

Evaluating the Effects of Beta Glucans on Reducing the Stress Effects of Immunizations

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Immunostimulants: A Definition

Substances that Enhance the Immune
System

Non-Specific Immune System
Broad Spectrum

Immunostimulants in Fish Culture

- Stress and Disease are Common in Intensive Fish Culture
- Immunostimulants Can Potentially Help Prevent, Lessen, or Mitigate Effects of Stress and Disease.

Methods of Administration

- **Injection** – Most effective but most labor intensive. Not practical for large numbers or very small fish.
- **Immersion** – Not as effective but less labor intensive.
- **Oral** – As effective as immersion but easiest to administer.

Dietary Immunostimulants for Fish

- Production-grade diets fortified with natural substances.
- Diets are promoted with claims of enhanced immunity, increased health, and better survival.
- *Few production level studies or published results to substantiate claims.*

Hagerman NFH



Salmon River



Furunculosis in 2000

- Summer steelhead broke with furunculosis in 2000.
- Planned to vaccinate in 2001.
- Considered using Beta Glucan enhanced diet.

Beta Glucans

- Derived from bacteria, yeast, fungus, or plants.
- Shown to increase levels of lysozyme, macrophage activity, and phagocytosis.
- Preferred in aquaculture.

Evaluation Study

- Designed an evaluation study.
- Selected mucus lysozyme as the response variable.
- Mucus lysozyme is easily sample in a production setting and is non-lethal.

Experimental Design

- Controls
- Glucans Only
- Vaccinated Only
- Glucans and Vaccinated

Objectives

1. To determine if feeding beta glucans affects the non-specific immune system prior to vaccination.
2. To determine if changes in the non-specific immune system affect fish response during vaccination.
3. To document changes in general fish health before and after these treatments, both independently and in concert.

The Fish Immune System

Lymphoid tissues: *kidney, spleen*, thymus

Mucosal tissues: gut, *skin*, gills

Mucus is first barrier

Sites of leucocyte populations: - trap invaders
- produce non-specific immune factors

Glucan - absorbed in the gut

- reaches liver, spleen, and kidney via blood

Macrophages - capture blood-borne particles

- e. g. glucan and bacteria

Macrophages - mobilized from blood to specific tissues

react - pathogens, stress, blood-borne particle

Background

Routine rearing procedures

Fish health screening – no disease detected

Glucan – in Silver Cup for 6 weeks

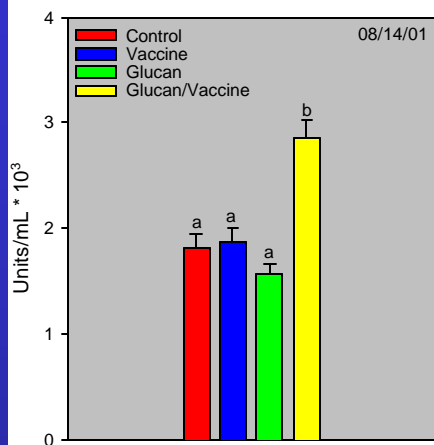
Lysozyme - product of the lymphoid tissues

- macrophages**
- measured as response variable**

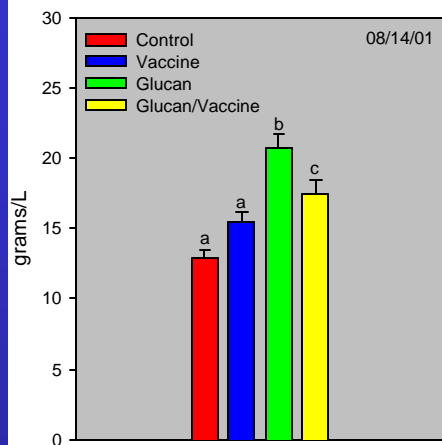
Sub clinical infection - adaptive diagnostic analysis

- new lysozyme analysis**
- liver & spleen glucan**
- liver acid phosphatase**

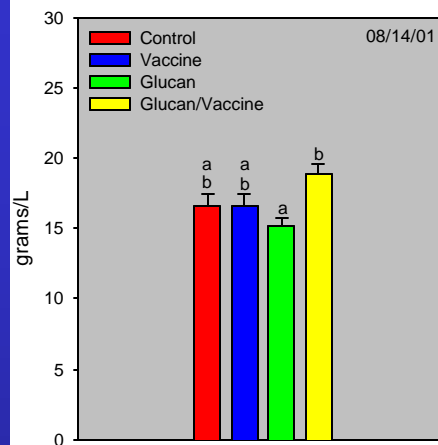
Lysozyme



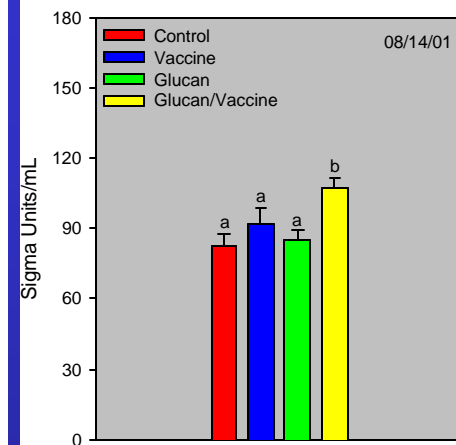
Liver Glucan



Spleen Glucan



Acid Phosphatase



Six week Beta Glucan feeding regime
Glucan and Glucan, Vaccine Treatments only

Start
07/20/01

End
08/31/01

Baseline sampling

All groups sampled

All groups sampled

All groups sampled

All groups sampled

07/17/01 07/31/01 08/07/01 08/14/01 08/27/01



25 dy glucan

**Vaccination (Vaccine and
Glucan, Vaccine treatments only)**

Start
09/22/01

End
09/28/01

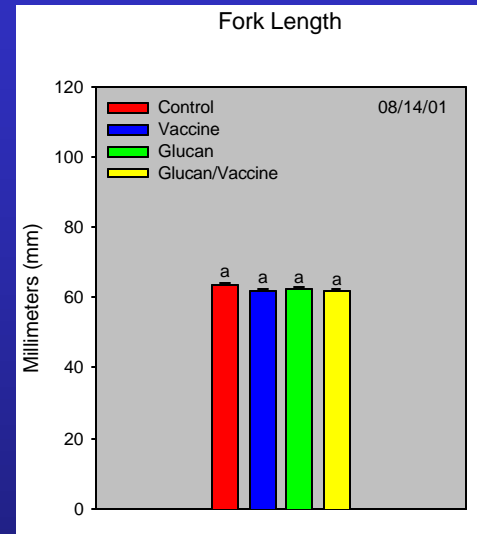
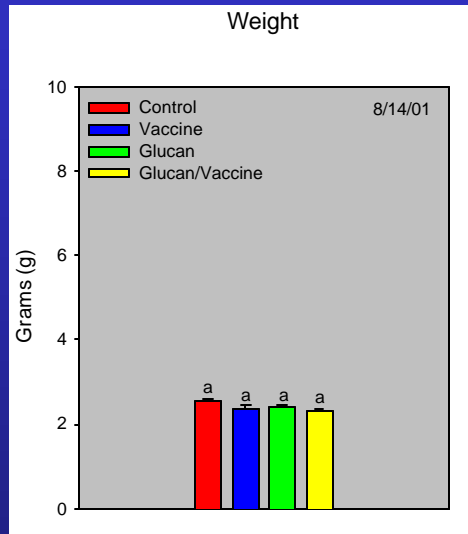
New feed type introduced

All groups sampled

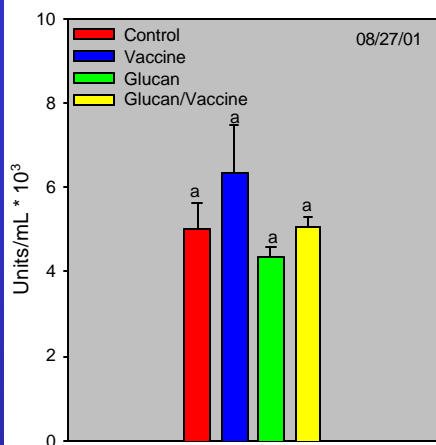
Romet fed to Vaccine
treatment only

All groups sampled

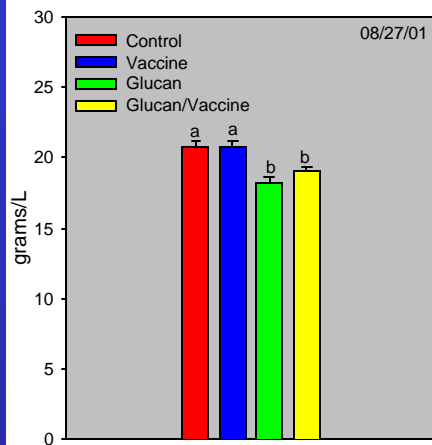
09/05/01 09/10/01 09/19/01 10/03/01



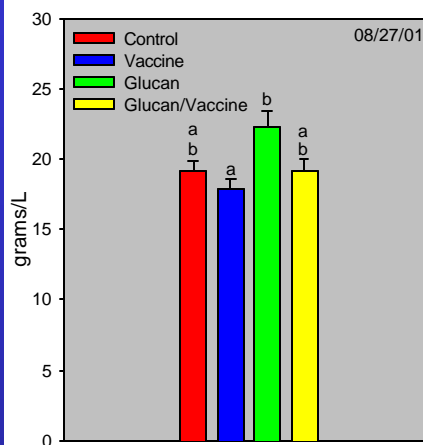
Lysozyme



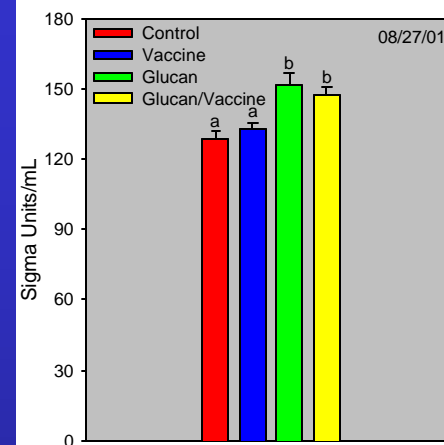
Liver Glucan



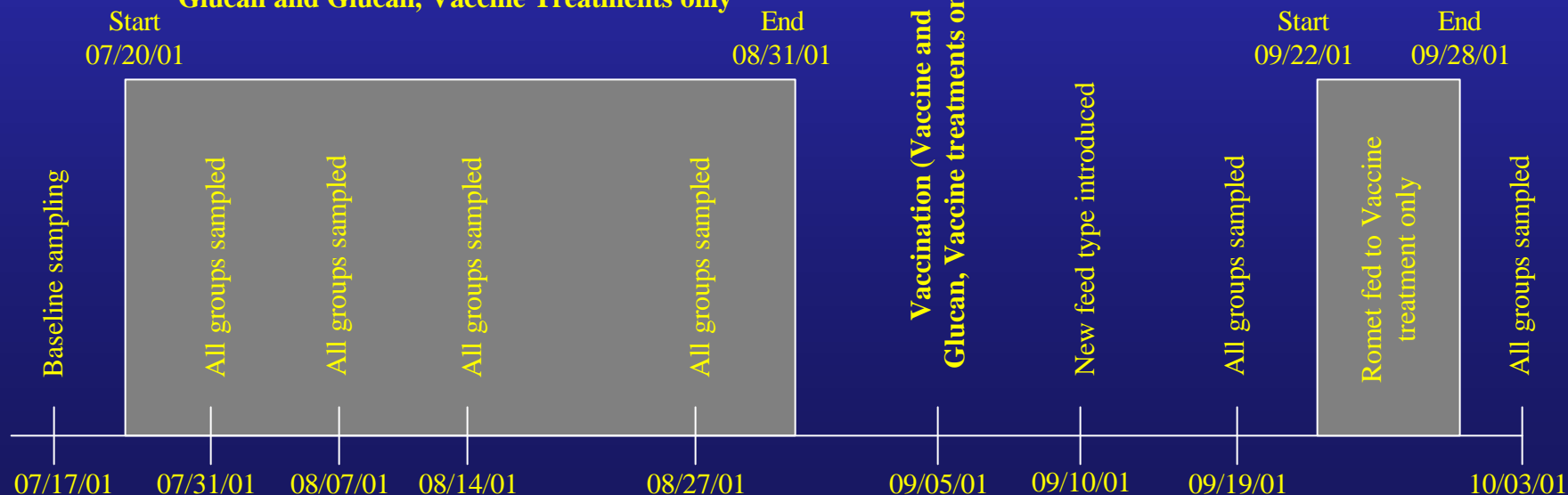
Spleen Glucan

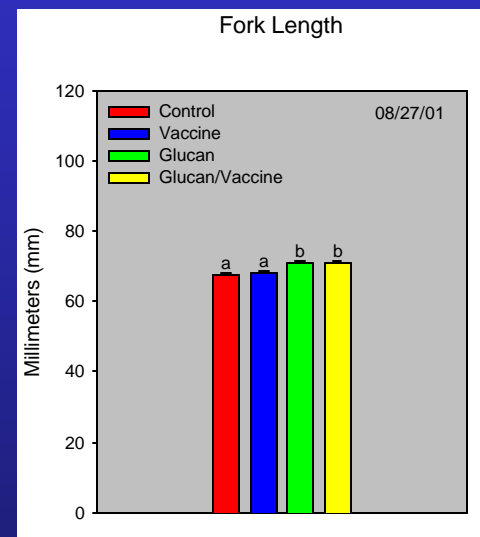
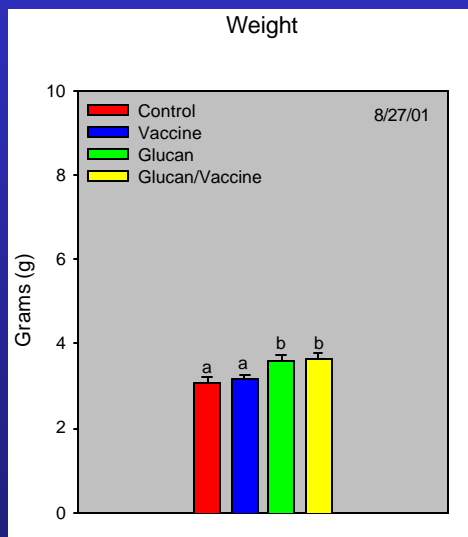


Acid Phosphatase

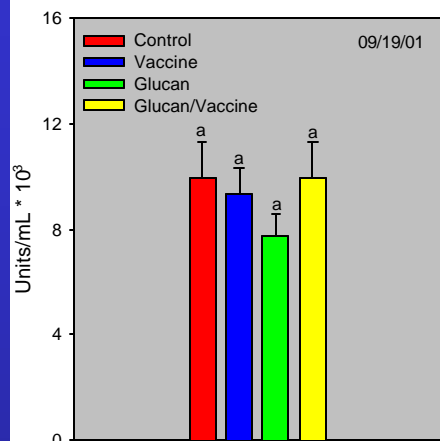


Six week Beta Glucan feeding regime Glucan and Glucan, Vaccine Treatments only

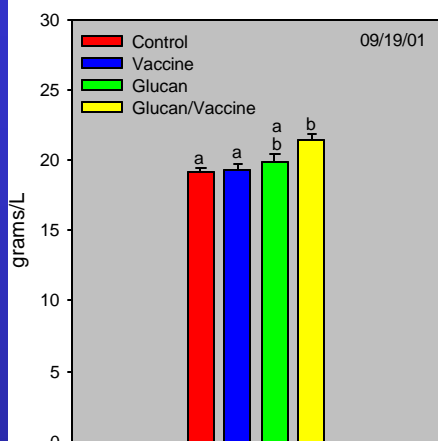




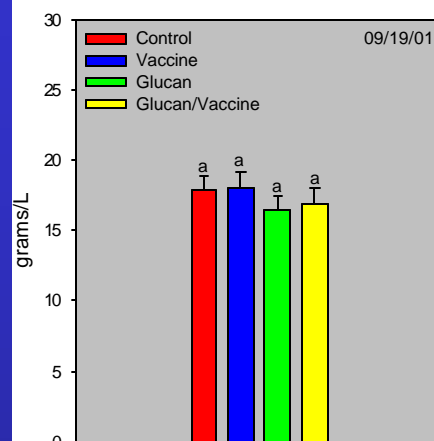
Lysozyme



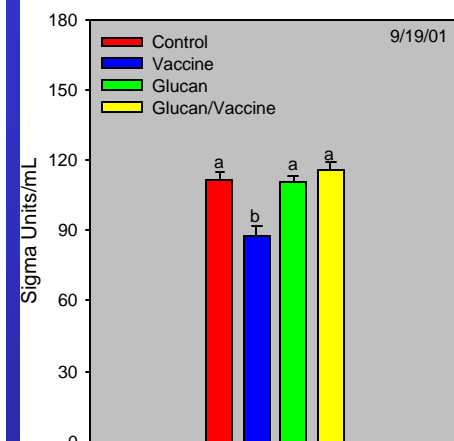
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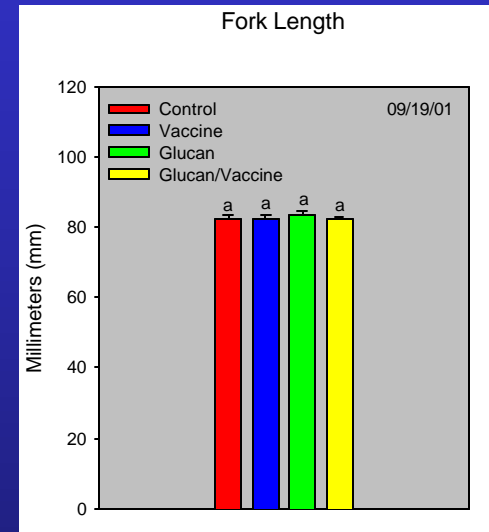
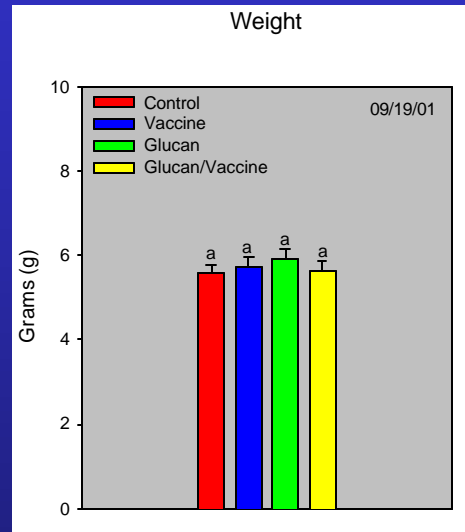
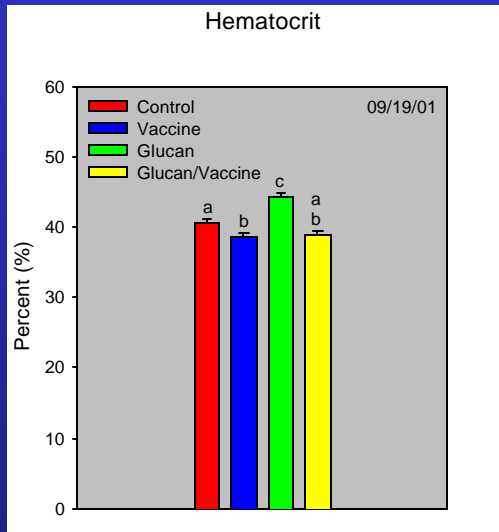
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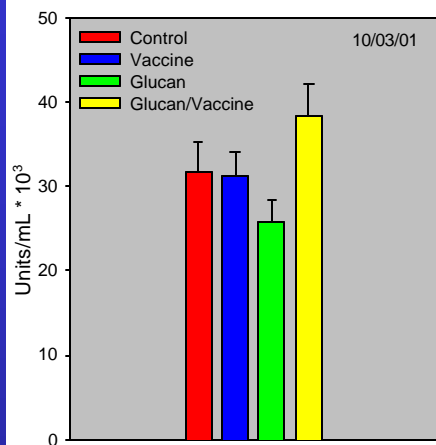
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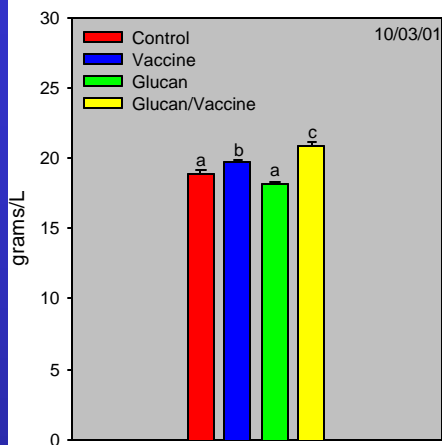




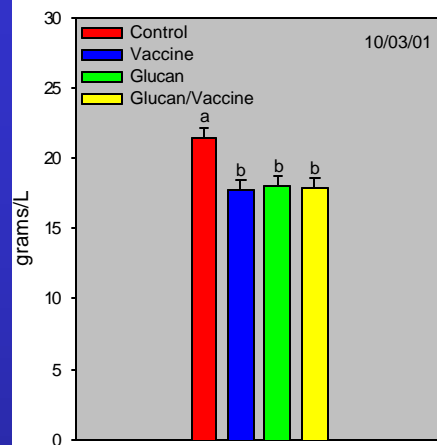
Lysozyme



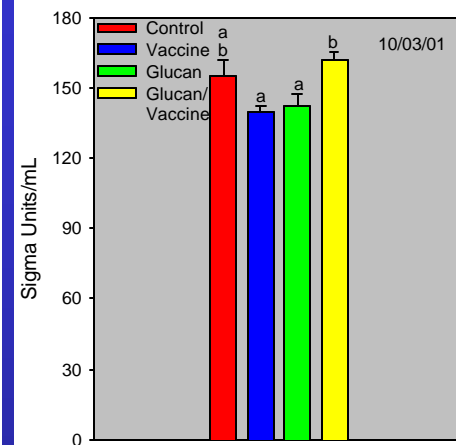
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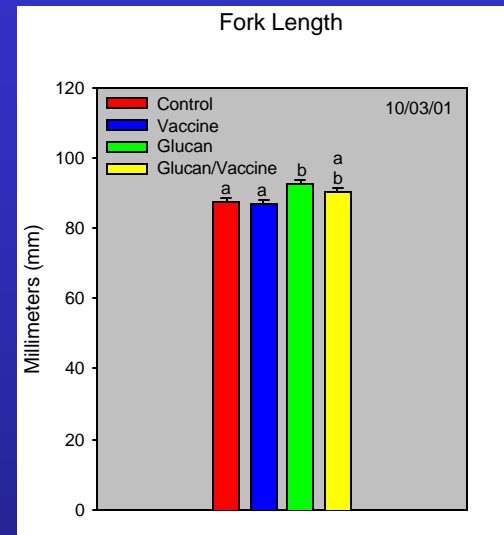
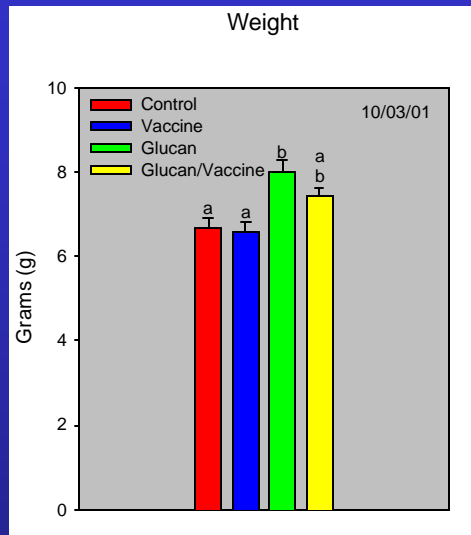
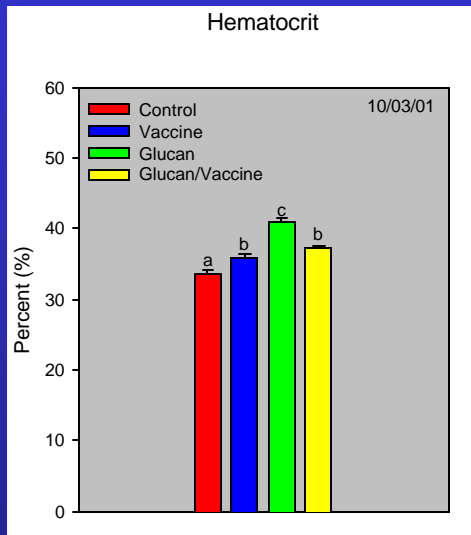
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Summary of significant results

Lysozyme - Glu/Vac sig higher @ 25 dy and 4 wk post vac

Liver glucan - Glu and Glu/Vac sig higher @ 25 dy

- Glu and Glu/Vac sig lower @ 38 dy
- Glu/VAC sig higher than no glucan groups @ 2 wk
- Glu/VAC sig higher @ 4 wk

Spleen glucan - Glu and Glu/Vac sig diff @ 25 dy

- Glu and Vac sig diff @ 38 dy
- Control sig higher @ 4 wk

Liver acid phosphatase - Glu/Vac sig higher @ 25 dy

- Glu & Glu/Vac sig higher @ 38 dy
- Vac sig lower @ 2 wk



More Questions than Answers

Glu/Vac sig higher lysozyme @ 25 dy

– evidence of immune response of sub-clinical infection ?

Glu/Vac sig higher liver glucan @ 2 & 4 wk

– evidence of vaccine stimulatory effect?

Glu/Vac ACP sig higher @ 25 dy

– evidence of sub-clinical infection?

Glu/Vac & Glu sig higher ACP @ 38 dy

– evidence of immune stimulation?

Glu/Vac & Glu lower liver glucan @ 38 dy

– evidence of immune suppression?

Control spleen glucan sig higher @ 4 wks

– evidence of ?

Conclusions

Significant increases in length and weight @ 38 dy and 4 wk

General increase in lysozyme in all groups over time

Liver glucan levels in all groups similar late August +

Significant increase in liver glucan @ 4 wks

ACP increases & decreases similarly in all groups