Replacement Report

Research Review

Pasteurized Waste Milk

Waste milk is pasteurized to destroy pathogens and reduce the risk of disease (e.g. E. coli, salmonella, Johnes) transmission to calves. Pasteurizers are not sterilizers. They reduce the number of pathogens. They do no eliminate all pathogens. If the bacteria numbers in milk are too high, the pasteurizer will not reduce the concentration of bacteria in milk to a safe amount. With improper pasteurization some of the nutrients in the milk could be lost. For example, the short chain, volatile fatty acids will be evaporated (volatilized). Excessive heat could damage milk proteins or amino acids, reducing their digestibility.

Dr. Bob James, at Virginia Tech University suggests that the standard plate count (SPC) for pasteurized milk should be no more than 20,000 colony forming units (CFU) per ml. Several surveys of pasteurizer use on US dairies have reported that the pre-pasteurization plate count of milk exceeded 6,000,000 CFU/ml, which likely exceeds the ability of pasteurizer to reduce the number to less than 20,000 CFU/ml post-pasteurization. Waste milk must be handled in such a way to minimize bacteria growth so that a pasteurizer is not overwhelmed. Additionally, pasteurized milk needs to be quickly cooled and quickly fed to not allow the bacteria to multiply to harmful levels. Dr. Sam Leady, a calf specialist with Attica Veterinary Clinic, says that at temperatures around 100 degrees Fahrenheit, bacteria can double their numbers approximately every 20 minutes. This means that if milk has 100,000 CFU/ml, in approximately 2 hours it could have approximately 6,000,000 CFU/ml.

Waste milk can come from fresh cows or mastitic cows that may have received antibiotics. Pasteurization does not destroy bacterial toxins or any antibiotics that could be in the milk. Surveys by Selim and Cullor in CA and Jorgensen and Hoffman in WI each found that over 60% of the pasteurized milk samples tested positive for antibiotics.

Success in pasteurizing milk is related to the ability to control the milk before and after pasteurization. A good standard operating procedure that is written and followed will help in the success of this. Time must be taken to clean the pasteurization equipment thoroughly and maintain the equipment for optimum operation efficiency. Frequent cultures of milk pre- and post-pasteurization and post-feeding are needed to monitor the quality of the milk and efficiency of the pasteurization and feeding process.

An on-farm trial by Jamaluddin in CA reported calf average daily gain (ADG) to be increased by 0.19 lb/day with pasteurized verses unpasteurized waste milk. Another on-farm trial by Godden in WI reported that calves fed 1 gallon of pasteurized milk gained 0.28 lb/day faster than calves fed 1 gallon of milk replacer formulated to

National Research Council (NRC) guidelines. In this trial calves fed milk consumed 10 to 15% more dry matter from milk than from milk replacer, leading to part of the difference in gains. A controlled research trial in OH (Hill, 2007) fed calves at equal dry matter intake, pasteurized milk, milk replacer formulated to NRC guidelines, and milk replacer formulated to more closely mimic cow's milk (Table 1). They observed that calves fed pasteurized milk grew faster than calves fed milk replacer formulated to NRC guidelines. Additionally, they observed calves fed milk replacer formulated to mimic cow's milk grew faster than calves fed pasteurized milk. In the WI field trial and the OH controlled research trial, the results for calves fed pasteurized milk and milk replacer formulated to NRC guidelines were remarkably similar. However, there are better, more modern ways to formulate milk replacer as demonstrated in the OH trial.

The milk replacer in the OH trial that more closely reflected the composition of milk contained added amino acids and fatty acids that the MR formulated to NRC guidelines did not have. In fact, a calf's real requirements are for amino acids and fatty acids, not crude protein and metabolizable energy met with lactose, protein, and crude fat, as the NRC guidelines reflect.

Note the large responses in calf ADG to added amino acids in Figures 1 and 2. In the trial in Figure 1, adding lysine and methionine to the 20% protein milk replacer increased ADG by 7% over no added amino acids. In the trial in Figure 2, adding lysine and methionine to the 26% protein milk replacer increased ADG by 16% over no added amino acids.

The NRC suggests only an energy requirement for calves. This is met in the milk replacer formulation process by adding lactose, protein, and animal fat. Note the large response in ADG and abnormal fecal scores (days with scours) in Figure 3 when different types of fatty acids are specifically replacing animal fat in a milk replacer. The calves fed the optimum blend of fatty acids in this trial gained approximately 20% faster and had approximately 40% fewer days with abnormal fecal scores.

Success in pasteurizing milk is related the ability to control the milk before and after pasteurization. A good standard operating procedure that is written and followed will help in the success of this. However, it is does have weaknesses compared to a properly formulated milk replacer.

Table 1

NRC MR, Milk-like MR, and Pasteurized Milk

0-42 days	NRC MR	Milk like MR	Milk
Low DM level	1 lb powder	1 lb powder	.83 gal
DM intake, lb	.96	.96	.96
CP intake, lb	.22	.20	.22
Fat intake, lb	.20	.20	.24
Gain, lb	**.94[a]**	**1.12[b]**	**.98[c]**
St. Intake, lb	.79[a]	.96[b]	.90[b]
Scour days	10.13[a]	9.00[b]	8.88[b]

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[abc] Means with different superscripts differed P < .05

Figure 1

Amino acids reduce the CP required in a milk replacer

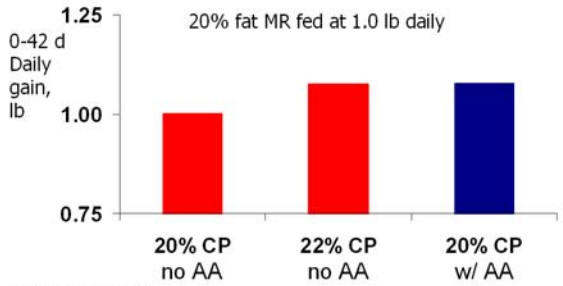

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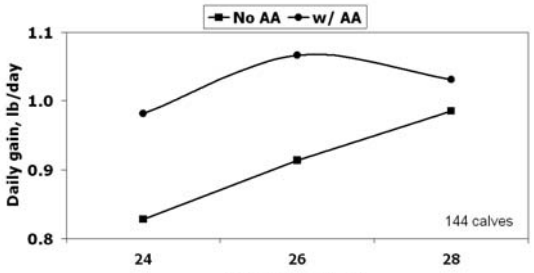
Figure 2

Crude protein vs amino acids for milk replacers

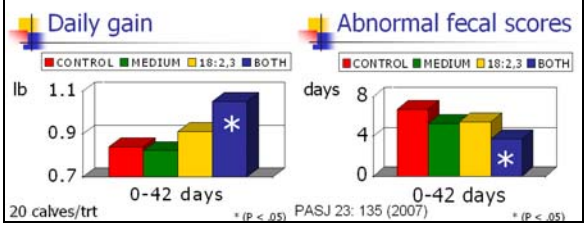


Calves fed 17% fat MR fed at 1.5 lb per day and weaned at 28 days.

Figure 3

Synergism of fatty acids

Medium chain and 18:2,3 fatty acids 20% CP, 20% fat MR fed at 1 lb daily



20 calves/trt

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