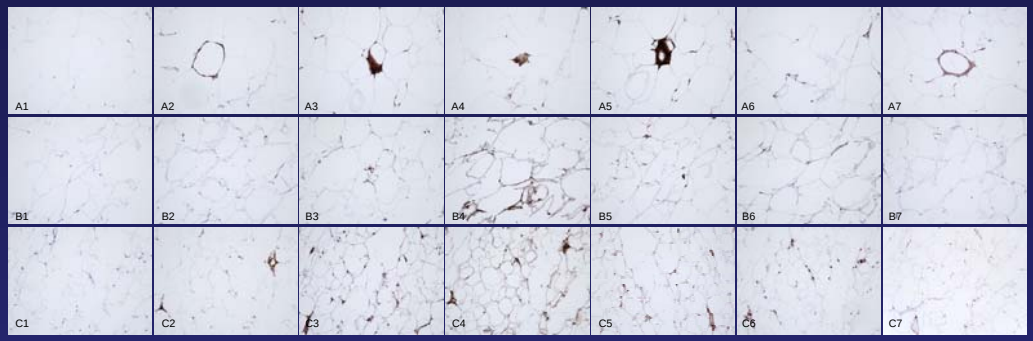

Figure 1: Pig number 9056 Row A: Perisplenic Adipose Tissue: A1: Nonimmune, A2: SRA, A3: iNOS, A4: Resistin, A5: MCP-1, A6: Omentin, A7: CD3
Row B: Subcutaneous Adipose Tissue: B1: Nonimmune, B2: SRA, B3:iNOS, B4: Resistin, B5: MCP-1, B6: Omentin, B7: CD3
Row C: Periadventitial Adipose Tissue: C1: Nonimmune, C2: SRA, C3: iNOS, C4: Resistin, C5:MCP-1, C6: Omentin, C7: CD3

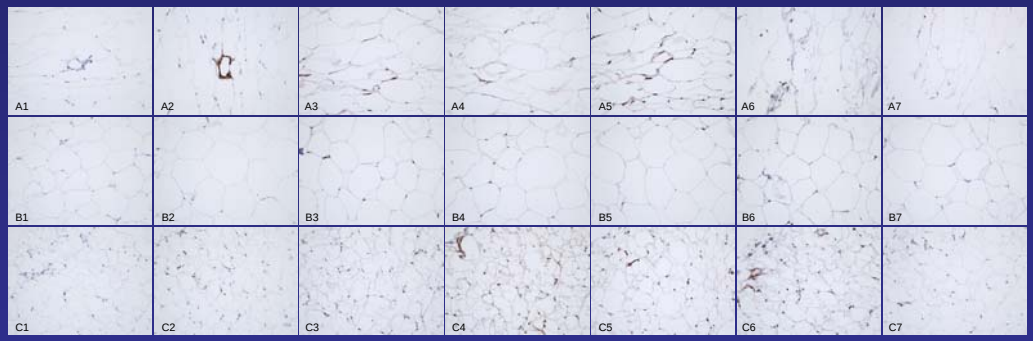

Figure 2: Pig number 9054 Row A: Perisplenic Adipose Tissue: A1: Nonimmune, A2: SRA, A3: iNOS, A4: Resistin, A5: MCP-1, A6: Omentin, A7: CD3
Row B: Subcutaneous Adipose Tissue: B1: Nonimmune, B2: SRA, B3:iNOS, B4: Resistin, B5: MCP-1, B6: Omentin, B7: CD3
Row C: Periadventitial Adipose Tissue: C1: Nonimmune, C2: SRA, C3: iNOS, C4: Resistin, C5:MCP-1, C6: Omentin, C7: CD3

Summary

- Adipocyte diameter appears to be related to adipose tissue location; however, the statistical significance is yet to be determined for the average diameters measured.
  - o Periadventitial adipocytes on average had the smallest diameter.
  - o Subcutaneous adipocytes on average had the largest diameter.
  - o Perisplenic adipocytes had the most variation in diameter between the two diets.
    - ▪ It appears that the high fat diet causes an increase in perisplenic adipocyte diameter.
  - o Statistical calculations have yet to be performed on the data due to time constraints.
- Images of the staining for a nonimmune and the six immunohistochemistry antibodies were taken for two pigs at all three adipose tissue locations.
  - o Perisplenic adipose tissue and periadventitial adipose tissue appears to have the greatest amount of IHC staining.
  - o Subcutaneous adipose tissue appears to have less inflammatory cytokines.
  - o Image capture is in progress for the tissue samples of the other five pigs.
  - o Immunohistochemistry analysis will be performed on all of the images to determine the percent staining.
- The immunohistochemistry should give an indication of inflammation and adipokine activity of each of the adipose tissue locations.

Acknowledgements

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