Dietary Fiber Sources

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Feed fiber composition is usually considered as one of the factors that have an impact on digestive tract microbiota composition. The investigations on the level of fermentation and in-vitro digestibility of different fibers are not well understood. The aim of the current entry is to determine the effect of different fiber sources on intestinal nutrient digestibility, hindgut fermentation, and microbial community composition under *in vitro* or *in vivo* conditions. For example, cornstalk treatment displayed higher digestibility compared to alfalfa hay and rice straw. Similar results were observed with *in-vitro* digestibility using intestinal digesta. *Firmicutes* were the most abundant phyla, and *Lactobacillus* were the prominent genera in response to alfalfa compared to rice straw and cornstalk treatments. In simulated *in-vitro* digestion, corn stalk fiber improved dry matter digestibility, while rice straw fiber improved volatile fatty acid content and fermentation efficiency. Alfalfa fiber improved the thickness of deposited *Firmicutes* and *Lactobacillus.*

gut microbiome | fatty acids | methane production | fiber fermentation | Diabetes mellitus

1. Introduction

Dietary fibers are heterogeneous and consequently have different effects on both the gut microbial community and the host animal [1][2]. The main end products of bacterial fermentation of dietary fiber are short chain fatty acids (SCFAs) [3], vitamins [4], H_2 and CO_2 [5]. Moreover, the intestinal microbiota can control various biological processes such as nutrient absorption, lipid and glucose homeostasis, and systemic inflammation [6]. SCFAs can improve the well-being of the host animal. For instance, butyrate is the preferred energy source for colonic epithelium cells [7]. Such an energy source can decrease the rate of formation of secondary bile acids from primary bile acids, and protect the host against colorectal cancer. Additionally, higher concentrations of primary bile acids have been observed in non-atherosclerosis patients than in atherosclerosis patients [8][9]. Moreover, propionate reduces the biosynthesis of cholesterol [10], providing protection against cardiovascular disease (CVD) [11]. Most acetate molecules are absorbed from the circulatory system by the liver, and used as an energy source. They are also used as a substrate to form cholesterol and long-chain fatty acids (LCFAs) [12][13].

2. Specifics

The determination of fiber digestibility by *in-vitro* fermentation of feedstuff is applied in research and commercially to evaluate the nutritional value of fibrous feeds for livestock [14][15]. Although in-*vivo* determination fiber digestibility is regarded as standard for digestibility evaluation, it remains time consuming, expensive, and labor intensive [16].

Therefore, *in-vitro* techniques are highly used and are often correlated with in-vivo estimates [17]. *In-vitro* digestion models are mostly used to investigate structural changes, digestibility, and liberation of feed components under stimulated gastrointestinal conditions.

According to Williams et al. [18], dietary fiber contains non-digestible constituents, which physiologically influence digestion by rearranging digesta, modulating digestion processes, and acting as the main substrate for microbial fermentation. Feed fiber composition is usually considered as one of the factors that have an impact on digestive tract microbiota composition and the movement of dietary fiber constituents, leading to changes in the composition of microbiota [19]. However, the current known role of fiber constituents during digestion remains controversial, while the impact of high fiber feeds on digestion depends on the type, form, and the level of inclusion of fiber in diet [20]. Previous research has been performed on the digestibility of dietary fiber using *in-vivo* and *in-vitro* techniques. Recently, Zhao et al. [21] have studied the effect of wheat bran, corn bran, sugar beet pulp, oat bran, soybean hulls, or rice bran on ileal digestibility and the levels of volatile fatty acids in growing pigs; however, investigations on the level of fermentation, *in-vitro* digestibility and the microbiome composition of different fiber types are not well understood [3][4]. Therefore, the herein entry aims to illustrate the effects of different fiber sources on intestinal nutrient digestibility, hind gut fermentation, and gut microbial composition.

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