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Sub-acute Ruminal Acidosis (SARA) and its Consequence in Dairy Cattle: A Review of Past and Recent Research at Global Prospective

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ABSTRACT

Dairy producer increase milk production by over feeding grain diets that are high in starch and low in fiber to increase intake of energy and met dietary requirements of the high yielding dairy cows. However, these diets increase the risk of subacute ruminal acidosis (SARA). Thus, maximizing milk production without incurring Sub-acute ruminal acidosis is a challenging most dairy producers. The main aims of this paper were to review available article on general aspects of Sub-acute ruminal acidosis and its consequence in dairy cattle by focusing on past and recent article and helping to update the current knowledge for early recognition and limit the associated negative impact in dairy industry. Sub-acute ruminal acidosis is a well-recognized and economically important digestive disorder found particularly in well-managed dairy cattle. It is a consequence of feeding high grain diets to dairy cows and characterized by daily episodes of low ruminal which generally occurs when ruminal pH stays in the range of 5.2 and 6 for a prolonged period resulting in depresses fiber digestion and possibly milk production. There is no typical clinical sign of illness in SARA affected cows. However, SARA is said to be associated with inflammations of different organs and tissues in dairy cows. Rumenocentesis remains the most reliable means of diagnosing SARA. The cow at risk to develop SARA includes cows in the early lactation, Primiparous cows and Cows grazing or fed with rapidly fermentable low fiber grass. SARA has long-term health and economic consequences, which include feed intake depression, fluctuations in feed intake, reduced diet digestibility, reduced milk yield, reduced milk fat percent, gastrointestinal damage, liver abscesses, and lameness. Apart from compromises to dairy cow health and economics, SARA is of concern for animal welfare reasons, since lameness and laminitis impact significantly on cow comfort and general well-being. Thus, it represents a significant concern for dairy industry and the cattle should be regularly monitored to facilitate early recognition of the condition and limit the associated economic losses.

Contents

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Introduction

Over the last few decades, the productivity of dairy cows has increased greatly. However, As milk yield increases, the management challenge of meeting a cow's dietary nutrient needs becomes greater (Sundrum, 2015). Currently in many dairy herd situations, milk production can appear to be temporarily increased by over- feeding grain because dietary requirements of energy and fiber are not easily met for the high yielding dairy cows (Kmicikewycz, 2014; Oetzel, 2007). This is especially true for early lactation cows because their energy expenditure exceeds the energy consumed. Diets high in starch and low in fiber are fed to increase intake of energy, but these diets increase the risk of subacute ruminal acidosis (SARA) (Kmicikewycz, 2014; Oetzel, 2007; Krause, 2008; Krause and Otzel, 2006; Bipin et al., 2016). Sub-acute ruminal acidosis is a well-recognized digestive disorder of high yielding dairy cows that has negative impact in both animal health and herd profitability particularly in well-managed dairy herds (Kitkas et al., 2013; Plaizier et al., 2014; Enemark, 2008; Antanaitis et al., 2015; Kleen et al., 2013). This digestive disorder is the consequence of feeding high grain diets to dairy cows, which are adapted to digesting predominantly forage diets. The current definition and ruminal pH threshold for SARA vary among studies. However, SARA generally occurs when ruminal pH stays in the range of 5.2 and 6 for a prolonged period (Li et al., 2013). SARA is characterized by daily episodes of low ruminal pH (Krause and Otzel, 2006), during which rumen pH is depressed for several hours per day (Plaizier et al., 2014) due to accumulation of volatile fatty acids and insufficient rumen buffering (Plaizier et al., 2008).

There is no typical clinical sign of illness in SARA affected cows (Krause and Oetzel, 2005; Mutsvangwa et al., 2002; Tajik and Nazifi, 2011). However, SARA is said to be associated with inflammations of different organs and tissues in dairy cows. Its consequences are diverse and complex, which include feed intake depression, fluctuations in feed intake, reduced diet digestibility, reduced milk yield, reduced milk fat percent, gastrointestinal damage, liver abscesses, and lameness (Krause and Otzel, 2006; Plaizier et al., 2008; Radostits et al., 2007). Injury to the gastrointestinal lining followed by localized or systemic inflammation appears to mediate many of these negative effects.

Prevalence of SARA in dairy herds is not well studded. However, it is an increasing problem for the dairy industry, even in well-managed, high-yielding dairy cattle. Its prevalence increases as cows consume more total DM and as cows consume diets containing higher proportions of grain (Krause and Otzel, 2006). Prevalence of SARA has been documented from 19 to 26% in early to mid-lactation cows (Garrett et al., 1997; Oetzel et al., 1999). Kleen, (Kleen, 2004) indicated the incidences of SARA in early and mid-lactation cows to be 11% and 18%, respectively. In addition, recently Kleen et al. (2013) reported 20% prevalence out of 315 cows in Northern Germany. Furthermore, the most recent study by Stefańska et al. (2016) also found 14% prevalence from a total of 213 cows. Thus, SARA is the most important nutritional disease and represents a significant concern as it can negatively impacts the dairy industry by decreasing dry matter intake, milk production, profitability, and increasing culling rate and death loss (McCann et al., 2016). However, there is paucity of well documented information on its general aspect and consequence in dairy cattle. Therefore, the main objectives of this manuscript were to review the general aspects of Sub-acute ruminal acidosis including it clinical sign, diagnostic methods and its consequence in dairy cattle by focusing on both past and recent researches at global prospective.

Literature Review

Definition and General Aspects of SARA in Dairy Cattle

Ruminal acidosis is a bovine disease that affects feedlot as well as dairy cattle. By definition, acidosis is a decrease in the alkali (base excess) in body fluids relative to the acid (hydrogen ion) content (Owens et al., 1998; Dehkordi and Dehkordi, 2011). Ruminal acidosis is usually associated with the ingestion of large amounts of highly fermentable, carbohydrate-rich feeds which

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