Enhanced herd health and performance with omega-3 fatty acids

The high producing dairy cow faces many challenges in regards to their health and performance. The most important of these, which can drastically impact dairy farm profitability and the profitability of the global dairy enterprise, is reproductive performance, with reproductive failure having been identified as the most prevalent reason for involuntary culling.

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It is well understood that as dairy cow milk yields continue to increase, this is having an increased negative impact on fertility, with lower yielding cows having higher fertility rates, partly though faster removal rate of progesterone from the blood by the liver.

Egg implantation

After ovulation, the corpus luteum produces the hormone progesterone to maintain the uterus ready for implantation of the fertilised egg.

There is a window of just 14-16 days for the fertilised egg to successfully implant. The hormone interferon tau (IFNt) is produced by the embryo during conceptus elongation, and is the signal for maternal recognition of pregnancy in ruminants. IFNt acts to inhibit the release of prostaglandin (PGF2a) that would otherwise cause the degradation of the corpus luteum and terminate the pregnancy.

However, it takes around 12-13 days for the embryo to develop and elongate enough to produce the IFNt. If too much PGF2a or insufficient IFNt is produced, then pregnancy is not recognised, leading to return to oestrus.

In high yielding dairy cows, the faster metabolism of progesterone via the liver results in lower blood circulating levels that are more easily overcome by PGF2a resulting in an increased risk of termination in these animals.

It is estimated that about 80% of inseminations are successful, though only around 38% are still viable after 42 days. Therefore this failure of maternal recognition of pregnancy is a major economic loss to the dairy industry.

Importance of nutrition

Whilst there are numerous factors which can impact dairy cow conception rates, including genetics; management; housing; and stress, one of the most important

Continued on page 9

Fig. 1. The effect of omega-3 fatty acids (EPA and DHA) on conception rates of a high yielding dairy herd (adapted from Swanepoel & Robinson, 2019, unpublished).

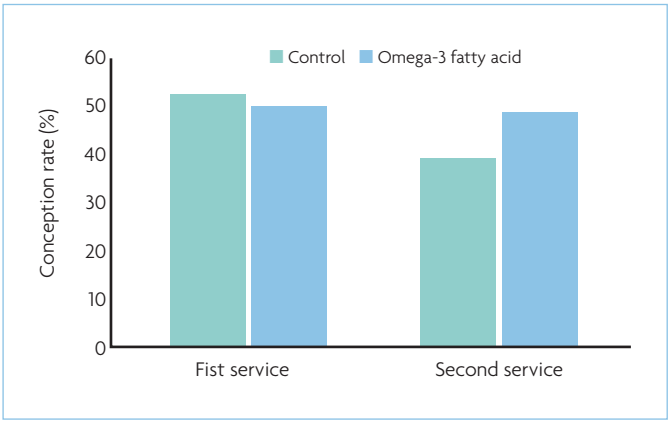
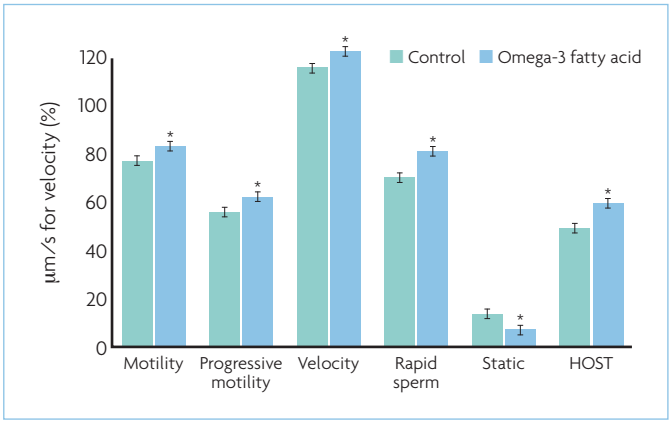


Fig. 2. Effect of omega-3 fatty acid supplementation (DHA and EPA) on bull spermatozoa in fresh semen (*denotes significant difference to control p<0.05) (adapted from Gholami et al., 2010).



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influencers is nutrition. Nutrition can have a direct impact on the fine hormonal balance within the dairy cow, which in turn can determine the success of insemination.

One method to improve conception rates is to suppress the production of PGF2a. This can be achieved by feeding long chain polyunsaturated fatty acids (PUFAs), such as the omega-3 fatty acids eicosapentaenoic acid (EPA) and docosaheptaenoic acid (DHA).

Many forages and feed ingredients are naturally low in omega-3 fatty acids, so it can be beneficial to add a supplement high in these essential fatty acids, such as Optomega Plus by Anpario which is a rich source of EPA and DHA.

Improving conception rates

The addition of the omega-3 fatty acids, EPA and DHA, to the diet of high yielding dairy cows (producing >50kg milk/cow/day) has been found to improve conception rates, specifically at second service, compared to those fed a control basal TMR diet (Fig. 1).

In this particular study, cows received a double-OvSynch reproduction program for first service, with a single OvSynch program for second service.

The conception rate at second service was increased from 39.5% to 49.1% when the omega-3 fatty acid product was included.

The benefits associated with supplementing diets with EPA and DHA omega 3 fatty acids are also extended to bulls, whereby semen quality is enhanced, and fertility success is ultimately increased. Spermatozoa production takes between 6-8 weeks in bulls, therefore the effect of omega-3 fatty acid supplementation on bull spermatozoa in fresh semen was analysed after nine weeks of feed supplementation in Holstein bulls.

The motility, velocity, proportion of rapid spermatozoa, sperm viability and membrane integrity (HOST) were all significantly improved in bulls supplemented with Anpario's omega-3 fatty acid product compared to bulls fed a control diet (Fig. 2).

The bulls supplemented with EPA and DHA also presented statistically fewer static spermatozoa.

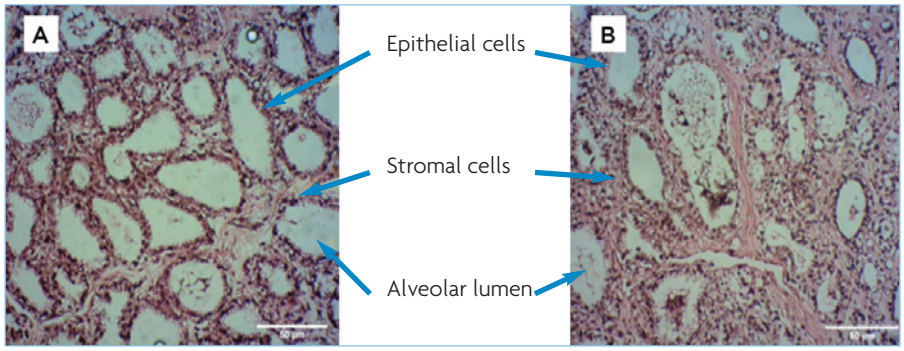

Fig. 3. Mammary tissue of dairy cows fed omega-3 fatty acids EPA and DHA (A) or palm oil (B) (adapted from Barfourooshi et al., 2018).

There are also other benefits offered to the dairy herd, associated with dietary supplementation of omega-3 fatty acids EPA and DHA. The milk production of the dairy cow is affected by many factors, with the development of the mammary gland being a key component of this.

There are two main types of cells within mammary tissue – epithelial and stromal cells. Alveolar epithelial cells form the alveoli which produce and secrete milk. Stromal cells provide structural support and nutrients.

It was found that the addition of omega-3 fatty acids EPA and DHA, compared to other fatty acids found in palm oil, led to significantly increased milk yields. This was most likely as a result of the impact that EPA and DHA had on mammary development.

Cows supplemented with omega-3 fatty acids had an average 8.5% greater percentage of mammary epithelial cells, and greater alveoli numbers compared with palm oil supplemented cows.

The EPA and DHA supplementation also increased total alveoli number, suggesting a greater capacity for milk secretion compared to other fatty acid sources such as palm oil (Fig. 3).

The supplementation of long chain PUFAs, such as the omega-3 fatty acids EPA and DHA, can also offer multiple benefits to consumers.

Improving the health status of humans

Dairy products have widely been criticised as being a source of 'unhealthy' saturated fats in human diets and they have been accused of leading to increased incidence of health problems, such as cardiovascular disease.

However, healthy fats, such as conjugated linoleic acid (CLA) and omega-3 fats, such as EPA and DHA, have been shown to improve the health status of humans.

Therefore, the addition of EPA and DHA to dairy cow rations, was found to increase the beneficial fatty acids profile of the milk whilst reducing the n6:n3 and saturated: unsaturated fats ratios.

Consuming omega-3 enriched milk can help to improve human health with research by the British Heart Foundation showing links to reduced blood pressure and a lower risk of heart attack.

Supplementing your dairy herd diet with omega 3 fatty acids, such as EPA and DHA, can therefore make a significant difference to your farm profitability as a result of higher milk yields, improved milk quality and increased fertility as well as improving the quality and nutritional content of the milk. ■

References are available from the author on request