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Genomics Approach to Identify the Cause of the Missing Omega-5 Gliadin Protein in O-free Wheat

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Previous studies have developed a new breed called O-free, which lacks omega-5 gliadin by crossing Keumkang and Olgeuru. We verified the properties of O-free through RNA sequencing analysis of O-free and two parent lines (Keumkang and Olgeuru). The results of the similarity analysis of EST with gliadins and glutenins showed the similarity of gluten and gliadin sequence, but O-free ESTs showed no similarity of omega-5 gliadin sequence. In addition, mapping results between the raw RNA sequencing data from O-free and omega-5 gliadin sequence showed deletion of the N-terminal sequence, an important characteristic of omega-5 gliadin. We also designed specific PCR primers that could identify omega-5 gliadin in the genomic DNA, and the results showed that no omega-5 gliadin fragments were detected in the O-free. Based on these results, we confirmed that omega-5 gliadin deficiency in the O-free is due to simple deletion of chromosomes, not post-transcriptional or post-translation regulation. Furthermore, the single nucleotide polymorphisms (SNP) of the low-molecular-weight glutenin subunit (LMW-GS) gene in O-free produce truncated polypeptides that causing a premature stop codon. We expect that the O-free line may serve as an excellent source of wheat that could prevail in the hypo-allergen wheat market, which has recently gained interest worldwide.

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