Diurnal, circadian and monthly expressions of genes for period, arylalkylamine-*N*-acetyltransferase 2, and melatonin receptor in the pineal gland of grass puffer

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Many marine species exhibit lunar-related spawning cycles. Grass puffer, *Takifugu niphobles*, is a common intertidal puffer species in Japan, and it spawns in semilunar cycles during spring tide from spring to summer. These fish aggregate at certain seashore sites several hours before high tide, and spawning usually continues for 1-2 hours during the rising tidal phase. To investigate the regulatory mechanism of the semilunar-synchronized spawning rhythm, we examined diurnal, circadian, and monthly variations in expression of genes for period (*per*), arylalkylamine-*N*-acetyltransferase2 (*aanat2*), and melatonin receptor (*mel*) in the pineal gland of grass puffer. The levels of expressions of *per* and *aanat2* showed apparent diurnal and circadian variations with a peak during day or darkness, while no monthly variations were observed. The expression of *mel* showed diurnal variations under light/dark cycles and unique cyclic variations with a period of 14 hours under constant darkness. Furthermore, *mel* showed monthly variations with a peak at lunar age 6. These results suggest that the expression of melatonin receptor gene and thus responsiveness to melatonin in the pineal gland are most probably important for the semilunar- and tidal-related spawning rhythm.