Calf Notes.com

Calf Note 171 – Immunity in Jersey calves

Introduction

A common question when I visit with calf raisers is something to the effect of "Why do I have more challenges with my Jersey calves"? It's a common query, especially with producers who raise both Jerseys and Holsteins. Producers often relate that Jersey calves are somehow more "sensitive" to disease and if they become ill, they seem to "go downhill" more rapidly than other breeds.

So, what are some of the reasons that Jersey calves may differ from Holsteins? Some recent research suggests that both nutrition and immunity effects may be involved.

Body size

Of course, Jersey calves are smaller than Holsteins. However, According to Dr. Bob James of Virginia Tech, Jersey calves have a larger surface area to volume ratio than Holstein calves . If you're interested in a nice tutorial on how surface area is related to body size, click here: (http://openlearn.open.ac.uk/mod/oucontent/view.php?id=398740&section=5.3). From a practical standpoint, this means that Jersey calves have a higher maintenance requirement per unit of body weight compared to Holsteins. (More information on differences in feeding programs for Jerseys is available here: http://pubs.ext.vt.edu/news/dairy/2012/01-12/dp_2012-01-02_pdf.pdf). Thus, Jersey calves may need more energy than Holstein calves per unit of body weight.

Immunity

In addition to surface area, recent research suggests that Jersey calves may have a different level of immunity than Holstein calves.

A study published in the December 2012 issue of the Journal of Dairy Science by Michael Ballou from Texas Tech compared the innate immune response of Holstein and Jersey calves. The calves (20 Holsteins and 22 Jerseys) were fed either a conventional (454 g/day of 20/20 CMR) or an intensified (Jerseys: 568-680 g/d of a 28/25 on wk 1 and wk 2-6; Holsteins: 810 and 1,180 g/d of a 28/20 on wk 1 and wk 2-6) milk program. Periodically, blood samples were collected and analyzed for markers of immunity and various biochemical parameters.

While there were some interesting differences due to feeding program, this Calf Note will focus primarily on breed differences.

Jersey calves in the study consistently had higher serum total protein compared to Holstein calves. This has been shown previously; Jones et al. (2004) reported that Jersey calves absorbed colostrum IgG more efficiently than Holsteins. These data suggest that Jersey calves have higher circulating

IgG, so to the extent that the circulating IgG (serum total protein) influence immunity, Jerseys should be better protected than Holsteins against disease.

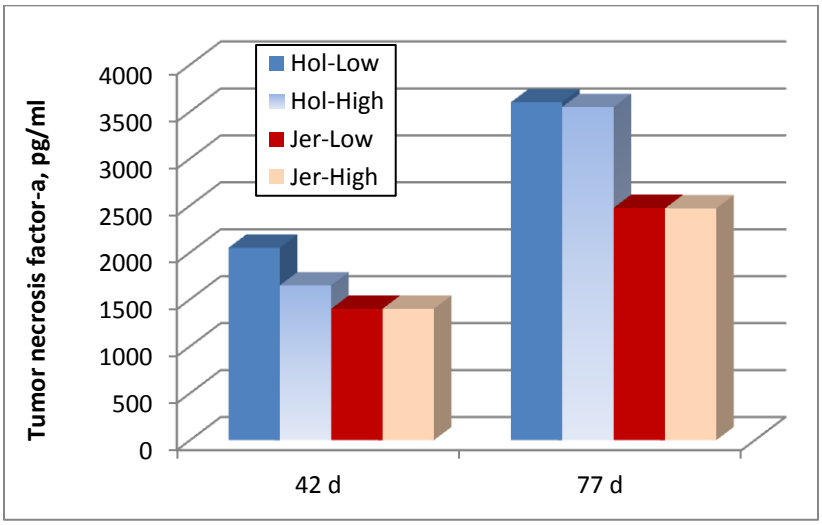

Figure 1. Secretion of TNF-a from isolated PBMC when cultured with PS from E. coli on d 42 and 77. Adapted from Ballou, 2012.

Texas Tech researchers reported several differences in immune response between Holsteins and Jerseys. First, peripheral blood mononuclear cells (**PBMC**) from Holstein calves produced tumor necrosis alpha (**TNF-α**) when stimulated with lipopolysaccharide compared to PBMC from Jersey calves (Figure 1). What does this mean? Basically, immune cells such as PBMC recognize when an immune response is needed in the body (e.g., when there is an infection). We can simulate this by exposing PBMC (which we collect from a blood sample) to chemicals such as lipopolysaccharide (**LPS**). The LPS is a "universal" signal to the body that there has been a bacterial invasion and an immediate immune response is needed to fight the infection. The PBMC then secrete chemicals (including TNF-α) that tell the rest of the body to initiate an immune response. Physical signs such as anorexia and fever are manifestations of this immune response.

It appears that PBMC from Jerseys are less responsive to stimulation than PBMC from Holsteins. This might imply that Jersey calves may be less capable of fighting infection; however (and as pointed out in the research paper), the relationship between PBMC responsiveness and disease resistance in young calves requires more research data.

Jersey calves also showed reduced neutrophil oxidative burst and a lower ability to kill *E. coli* when whole blood was cultured with *E. coli* for 10 minutes. Oxidative burst is the rapid release of chemicals (oxygen species) that effectively kill bacteria and fungi. Oxidative burst is an index of the ability of immune cells (e.g., neutrophils) to kill bacteria. Reduced immunity in Jerseys were only observed after the neonatal period.

Moreover, the oxidative burst and killing ability of Jersey calves at 77 days were more when the Jersey calves were fed the lower plane of nutrition prior to weaning. The implications of this finding are intriguing. First, the data suggest that preweaning plane of nutrition may influence post-weaning immune response. Also, the data suggest that Jersey calves may require more preweaning nutrition to maintain adequate immunity post-weaning.

Summary

These data, along with other published studies, suggest that Jerseys are fundamentally different from Holstein calves. Their smaller body weight but greater surface area suggest that Jersey calves may have a greater maintenance energy requirement. They are more efficient in absorbing IgG and, at similar intakes of IgG, will have greater concentrations on serum IgG (passive immunity). However, their cellular immune response appears to be somewhat less efficient than Holstein calves and this response is affected by their preweaning nutrition. More research will help us better understand the unique nutrition and management requirements of Jersey calves and allow us to better formulate nutritional and management programs for these animals.

References

Ballou, M. A. 2012. Immune responses of Holstein and Jersey calves during the preweaning and immediate postweaned periods when fed varying planes of milk replacer. J. Dairy Sci. 95:7319-7330.

Jones, C. M., R. E. James, J. D. Quigley, III, and M. L. McGilliard. 2004. Influence of pooled colostrum or colostrum replacement on IgG and evaluation of animal plasma in milk replacer. J. Dairy Sci. 87:1806–1814.

Written by Dr. Jim Quigley (09 December 2012)

Calf Notes.com (http://www.calfnotes.com)