

Science of Magnitude™

**Research Evaluating the Impact of Feeding Magnitude™
on Stallion Sperm Production and Motility Characteristics**

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Introduction

The phospholipid membrane of mammalian spermatozoa has a characteristic fatty acid composition. In most mammals, DHA (docosahexaenoic acid; 22:6, a long-chain polyunsaturated omega-3 fatty acid, or a LC-PUFA) is the major component of the membrane, although this varies by species as well as by individual (4, 8). Recent research suggests that DHA is important to normal spermatozoa function. The deficiency of LC-PUFAs in the spermatozoon plasma membrane, especially DHA, is one marker of impaired fertility in men (4).

The semen lipid profiles for boars and stallions are similar (8), and studies have shown that a high DHA to DPA (docosapentaenoic acid; 22:5, an omega-6 fatty acid) ratio is associated with greater fertility (9). In boars, high DPA concentrations are associated with poor semen quality, while high DHA concentrations are associated with good semen quality. Moreover, boars fed DHA-enriched diets had ejaculates with increased sperm concentration and a higher percentage of morphologically normal spermatozoa (10). This relationship may be especially important in stallions. Popular stallions in all breeds are often bred to a large number of mares. But, approximately 30 percent of stallions have semen that has poor quality after cooling and storage at 5° C, or after freezing and thawing.

Horses and other animals are unable to synthesize the essential omega-3 LC-PUFAs from saturated or monounsaturated fatty acids, thus, they must be provided in the diet. Unfortunately, most horse feeds are very high in precursors for omega-6 fatty acids while the precursors for omega-3 fatty acids, such as DHA, are low. Plant sources of omega-3 fatty acids, such as flaxseed meal or flaxseed oil, contain only short chain precursors that cannot be converted to DHA in sufficient quantities to meet requirements. Research at Colorado State University has demonstrated that feeding horses a supplement containing DHA resulted in increased plasma levels of DHA, whereas feeding flaxseed meal did not increase plasma levels of DHA (11). Thus, the omega-3 LC-PUFAs, from marine sources, must be provided in the diet to supply DHA for sperm production.

Magnitude™ provides an unique proprietary blend of LC-PUFAs, in particular the important LC-PUFAs DHA and EPA (eicosapentaenoic acid, 20:5 n-3), plus complementary antioxidants and vitamins. Magnitude's source of fatty acids is similar to those often used in human foods and nutraceuticals, and several studies have confirmed the safety of DHA in both humans and other mammals (7). Research suggests that DHA oils do not cause toxicity, even at doses 100 times the daily recommended human intake (2).

Research Trials

Brinsko and colleagues at Texas A&M University (3) reported that feeding a DHA-enriched nutraceutical, similar to Magnitude™, resulted in a three-fold increase in semen DHA levels and a 50 percent increase in the ratio of DHA to DPA in semen. Sperm concentration was increased 1.8 fold and motility characteristics were improved following 48 hours of cooled storage. Most importantly, feeding the DHA supplement to stallions with poor sperm characteristics following cooling and storage resulted in significant improvements ($P = 0.10$)

in progressive motility of sperm after 24 hours and 48 hours ($P = 0.03$) of cooled storage (Fig. 1). Similar improvements in sperm motion characteristics were observed in frozen-thawed semen. These researchers concluded that DHA supplementation may be most beneficial for stallions of marginal fertility whose sperm do not tolerate the rigors of cooling and storage. They also noted the freezability of semen appeared to be improved.

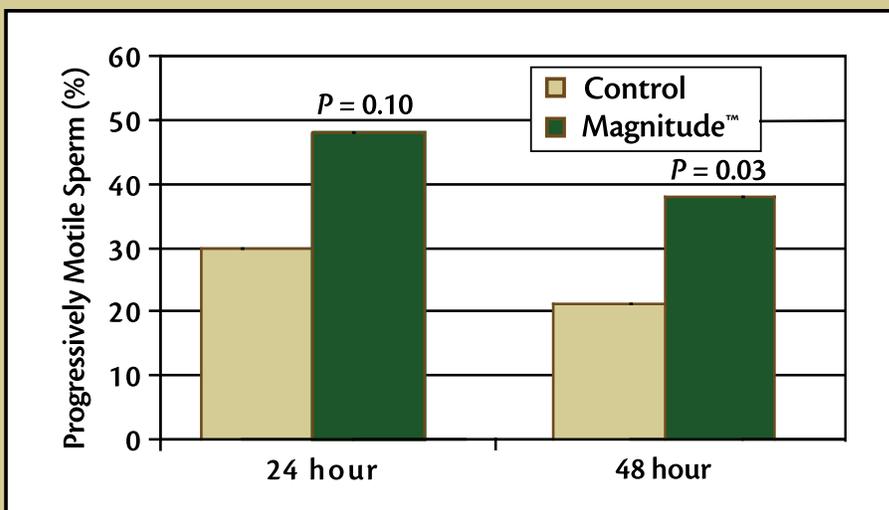


FIGURE 1:
Effect of feeding Magnitude™ on semen of stallions (n = 4) having <40% progressively motile sperm after 24 and 48 hours of cooling and storage.

Adapted from Texas A&M University 2005 (3)

Harris et. al. at the University of Arizona (5,6) reported results similar to Texas A&M after feeding Magnitude™ to stallions for 90 days. Daily sperm output was increased ($P < 0.05$) by 46 percent in supplemented stallions compared to stallions fed control diets. The percentage of morphologically normal spermatozoa (Fig. 2) was also increased ($P < 0.05$). This improvement was most dramatic for the stallion with the lowest initial morphology score and lowest progressive motility. Improved progressive motility was observed following 48-hour cooled storage and

cryopreservation (Fig. 3). Sperm plasma membrane DHA concentration was increased ($P < 0.05$) in supplemented stallions, but remained unchanged in stallions fed the control diet. DPA levels in supplemented and control stallions did not change, thus the DHA:DPA ratio was improved for stallions supplemented with Magnitude™. These researchers also suggested that supplementation of stallions with Magnitude™ could increase daily sperm output and provide particular benefit in stallions with poor quality ejaculates.

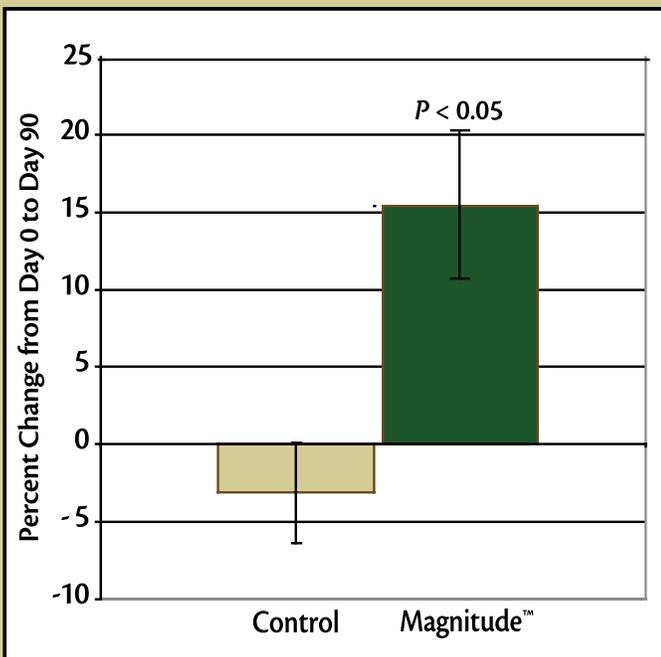


FIGURE 2:
Effect of feeding Magnitude™ on the percentage of morphologically normal spermatozoa in fresh semen (n = 6).

University of Arizona 2005 (5,6)

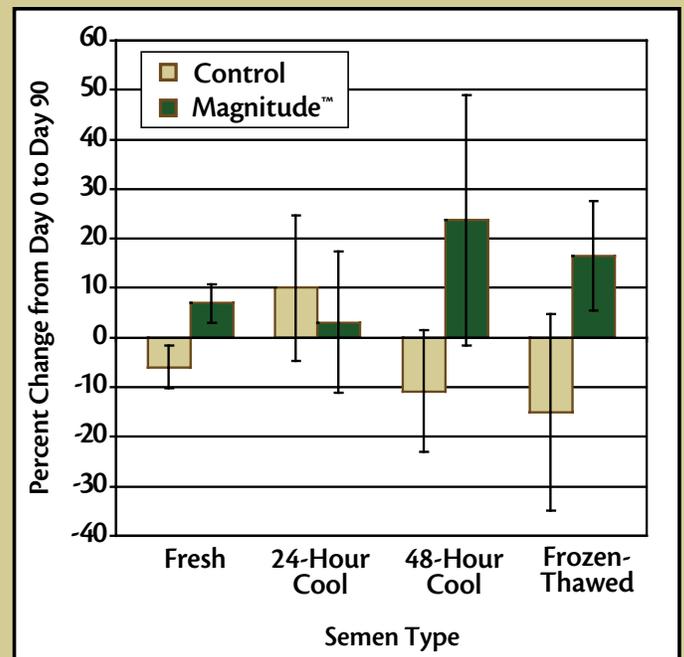


FIGURE 3:
Effect of feeding Magnitude™ on the percentage of progressively motile spermatozoa (n = 6).

University of Arizona 2005 (5,6)

Trials conducted during the 2005 breeding season at Colorado State University (12) and the University of Arizona (1) confirm and support the previous research. Stallions were allotted to either control or Magnitude™ supplemented diets. Sperm reserves were depleted by daily semen collection for five days. Then semen was collected daily for a three-day experimental period. This procedure was conducted both pretrial and at the end of a 90-day feeding period. Standard semen analysis was performed on each ejaculate of fresh, cooled for 24 and 48 hours, and frozen-thawed semen. The results are presented in Figure 4 (for Colorado State University) and Figure 5 (for University

of Arizona) as percent change in TPMS (total progressively motile sperm per ejaculate) at the end of the trial period relative to the TPMS for each stallion at the beginning of the trial. The TPMS was calculated by multiplying the total cells (daily sperm output) in fresh semen, times the percent progressively motile sperm in fresh, cooled, and frozen-thawed semen. Magnitude™ resulted in improved TPMS for fresh, 24- and 48-hour cooled, and frozen-thawed semen in both trials. Of particular note was the significant ($P < 0.10$) increase in TPMS in fresh and 24-hour cooled semen at Colorado State University and 48-hour cooled semen at the University of Arizona.

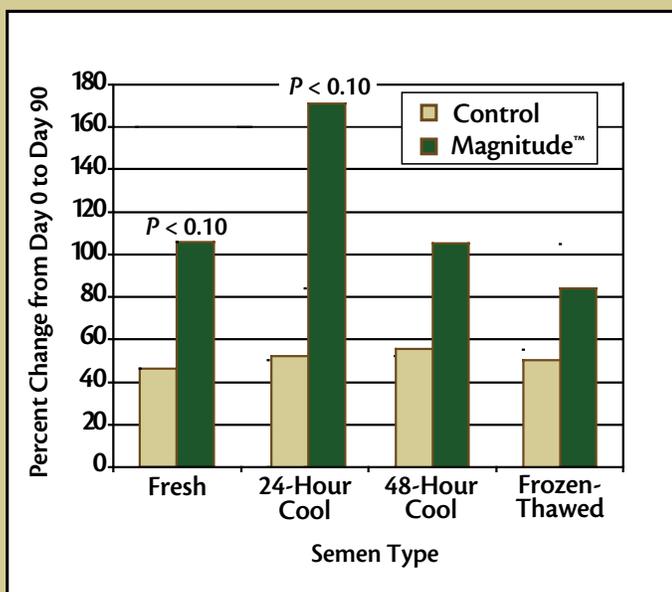


FIGURE 4:
Effect of feeding Magnitude™ to stallions (n = 10) on daily output of total progressively motile sperm per ejaculate.

Colorado State University 2005 (12)

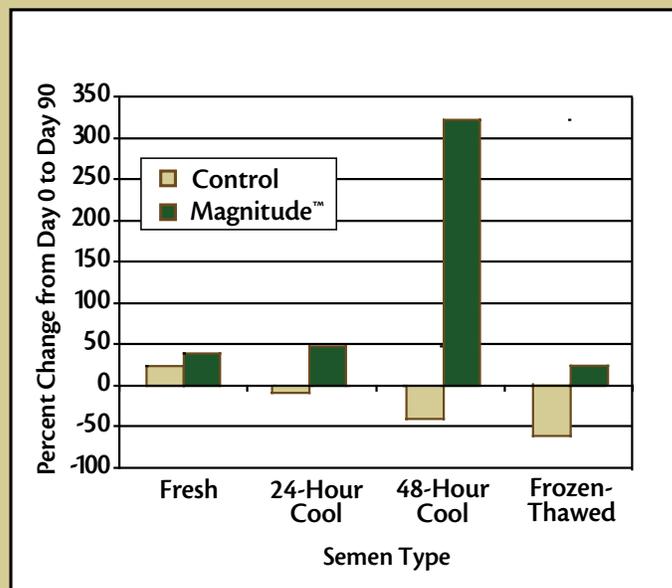


FIGURE 5:
Effect of feeding Magnitude™ to stallions (n = 6) on daily output of total progressively motile sperm (TPMS).

University of Arizona 2005 (1)

Conclusions

Trials in stallions and other mammalian males have clearly demonstrated the positive impact of supplementing diets with DHA on sperm production and motility characteristics as indicators of fertility. Plant sources of omega-3 fatty acids (e.g. flax) do not supply DHA. The precursors of DHA in these plant sources cannot be metabolized to DHA in sufficient quantities to meet the dietary requirements. Therefore, a marine source of omega-3, such as the high quality DHA in Magnitude™, must be provided in the diet to achieve the beneficial effects associated with incorporation of DHA into the sperm cell.

References

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