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**Title:** Heterologous expression of Brassica juncea microsomal  $\omega$ -3 desaturase gene (BjFad3) improves the nutritionally desirable  $\omega$ -6: $\omega$ -3 fatty acid ratio in rice bran oil

**Authors:** Chattopadhyaya, B. (/jspui/browse?type=author&value=Chattopadhyaya%2C+B.)

**Keywords:** A-linolenic acid  
Bran-specific transgene expression  
Microsomal  $\omega$ -3 desaturase (Fad3)  
Nutritional improvement  
Rice bran oil (RBO)  
 $\omega$ -6: $\omega$ -3 fatty acid ratio

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**Abstract:** ce bran oil (RBO), being naturally rich in antioxidants, is currently regarded as one of the health-beneficial edible oils. However, the RBO has essential linoleic acid ( $\omega$ -6, C18:2) and  $\alpha$ -linolenic acid ( $\omega$ -3, C18:3) in nutritionally disproportionate level (~25:1), contrary to the WHO/FAO's recommendation of ~5:1. Among few naturally occurring C18:3 enriched oil-seeds, Brassica juncea (Indian mustard) has almost equal proportion of  $\omega$ -6 and  $\omega$ -3 fatty acids in its oil due to the activity of microsomal  $\omega$ -3 desaturase (Fad3), which converts C18:2–C18:3. Therefore, the full length Fad3 coding DNA sequence (CDS) was isolated from the developing seeds of B. juncea, functionally characterized and heterologously expressed for the nutritional enhancement of RBO. Sequence analysis revealed that the 1,134 bp long BjFad3 CDS corresponds to a polypeptide of 377 amino acids, which is highly (85–95 %) homologous to other known Fad3 enzymes of plant kingdom. The BjFad3 gene was initially characterized in transgenic tobacco to establish its linoleate desaturase activity. Thereafter, rice bran-specific expression of the BjFad3 was carried out to alter the fatty acid profile of RBO. Several independent transgenic lines of tobacco and rice plants were developed by Agrobacterium-mediated transformation. Standard molecular biological techniques were used to confirm the transgene integration in the respective genomes and subsequent in planta expression. The BjFad3 transgene expression correlated to the significant increase in C18:3 fatty acid content (up to tenfold) in both tobacco seed oil and RBO, and thereby improving the nutritionally desirable  $\omega$ -6: $\omega$ -3 ratio (~2:1) in one of the transgenic rice lines.

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