EGG WHITE HYDROLYSATE TO COUNTERACT THE REPRODUCTIVE IMPAIRMENTS AFTER ALUMINUM EXPOSURE IN RATS

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Resumo:

1. INTRODUCTION While a good deal of research has been conducted on the acute reproductive effects of Al, little is known about the effects of longer-term exposure. Moreover, due to the non-linear dose-response effect of Al, is urgent to investigate the effects of Al exposure at a human dietary level and then to compare with Al effects at high levels. Herein we investigated the effects of Al exposure at two different doses: one representing human Al exposure by diet and, one model of exposure at high level known to produce toxicity, and then we have compared these results. 2. METHODS Three-month-old male Wistar rats were divided into two major groups: 1) low aluminum levels, and 2) a high aluminum level. Group 1 rats were treated orally by drinking water for 60 days as follows: a) control - received ultrapure drinking water; and b) aluminum at 8.3 mg/kg b.w (MARTINEZ et al., 2017) Group 2 rats were treated through oral gavages for 42 days as follows: a) control - received ultrapure water; b) aluminum at 100 mg/kg b.w (PRAKASH & KUMAR, 2009). We analyzed sperm parameters (daily sperm production per testis, sperm number, transit time in epididymis, morphology and motility), biomarkers of oxidative stress in testis, epididymis and prostate, testis and epididymis histology and immunohistochemistry and, Al content in reproductive tissues. Ethics Committee Approval 028/2014 - Unipampa. 3. RESULTS AND DISCUSSION Al treatment even at low doses impaired spermatogenesis and sperm quality, increased reactive oxygen species and lipid peroxidation, altered the antioxidant capacity and induced an inflammation pattern testicular with an increase on macrophage activation. Our data demonstrate that 60-day subchronic exposure to low doses of Al from feed and added to the water, which reflect human dietary Al intake, reaches a threshold sufficient to promote male reproductive dysfunction. Based on the pro-oxidant actions of Al, we decided to investigate the effects of egg white protein hydrolysate (EWH), obtained after enzymatic hydrolysis with Pepsin and with known antioxidant properties, on reproductive effects caused by subchronic Al exposure. For this, Al-exposed rats were co-treated with 1 g/kg/day of EWH during the same period of Al exposure, according to MIGUEL et al., 2006. Surprisingly, EWH prevented the male reproductive dysfunction as well as reduced the Al content in testis and epididymis showing an ability to counteract the toxic effects of the Al. 4. FINAL CONSIDERATIONS Our study shows that 60-day exposure to low doses of Al, which aimed to mimic human exposure to Al by the dietary route, are able to impair male reproductive health. Moreover, the current study shows, for the first time, that the cotreatment with EWH was able to prevent the reproductive adverse effects after Al exposure at low levels as well as after Al exposure at the higher dose of 100 mg/kg. Our findings provide a better understanding of the reproductive health risk after Al exposure and point to a possible prevention based on a functional food ingredient.
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EGG WHITE HYDROLYSATE AS A FOOD INGREDIENT TO COUNTERACT THE REPRODUCTIVE IMPAIRMENTS AFTER ALUMINUM EXPOSURE IN RATS

1. INTRODUCTION

Human exposure to Aluminum (Al) is inevitable, and its real consequence perhaps unknown (EXLEY, 2013). While a good deal of research has been conducted on the acute reproductive effects of Al, little is known about the effects of longer-term exposure. Moreover, due to the non-linear dose-response effect of Al, is urgent to investigate the effects of Al exposure at a human dietary level and then to compare with Al effects at high levels. Herein we investigated the effects of Al exposure at two different doses: one representing human Al exposure by diet and, one model of exposure at high level known to produce toxicity, and then we have compared these results.

2. METHODS

Three-month-old male Wistar rats were divided into two major groups: 1) low aluminum levels, and 2) a high aluminum level. Group 1 rats were treated orally by drinking water for 60 days as follows: a) control ± received ultrapure drinking water; and b) aluminum at 8.3 mg/kg b.w (MARTINEZ et al., 2017) Group 2 rats were treated through oral gavages for 42 days as follows: a) control – received ultrapure water; b) aluminum at 100 mg/kg b.w (PRAKASH & KUMAR, 2009). We analyzed sperm parameters (daily sperm production per testis, sperm number, transit time in epididymis, morphology and motility), biomarkers of oxidative stress in testis, epididymis and prostate, testis and epididymis histology and immunohistochemistry and, Al content in reproductive tissues. Ethics Committee Approval 028/2014 - Unipampa.

3. RESULTS AND DISCUSSION

Al treatment even at low doses impaired spermatogenesis and sperm quality, increased reactive oxygen species and lipid peroxidation, altered the antioxidant capacity and induced an inflammation pattern testicular with an increase on macrophage activation. Our data demonstrate that 60-day subchronic exposure to low doses of Al from feed and added to the water, which reflect human dietary Al intake, reaches a threshold sufficient to promote male reproductive dysfunction. Based on the pro-oxidant actions of Al, we decided to investigate the effects of egg white protein hydrolysate (EWH), obtained after enzymatic hydrolysis with Pepsin and with known antioxidant properties, on reproductive effects caused by subchronic Al exposure. For this, Al-exposed rats were co-treated with 1 g/kg/day of EWH during the same period of Al exposure, according to MIGUEL et al., 2006. Surprisingly, EWH prevented the male reproductive dysfunction as well as reduced the Al content in testis and epididymis showing an ability to counteract the toxic effects of the Al.

4. FINAL CONSIDERATIONS

Our study shows that 60-day exposure to low doses of Al, which aimed to mimic human exposure to Al by the dietary route, are able to impair male reproductive health. Moreover, the current study shows, for the first time, that the co-treatment with EWH was able to prevent the reproductive adverse effects after Al
exposure at low levels as well as after Al exposure at the higher dose of 100 mg/kg. Our findings provide a better understanding of the reproductive health risk after Al exposure and point to a possible prevention based on a functional food ingredient.

5. REFERENCES


