

Active Hexose Correlated Compound Enhances Immune Function in Microgravity Analog for Spaceflight Effects in Mice

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Microgravity and Immune Function

- **Spaceflight increases risk of infectious diseases and cancer**
- **Microgravity is one of the most important stressors for space travelers**
- **Microgravity affects innate and adaptive immune functions, including T-cell function and inflammatory response**



Active Hexose Correlated Compound (AHCC)

- **AHCC is extracted from mycelia of Basidiomycetes (mushroom)**
- **AHCC is a mixture of oligosaccharides**
The main component is α -1,4-glucan
- **AHCC affects the immune system, producing**
 - **anti-tumor activity**
 - **enhanced resistance to infection**



**Tank for culture and
fermentation**



AHCC powder

Experiment Aim

**To examine the effect of AHCC
on immune function
in microgravity analog of rodents**

Experimental Groups

non-HU (non-microgravity)

0 g/kg/day AHCC

0.1 g/kg/day AHCC

1 g/kg/day AHCC

10 g/kg/day AHCC

HU (microgravity)

0 g/kg/day AHCC

0.1 g/kg/day AHCC

1 g/kg/day AHCC

10 g/kg/day AHCC

**8 wk female BALB/c mice
(n=5)**



**Hindlimb unloading
(HU) of rodents is
commonly used
to simulate
microgravity analog
in mice**

Materials and Methods

Pre-Treatment for Popliteal Lymph Node (PLN) Response

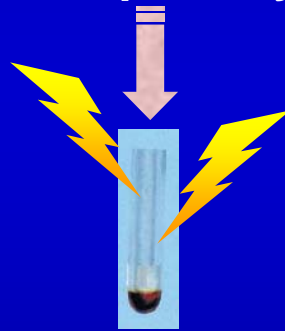
Day 0



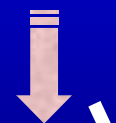
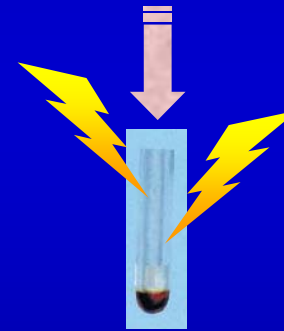
BALB/c (H2^d) syngeneic
splenocytes



C57BL/6 (H2^b) allogeneic
splenocytes



Irradiation
(3000 R)



Injected into
contralateral footpads

Treatment and Assay

Day 0



Day 7



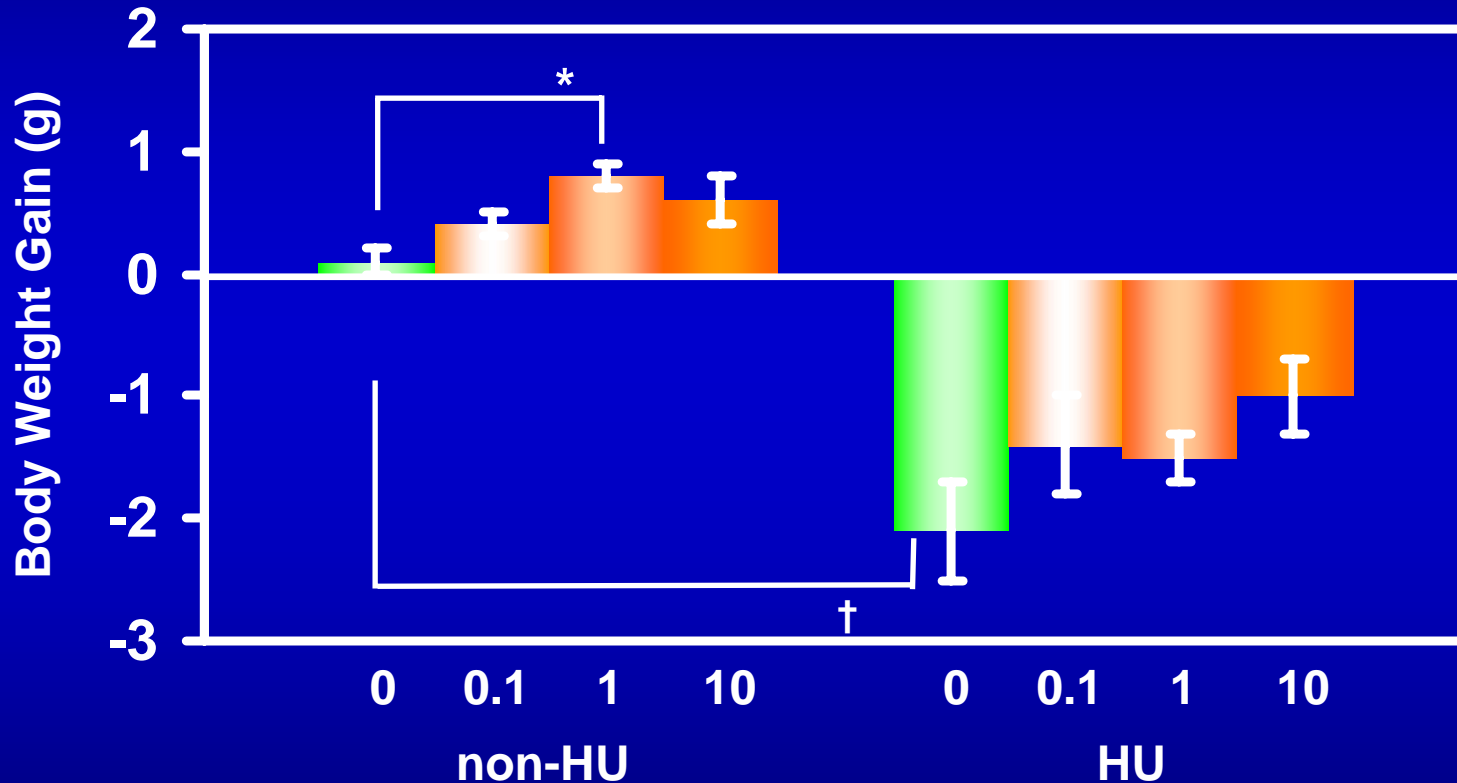
Experiment Treatment:

- HU was applied
- Drinking water containing AHCC was administered

Measurements:

- Body weight gain
- Spleen weight
- PLN proliferation response
- Splenocyte proliferation response
- Inflammatory cytokine production
- Inflammatory chemokine production

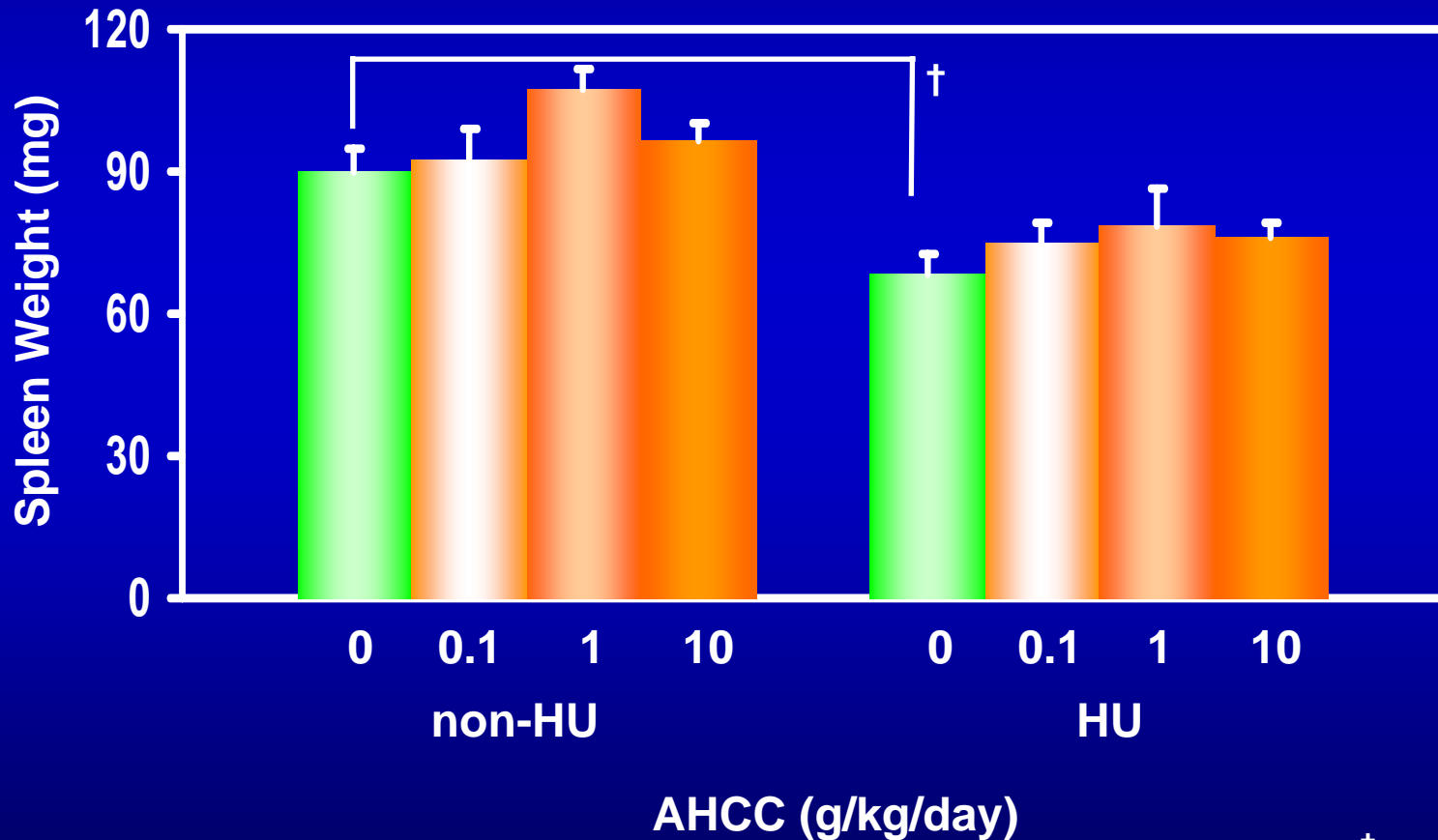
Effect of HU and AHCC on Body Weight Gain



AHCC (g/kg/day)

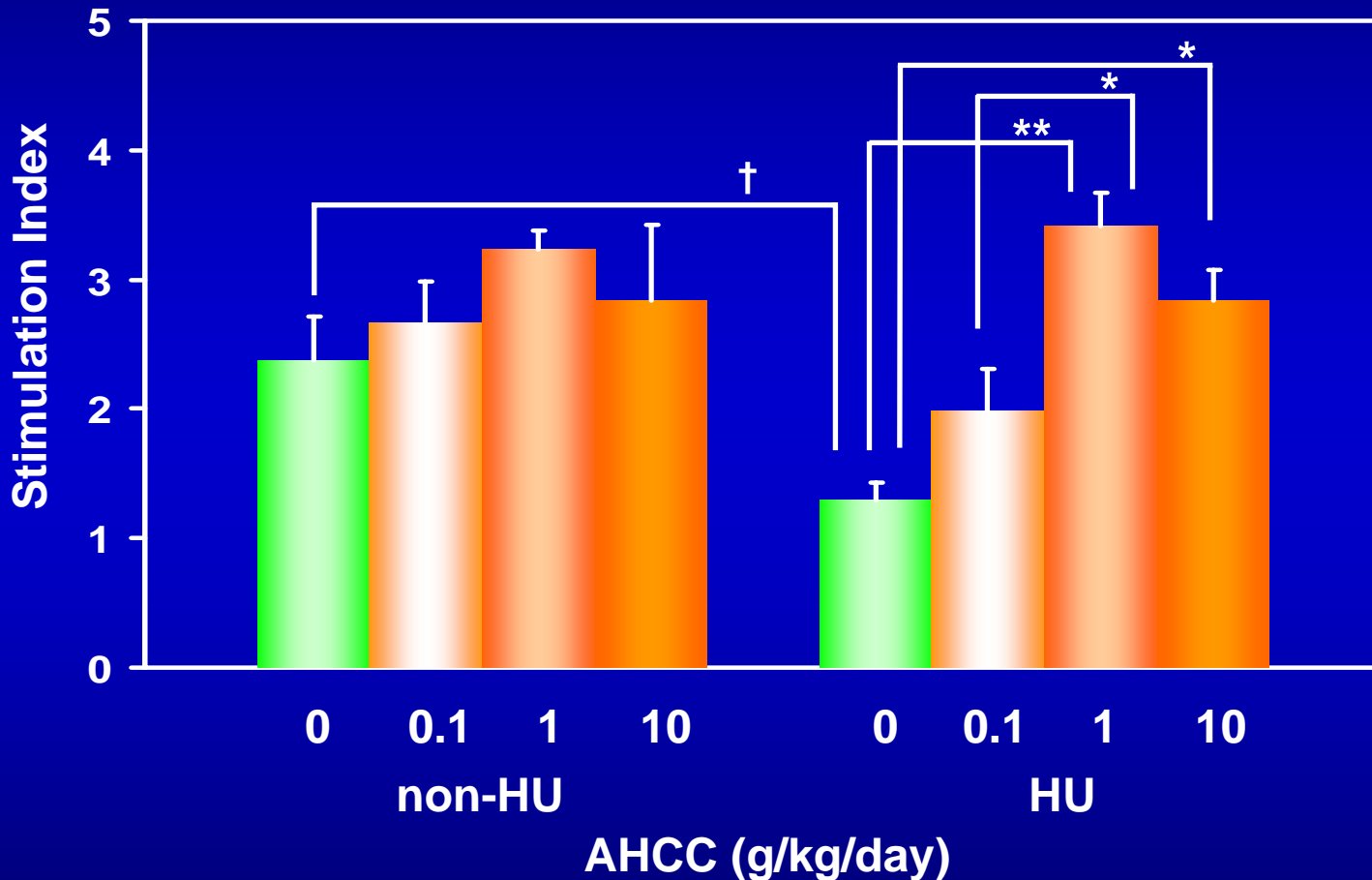
* $p < 0.05$, † $p < 0.001$

Effect of HU and AHCC on Spleen Weight



† $p < 0.05$

Effect of HU and AHCC on In Vivo PLN Proliferation Response

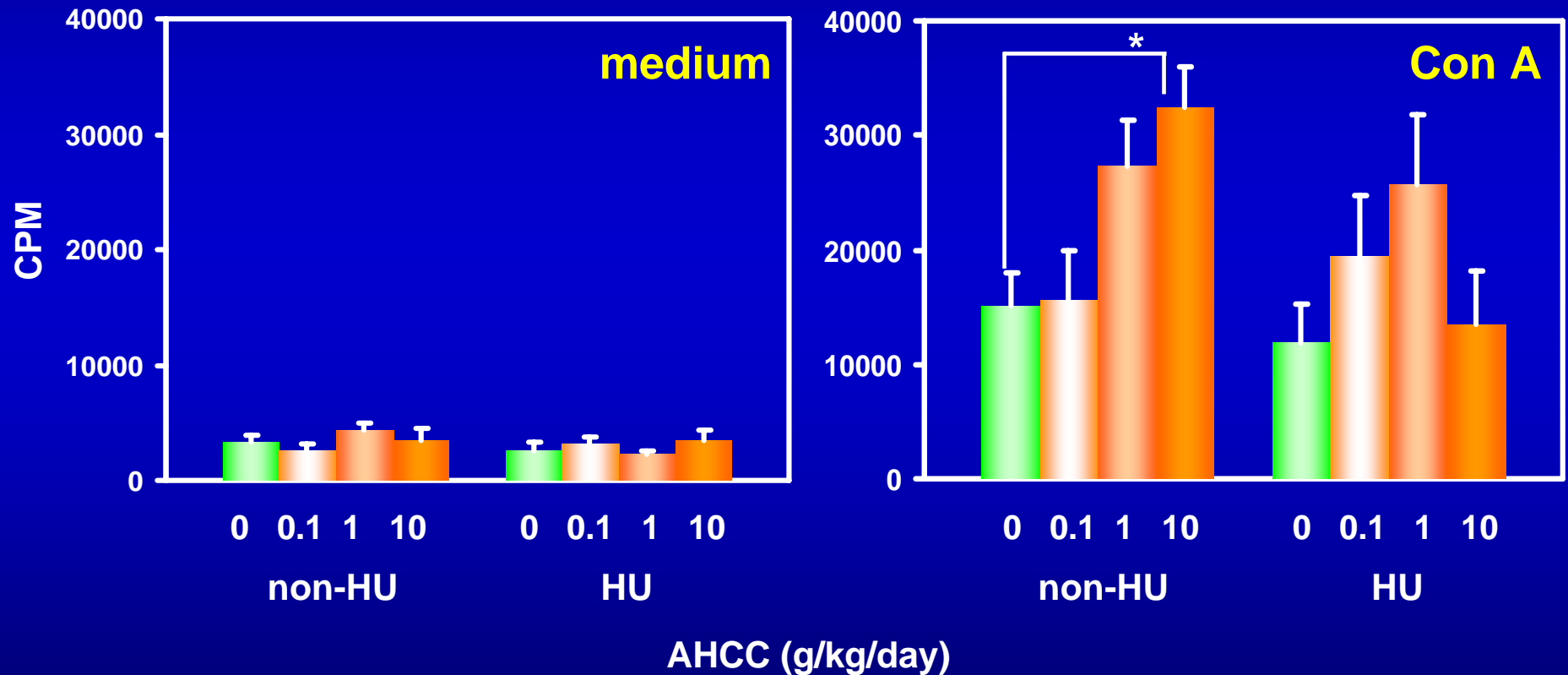


$$\text{Stimulation Index} = \frac{\text{Weight of allogeneic PLN}}{\text{Weight of syngeneic PLN}}$$



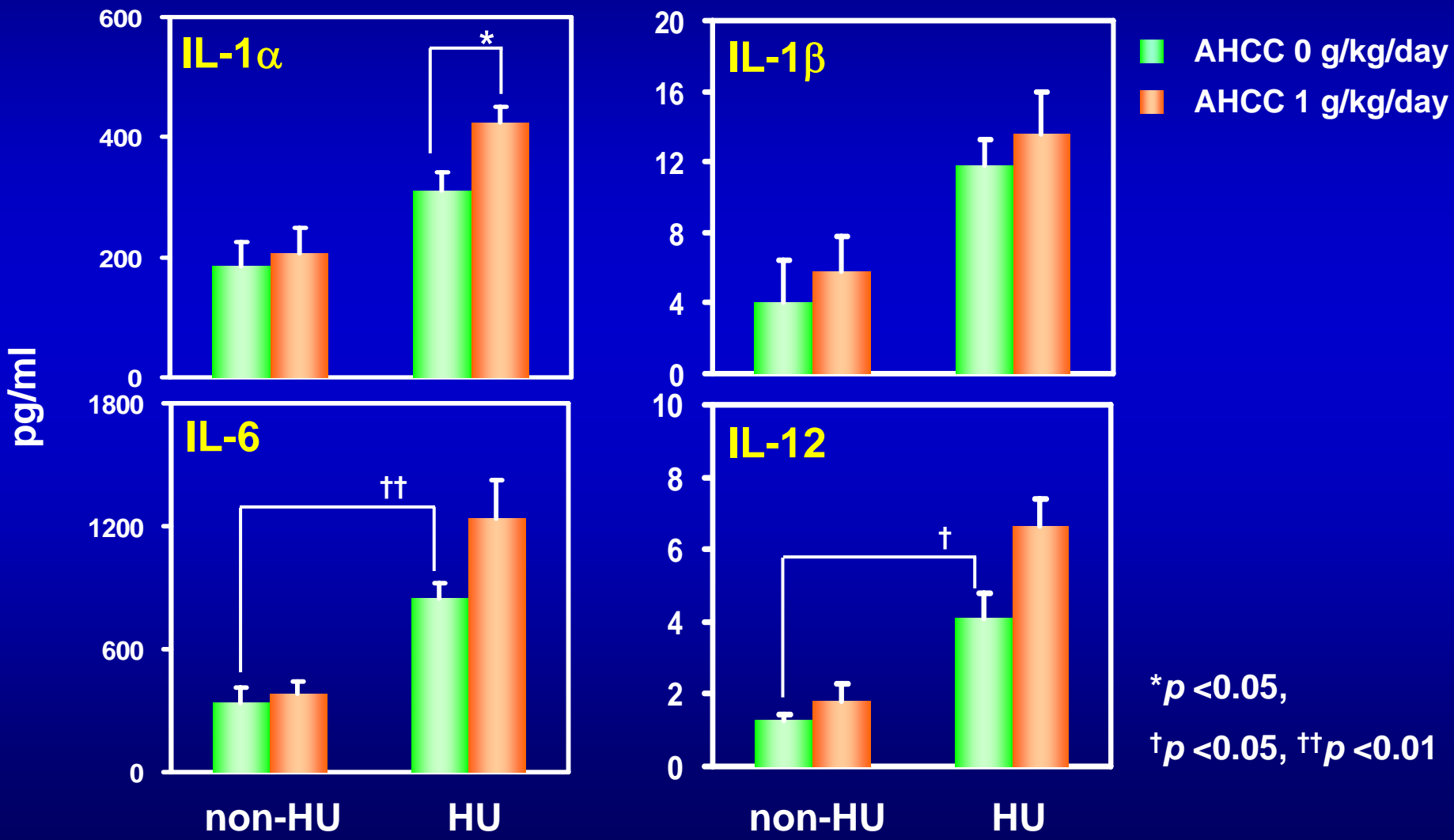
†p < 0.05, *p < 0.05, **p = 0.001

Effect of HU and AHCC on Ex Vivo Proliferation Responses of Splenocytes Stimulated with Con A

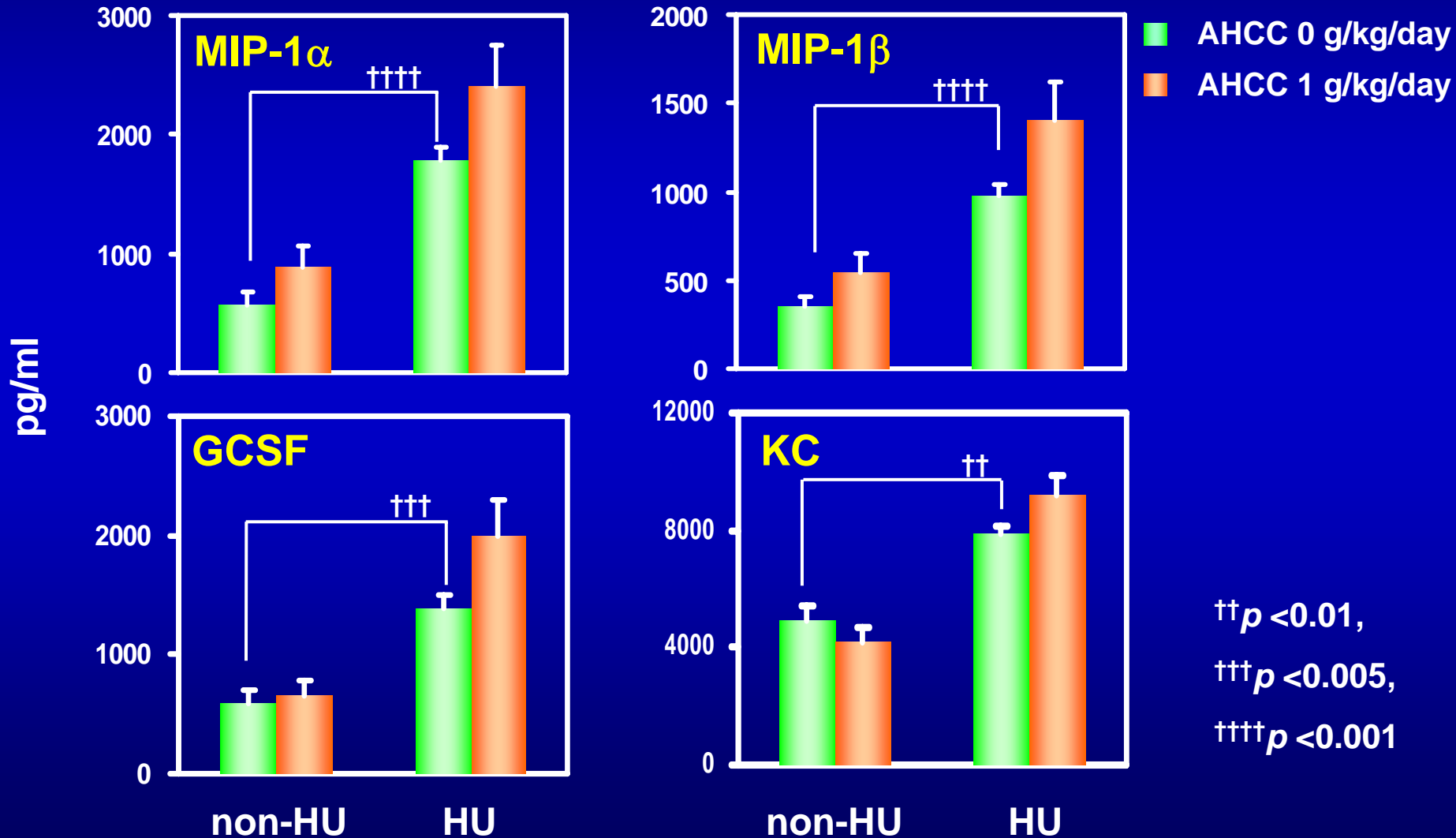


* $p < 0.01$

Effect of HU and AHCC on Inflammatory Cytokine Productions in Splenocytes Stimulated with LPS



Effect of HU and AHCC on Inflammatory Chemokine Productions in Splenocytes Stimulated with LPS



Results Summary

- **AHCC increased *in vivo* and *ex vivo* T-cell function in normal and microgravity (HU) analogs.**
- **Microgravity (HU) analog increased inflammatory responses. AHCC further increased those responses.**

Conclusions

- **AHCC administered under microgravity (HU) conditions enhances specific and non-specific immune function in mice.**
- **AHCC administered under microgravity (HU) conditions may help maintain the immune system, especially T-cell function.**

Thank you for your attention!!

