Canola meal use in starter mixtures for calves has been limited due to a perception that it has low palatability and digestibility. Researchers conducted a four-year project and four studies to evaluate the use of canola meal as a protein source for dairy calves. The goal was to evaluate the use of canola meal as a protein source in starter mixtures for Holstein calves around weaning and to evaluate strategies that may enhance canola meal use and improve gastrointestinal development. Altogether the results showed that high-quality canola meal can be used in starter mixtures for dairy calves and that the inclusion of glycerol and microencapsulated sodium butyrate stimulate starter intake, growth performance, and aspects of gastrointestinal development.

Canola meal use in starter mixtures (SM) for calves has been limited due to a perception that it has low palatability and digestibility. Researchers from two universities, the University of Saskatchewan and the University of Agriculture in Kraków, Poland, collaborated on a four-year project to evaluate the use of canola meal as a protein source for dairy calves. A total of four studies were conducted as part of the project, with an overall goal to evaluate the use of canola meal as a protein source in starter mixtures for Holstein calves around weaning and to evaluate strategies that may enhance canola meal use and improve gastrointestinal development.

Study 1. Evaluating the effect of heating temperature on ruminal protein digestion kinetics and estimated intestinal digestibility of canola meal.
Development of the gastrointestinal tract (GIT) in calves plays an important role especially during the weaning period when the transition from liquid to solid feeds occurs. Although canola meal is not commonly used in the starter mixture of calves, canola meal contains amino acids that may promote gastrointestinal development. Heat treatment of the canola meal may reduce protein degradation in the rumen thereby providing amino acids to the small intestine.

In the first study conducted at the University of Saskatchewan, researchers evaluated the impact of heating canola meal on in situ digestibility and estimated intestinal digestibility. Four sub-samples of canola meal were subjected to 1 of 4 treatments: remain untreated or heat treated to 100°C, 110°C or 120°C. Heat treatments were done in a tumble dryer, with temperatures steadily increased from room temperature until the desired one was reached and then the meal was held at that temperature for 10 minutes. Afterwards the meal was cooled down to 50°C and packaged.
The results suggest that a temperature of 110°C was most suitable for heat treating canola meal. At that temperature, there was a significant decrease in the degradable fraction for both dry matter (DM) and crude protein (CP), as compared with control, while the estimated intestinal digestibility also showed the highest value from all treatments.

**Study 2. Evaluating whether heat-treated canola meal and glycerol inclusion affect gastrointestinal development in Holstein calves at weaning.**
Canola meal has a high concentration of glutamine and glutamate, and if heat treated, the proteins containing those amino acids can by-pass the rumen, be digested and absorbed in the small intestine, positively influencing the development of the tissues. Feeding glycerol, which is easily digestible in rumen, could help increase the intake of starter mixtures through better palatability and digestibility, as well as stimulate growth of the rumen.

In this second study conducted at the University of Saskatchewan, researchers wanted to evaluate the effect that heat treating canola meal would have on small intestine and rumen development. They also assessed whether glycerol would influence the palatability and digestibility of the starter mixture. In the study, canola meal was either not heated or heated as described for Study 1. The four starter mixtures incorporated canola meal when not heated vs. heated and when included with or without glycerol. A total of 28 Holstein bull calves were sourced for this study and randomly assigned to 1 of the 4 starter mixture treatments.

The results showed that heat-treating canola meal tended to decrease average daily gain (ADG) and broadly reduced GIT tissue mass. However, glycerol inclusion, in general, had a positive effect on growth, ruminal fermentation, insulin concentration, and may alter GIT development. Therefore, starter mixtures for calves can include canola meal providing it is not over-heated. Glycerol inclusion appears to have beneficial characteristics as an ingredient in starter mixtures for dairy calves.

**Study 3. Effect of including canola meal or soybean meal in a pelleted starter mixture for calves when combined with microencapsulated sodium butyrate and their effect to stimulate gastrointestinal tract development in calves at weaning.**
The third study, which was conducted at the University of Agriculture in Kraków, Poland, included two components focusing on nutrient metabolism and growth performance. The objective of this study was to determine the possibility to further enhance the canola meal use in a pelleted starter mixture for newborn calves through supplementation of sodium butyrate. Researchers hypothesized that microencapsulated sodium butyrate would
promote rumen and small intestine development, increase digestibility and solid feed intake, which would result in better performance of calves around and after weaning. Treatments included canola meal or soybean meal as the protein source with or without microencapsulated sodium butyrate.

The research findings suggest that, relative to soybean meal, canola meal may negatively affect starter mixture intake and body weight gain. However, microencapsulated sodium butyrate did stimulate starter mixture intake and intestinal development. Studies 1 to 3 suggested that replacing soybean meal with canola meal may decrease starter mixture intake and that heat-treating canola meal exacerbated the effect. However, both glycerol and microencapsulated sodium butyrate had positive effects.

In the performance study, neither starter intake, nor average daily gain was affected by protein source and microencapsulated butyrate. Feed efficiency was not different between treatments post-weaning. Results of this study suggest that canola meal can be an acceptable source of protein in pelleted starter mixtures for calves and microencapsulated sodium butyrate inclusion in the starter mixture may decrease the number of days with diarrhea during rearing period.

**Study 4. Effect of canola meal use as a protein source in a starter mixture on feeding behavior and performance of calves during the weaning transition.**
In the final study conducted at the University of Agriculture in Kraków, Poland, the objectives were to determine the effect of canola meal and its inclusion rate in starter mixtures on frequency (no./d), time (min/d), and rate (g/min) of eating SM as well as frequency and time of drinking water during the weaning transition period. In this study, researchers also substituted 0, 50, or 100% of the soybean meal with canola meal, with all starter mixtures formulated to have similar crude protein content. A total of 36 Holstein female calves were included in the study.

The results showed that full replacement of soybean meal with canola meal reduced starter intake, however replacement of 50% of the soybean meal was acceptable for calves. Researchers conclude that the inclusion of canola meal in a starter mixture does not affect feeding behavior and performance of calves during the weaning transition. However, canola meal inclusion as a full replacement for soybean meal in starter mixtures has a negative effect on ADG, feed efficiency, and fecal score of calves during the pre-weaning period.

**Summary**
Altogether, the results of this four-part study suggest that high-quality canola meal can be used in starter mixtures for dairy calves and that the inclusion of glycerol and microencapsulated sodium butyrate stimulate starter intake, growth performance, and aspects of gastrointestinal development. Although the results showed that replacing 50% of the soybean meal with non-heated canola meal had no adverse effects, the optimal inclusion rate is not known. Therefore, researchers are conducting a followup study to evaluate canola meal inclusion using a dose-titration protocol to determine optimal inclusion rates in starter mixtures for dairy calves.
Scientific publications.