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The Effect of Introducing Foreign DNA into Nile Tilapia, *Oreochromis niloticus* Gonads on Male Fertility of the Progeny Produced Under Salinity Stress and its Effect on the Histology of the Testes

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ABSTRACT

This work was conducted to study the effect of the transfer of foreign DNA, isolated from sea bream, *Sparus aurata* or Artemia, *Artemia salina* into the testes of *O. niloticus* adult on male fertility of the progeny produced under different salinity levels through studying the histological changes of testes. The results showed that male fertility of *O. niloticus* decreased due to the introduction of foreign DNA into the gonads of their parents. This decrease depends on the type of DNA, since the results of the testes investigation revealed that *O. niloticus* received Artemia DNA displayed normal lobules of 40 %. In contrast, *O. niloticus* received sea bream DNA and showed only 28 % of normal lobules. The results also showed that males' fertility decreased with increasing salinity levels up to 32 ppt. Although all fish that received foreign DNA displayed low fertility, Nile tilapia that received Artemia DNA showed more salinity tolerance and highest fertility than Nile tilapia that received sea bream DNA.

INTRODUCTION

The freshwater shortage in many countries and its increasing demands in agriculture and other urban activities has increased the pressure to develop aquaculture in brackish water and seawater **(El-Sayed, 2006)**. Tilapia are important species, especially for tropical aquaculture and euryhaline fish, that can live and thrive in a wide range of salinity from freshwater to full seawater, even though some species tolerate a wider range of salinity than others **(Güner *et al.*, 2005; Kamal and Mair, 2005)**. Tilapia (including all species) is the second most important group of farmed fish after carp, and the most widely grown of any farmed fish. In 2004 tilapia moved up to the eighth most popular seafood in the USA. Global production of all tilapia species increased from 1.5 million tons in 2003 to 2.5 million tons by 2010, with a sales value of more than 5 billion USD. Most of this enhanced production is attributed to Nile tilapia **(FAO, 2018)**.

A major goal in introducing new genetic materials into the fish genome is to establish new improvement in commercial strains for use in aquaculture **(El-Zaeem, S. Y. *et al.*, 2011; El-Zaeem, S. Y. *et al.*, 2012; Hinits and Moav, 1999; Martınez *et al.*, 1999)**. Genetically-modified fish offer new potential for increased production of cultured organisms. This technology allows the introduction of new traits, or improvement of old ones, in a way that is impossible to be achieved with conventional breeding methods **(Alestrom and de la Fuente, 1999)**. Many species of genetically modified fish have been developed since the first genetically modified gold fish was reported **(Zhu *et al.*, 1985)**. The production of genetically modified fish has become a popular technique not only for producing desirable traits but also for studying mechanisms of developmental regulation of various genes and gene promoters like faster growth rate, disease resistance, cold or salinity tolerance, age at sexual maturity and

تأثير ادخال الحمض النووي الغريب الى مناسل اسماك البلطي النيلي على خصوبة النسل من الذكور المنتجة تحت مستويات ملحية مختلفة وتأثيره على انسجة الخصيتين

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الملخص العربي

تم اجراء هذا العمل لدراسة تأثير نقل الحمض النووى DNA الغريب المستخرج من سمك الدنيس (*Sparus aurata*) او من الارتيميا (*Artemia salina*) الى خصى البلطي النيلي (*O. niloticus*) البالغة على خصوبة الذكور المنتجة للذرية تحت مستويات مختلفة من الملوحة من خلال دراسة التغيرات النسيجية على الخصى. النتائج أظهرت ان ذرية البلطي النيلي (*O. niloticus*) انخفضت نتيجة لإدخال ال DNA الغريب داخل الغدد التناسلية للآباء. الانخفاض يعتمد على نوع الDNA الذي تم إدخاله، حيث ان نتائج فحص الخصيتين اظهرت ان البلطي النيلي (*O.niloticus*) المستقبل لـ DNA الارتيميا (*Artemia salina*) اظهر فصوص طبيعية بنسبة ٤٠٪ بينما البلطي النيلي (*O.niloticus*) المستقبل لـ DNA لسمك الدنيس (*Sparus aurata*) اظهر نسبة ٢٨٪ من الفصوص الطبيعية. النتائج أظهرت ايضاً ان خصوبة الذكور انخفضت بعد زيادة نسبة الملوحة الى (32ppt). على الرغم من ان جميع الأسماك المستقبلة لـ DNA الغريب أظهرت انخفاض الخصوبة، البلطي النيلي (*O.niloticus*) المستقبل لـ DNA الارتيميا (*Artemia salina*) اظهر تحمل للملوحة اكثر وخصوبة اعلى بالمقارنة مع البلطي النيلي (*O.niloticus*) المستقبل لـ DNA المستخلص من سمك الدنيس (*Sparus aurata*).