Gut microbiome plays a significant role in physiology and health of host fish. *Labeo rohita* is the most commonly cultured and commercially important freshwater fish species. This study provides a scientific base-line data on gut microbiome of farmed raised *Labeo rohita* by high throughput sequencing of 16S rRNA gene using next-generation sequencing (NGS) technology for the first time in Pakistan. Microbiome analysis included taxonomic identification which revealed four bacterial phyla named *Bacteriodata*, *Cyanobacteria*, *Firmicutes* and *Proteobacteria*. Among these phyla, *Proteobacteria* was the most occurring phylum specifically composing the bacterial community within the class Gammaproteobacteria. At order level, *Pseudomonadales* (31.9%) and *Enterobacterales* (66.8%) were most abundant. Less number of features belonging to Family *Lactobacillaceae* indicated the low prevalence of probiotic in the gut. The dominant and core microbiome was identified as *Enterobacterales* in all samples followed by high abundance of genus *Aeromonas* and *Pseudomonas*. Microbial diversity was measured by Alpha-Beta diversity metrics. Higher Mean Shannon Entropy value showed slightly higher diversity in farm 1. Simpson's Dominance Index value expressed high dominance of fewer genera in both farming conditions. Bray-Curtis dissimilarity analysis exhibited a consistent moderate difference between two farming habitats. These findings concluded that *Proteobacteria* is most abundant phylum and overall there is low diversity in both farming methods with the dominance of *Pseudomonas* and *Aeromonas*. The presence of these two genera represents the opportunistic pathogenic bacterial community in the gut that predicts a potential threat of a disease outbreak and dysbiosis emphasizing that there is a need of monitoring and controlled aquaculture practices. This research based data can be used for devising Biosafety legislation, farming strategies and management policies for better growth and productivity of *Labeo rohita* in farming culture ultimately leading to sustainable aquaculture.