

stress. In this context, frequent reports addressed the manifestation of different stress-related behavioural and physiological patterns, such as restless leg syndrome, migraine, and functional gastrointestinal disorders (FGIDs). Thus, a major problem in ASD patients' management could be related to the exacerbated effects of stress.

Objectives: In this study, we aimed to find a correlation between the stress perception and response and the manifestation of some neurological and FGIDs in ASD.

Methods: The main scientific databases were screened for studies describing the effects of stress in autism patients and animal models. Exclusion criteria: (1) studies not written in English language; (2) not available as full text; (3) not describing stress response; and/or (2) functional gastrointestinal manifestations in autism.

Results: The repetitive behaviours have a heterogenous pattern in both severity and manifestations, varying from repetitive motor movements and inflexible adherence to routines to hypo- or hyper-reactivity to exterior stimuli. Moreover, some studies describe repetitive behaviours as altered stress coping mechanisms meant to relieve anxious states – one of the main stress axis activation effects. We recently described some significantly reported FGID-like manifestations in ASD that could be the result of various abnormalities in the brain – gut interaction, such as impaired parasympathetic activity and increased endocrine stress response. In this context, there could be a correlation between the altered perception and response to stress and the FGID-like manifestations, as we previously described the stress axis implication in one of the most common FGID, irritable bowel syndrome – which is also frequently reported in ASD cases.

Conclusions: In ASD, the perception and response to environmental and social stress could be impaired. Thus, impaired stress coping mechanisms, defective stress axis, and altered behavior could lead to stress-specific manifestations, such as restless leg syndrome, migraine, and irritable bowel syndrome.

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Chronic stress exposure paradigm in zebrafish models – focusing on neurobehavioral and biochemical changes

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Introduction: Our previous reports on rodent models suggested that chronic stress exposure could lead to cognitive impairments, gastrointestinal transit changes, and oxidative stress. Zebrafish (*Danio rerio*) models are nowadays gaining more attention due to their advantages, as well as their complete neurobehavioral, biochemical, and genetic description and great similarity to human.

Objectives: The aim of this study was to describe and to identify possible interdisciplinary applications of the neurobehavioral and biochemical changes induced by chronic stress exposure in zebrafish.

Methods: The main scientific databases were screened for English-written studies describing chronic stress exposure effects in animal models. Inclusion criteria: (1) studies performed on zebrafish models; (2) reporting stress exposure effects on the animal behaviour, cognition, oxidative, and/or inflammatory status. Exclusion criteria: (1) studies not focussing on chronic stress exposure paradigm or (2) not using zebrafish models.

Results: We found that chronic stress exposure was applied to larvae, juveniles, and adult zebrafish. The neurobehavioral effects were mainly suggesting memory deficits and socio-affective impairments (such as anxiety and depressive-like behaviours). Several studies found oxidative stress and inflammation-related response in brain and gut. While our previous research experience in rodents thought us that chronic stress exposure could model functional gastrointestinal disorders of which mechanisms mainly address an impaired brain – gut interaction (irritable bowel syndrome), the data regarding the gastrointestinal status of zebrafish in similar experimental conditions are rather scarce. Some recent studies suggested that stress-exposed zebrafish showed impaired digestion and intestinal glucocorticoid receptors functions. Furthermore, it was reported that the zebrafish response to stress could be improved by probiotic administration and gut microbiota modulation.

Conclusions: Chronic stress exposure paradigm is often associated with cognitive and affective-like impairments. Several oxidative stress and inflammation-related changes were also reported. Further studies are needed to describe the brain – gut interaction-associated functional gastrointestinal impairments in zebrafish.

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