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# *Bacillus subtilis* as probiotic candidate for red sea bream: growth performance, oxidative status, and immune response traits

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## Abstract

The effects of dietary administration of *Bacillus subtilis* on the growth, digestive enzyme activity, blood chemistry, oxidative status and immune response of red sea bream (*Pagrus major*) were evaluated in the current study. Fish fed five different levels of *B. subtilis* at 0 (BS0), 1 x$10^4$ (BS1), 1 x$10^6$ (BS2), 1 x$10^8$ (BS3) and 1 x$10^{10}$ (BS4) CFU $kg^{-1}$ diet for 60 days. The obtained results showed that *B. subtilis* supplementation significantly improved growth performance (FBW, WG and SGR), feed utilization (FI, FCE, PER and PG) and whole-body protein content when compared to the control group ($P$<0.05). Furthermore, the specific activities of amylase, protease and lipase enzymes up regulated significantly upon *B. subtilis* incorporation in red sea bream diets ($P$<0.05). No changes have been reported on blood biochemical variables except for the plasma total protein, which increased significantly in fish fed BS3 diet when compared with the control diet ($P$<0.05). Hematocrit, hemoglobin and the nitro blue tetrazolium values also reported the highest values significantly in fish fed *B. subtilis*, especially in case of BS3 and BS4 diets ($P$<0.05). Serum bactericidal activity enhanced significantly in BS2, BS3 and BS4 groups ($P$<0.05), while mucus bactericidal activity showed no significant activity among tested groups ($P$>0.05). Serum lysozyme activity exhibited higher values in