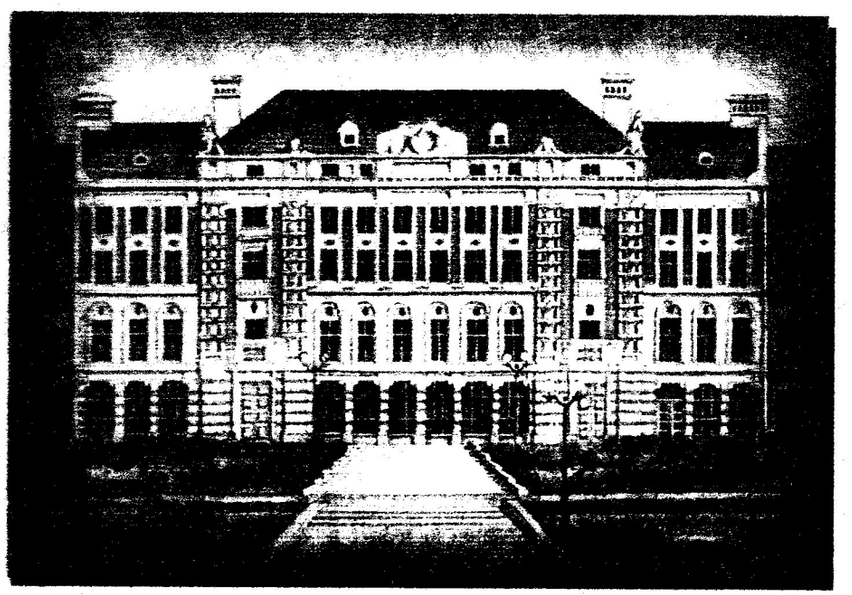
ISSN 1727-4338

Клінічна та експериментальна ПАТОЛОГІЯ



Т.XII, №3(45), 2013

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THE SEX RELATED DEPENDENCE OF THE GINGIVAL TISSUES RESPONSES ON INTERMITTENT HYPOXIA IN IMMATURE RATS

Key words: *hypobarick hypoxia, immature male and female rats, lipids peroxidation, antioxidation enzymes.*

Abstract. *This study showed that in immature rats there are differences in lipids peroxidation intensity and antioxidant activity in the gingival tissues between healthy intact male and female rats. In male rats lipids peroxidation intensity is significanly lower than in female and the gingival antioxidant capacity in female rats is higher than in male rats. Hypobarick intermittent hypoxia equal the altitude 4000 meters (2 hours per day for 14 days) in immature female rats decreases lipids peroxidation intensity and increases antioxidant capacities in gingival tissues; in immature male rats hypoxia has no effect on lipids peroxidation and decreases antioxidant activity compared with control (normoxia) group. In the present study, there was detected the sex related dependence of the gingival tissues responses (lipids peroxidation intensity and antioxidant activity) on intermitted hipobarick hypoxia in immature rats.*

Introduction

In recent years it has become apparent in dental research that, in man free radicals, reactive oxygen species, and anti-oxidant defense mechanisms play an important role in physiological and pathological situations. Europian scientists started in November 2009 up to November 2013 the second international congress in Oulu (Finland) to highlight and discuss the latest development in the broad field of hypoxia response [11].

Hypoxia is a condition in which the body as a whole (generalized hypoxia) or a region of the body (tissue hypoxia) is deprived of adequate oxygen supply. Hypoxia creates free radicals. Hypoxia and free radicals, such as reactive oxygen can alter function and/or activity of the transcription factor hypoxia-inducible factor 1(HIF1) which promote endothelial cell and tumor cell survival [8]. Reactive oxygen species (ROS) are involved in the cell growth, differentiation of tissues, development of organs and body as a whole. Low concentrations of ROS may be beneficial in processes such as defense against micro-organisms. Various ROS mediated actions in fact protect cells against ROS-induced oxidative stress and re-establish or maintain "redox balance". ROS plays a certain role in regulation of normal physiological functions, as well as in pathological implications of altered redox regulation. A dual role of both deleterious and beneficial species of ROS is clearly substantiated [13]. A mild and non-demaging intermittent hypoxia is used intentionally during altitude training to develop an athletic performance adaption at both the systemic and cellular level [1, 9].

Sex hormones play an important role in periodontal health and disease .It is clear that endogenous sex steroid hormones play significant roles in modulating the periodontal tissue responses [5]. Researchers have focused mainly on females [10]. The research of age characteristics of periodontal disease in children and older females is limited.

Objectives

The objective of this study was to investigate possible differences in the dental tissues prooxidant and antioxidant capacities between immature female and male rats, and their dental tissue reaction on intermittent hypoxia.

Material and methods

The experimental group under study consisted of 32 immature inbred male and female albino rats (one month old). Rats were assigned into one of the following groups in accordance with experimental conditions: 1) normoxia - control, 2) hypoxia. Hypobarick hypoxia was provided by the hypoxia chamber and was equal the altitude 4000 meters. The non-damaging intermittent hypoxia was applied for 2 hours per day from 9 to 11 o'clock a.m. Experiment lasted 14 days.

In a supernatant of the gingival tissues of male and female rats lipid peroxidation processes and antioxidant enzymes activity were studied.

Intensity of lipid peroxidation processes was evaluated by measuring the level of malonyl aldehyde

(MA), TBA (Thiobarbituric acid-active substances on Beruheim F. method (modified by Timirbulatov R.A and Selezneva's E.I.) [1]. Activity supperoxidedesmutase (SOD) was measured by means of restoration reaction of Nitrotetrazoline blue (NTB) to Nitroformazane[12]. The catalase (Cat) activity assay was done by a well known method [7].

There were calculated: 1) antioxidant- prooxidant index (AO/PO), and 2) balance of COD and Cat activity (COD/Cat). Index AO/PO= (SOD÷Cat)/(TBA products). The received results were processed statististically: based on the Student's criteria with the help of software program Microsoft Excel 2003.

Results and discussion

In this study differences in the gingival area proxidant and antioxidant capacities were significant between male and female immature rats in the control groups and animals with hypoxia. (Table 1 and 2).

In the control group (normoxia), in male rats lipids peroxidation intencity was significantly lower (TBA products in 51,7%, MA in 49,5%) than in female rats. In contrast, the gingival antioxidant capacity in female rats was higher than in male rats. In female animals SOD was 2,8 times and Cat 1,5 times more active and the level of balance SOD/Cat about 2 times higher than in male animals. As a result antioxidant-prooxidant index in control group of female animals was higher in 14,4% in comparison with male animals. As it is seen in female rats lipids peroxidation process is much more intensive and antioxidant activity significantly higher than in male rats at the immature age. Some studies have indicated dependace of pariodontal and gingival antioxidant capacities on oestroges. They can influence the periodontium at different life times such as puberty, menstruation, pregnancy, menopause and postmenopause [5]. Akalin et all [2] found that the antioxidant capacity in gingival crevicular fluid was lower in pregnant than in nonpegnant periodontitis groups. Salivery antioxidant activity during the ovulatory phase was significantly lower than during the follicular phase in the women with periodontities [6]. The effects of endogenous female sex hormones on the periodontium are studied much better than androgens. By this time it is clear that testosterone has inhibitory effects in the cyclooxygenase pathway of arachidonic acid metabolism in the gingiva, modulate interleukin-6 production by gingival tissue fibroblasts in vitro [5]. However, we could not find studies on a sex peculiarity of gingival area in immature animals where production of sex hormones by sex glands was not started.

Our study is in a concord with the other researchers that in the immature ages female animals are more susceptible to oxidative stress and their gingival antioxidant capacity is higher than in male animals. Our experiments with intermittent hypoxia proved that suggestion. In this study, hypoxic immature female gingival tissues reacted more intensively than male gingiva. Intermittent hypoxia in female rats decreased gingival capacities of DC in 11,7 % and MA in 17,2 % as compared with control group.

At the same time in hypoxic female rats gingival COD activity significantly increased in 39,8 %, balance

Table 1

Capacities of pro- and antioxidant systems in the gingiva of control and hypoxic female rats (M±m)

Female	TBA-reacting substances nmol/mg protein	MA nmol/mg protein	SOD U/min×mg protein	Cat μmol/min*mg protein
Normoxia control n=8	0.710±0.034	0.481±0.010	44.504±0.904	10.473±0.382
Hypoxia n=8	0.627±0.037	0.398±0.021	62.229±2.839	9.452±0.395
p	0.011	0.002	0.002	0.024

Table 2

Capacities of pro- and antioxidant systems in the gingiva of control and hypoxic male rats (M±m)

Male	TBA-reacting substances nmol/mg protein	MA nmol/mg protein	SOD U/min×mg protein	Cat μmol/min*mg protein
Normoxia control n=8	0.343±0.017	0.243±0.016	15.689±0.713	7.145±0.200
Hypoxia n=8	0.318±0.019	0.202±0.011	10.488±0.650	4.302±0.241
p			0.003	0.001

COD/Cat in 54.5% and index AO/PO in 52.6 % as compared with control (normoxic) group. In immature male rats intermittened hypoxia effects were entirely different. The lipids peroxidation intencity was about the same as in control group, the activity of SOD was lower in 33,1 %, Cat in 39,8 %, index AO/PO in 27,4 % as compared with control (normoxic) group.

One possible reason for the differences in the reaction between male and female immature rats may be genetic factor, because hormonogenesis in sex glands in immature age is absent. Of course, the hormones (estrogens and progesterone in females, androgens in male) play significant roles in modulating the periodontal tissues responses and directly may contribute to periodontal disease. In the present study, there was detected the sex related dependence of the gingival tissues responses (lipids peroxidation intensity and antioxidant activity) on intermittent hypobarick hypoxia in immature rats. May be that is why the authors in their review of literature (Effects of endogenous sex hormones on the periodontium) have concluded that the influence of sex hormones on periodontal wound healing is still largely unclear [5]

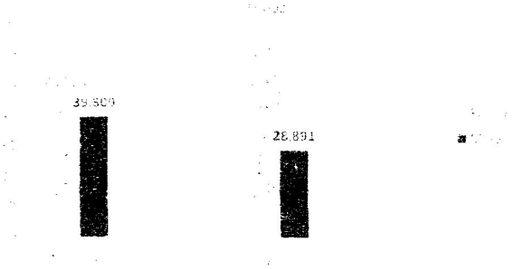

Figure 1. Balance SOD/Cat in the gingiva of control and hypoxic female and male rats

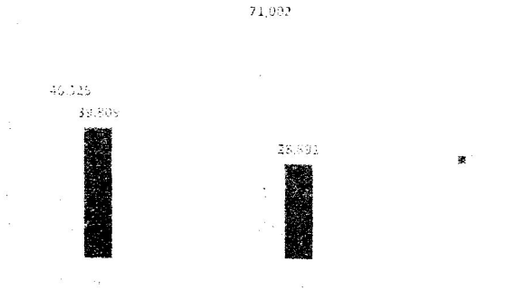

Figure 2. Index AO/PO in the gingiva of control and hypoxic female and male rats

Conclusion

We find a sex dependent difference in the gingival proxidant and antioxidant capacities in immature rats. In male rats lipids peroxidation intensity in gingival is significantly lower than in female rats, and the gingival antioxidant capacity in female rats is higher than in male rats. Intermittent hypoxia (equivalent the altitude 4000 meters, 2 hours per day for 14 days) decreases lipids peroxidation intensity and increases antioxidant capacities in gingival tissues in female rats; in male rats it has no effect on lipids peroxidation and decreases antioxidant capacity as compared with control group rats.

Perspectives of further research

Further research is needed to improve the understanding of the factors which cause the difference in the proxidant and antioxidant status of gingival tissues in male and female.

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СТАТЕВОЗАЛЕЖНА РЕАКЦІЯ ТКАНИН ЯСЕН СТАТЕВОНЕЗРІЛИХ ЩУРІВ НА ПЕРЕРИВЧАСТУ ГІПОБАРИЧНУ ГІПОКСІЮ.

Г. І. Ходоровський, Р.Р. Дмитренко, О. І. Ясінська

Резюме. В експерименті застосовували гіпобаричну переривчасту гіпоксію (2 годин на день протягом 14 днів) еквівалентну висоті 4000 метрам над рівнем моря. Встановлено, що в інтактних статевонезрілих щурів існує різниця в реакції тканин ясен на гіпоксію. У самців інтенсивність пероксидації ліпідів суттєво нижча ніж у самиць, а активність антиоксидантних ферментів вища в самиць у порівнянні з самцями. Переривчаста гіпоксія у самиць знижувала в тканинах ясен рівень пероксидації ліпідів та підвищувала антиоксидантну активність; у самців не впливала на пероксида-

шію ліпідів і знижувала рівень антиоксидантного захисту в порівнянні з інтактними тваринами. У даному дослідженні встановлена статева відмінність у стані пероксидації ліпідів і антиоксидантної активності в тканинах ясен статевонезрілих щурів, у яких гормоногенна функція статевих залоз ще не активна, а також вплив гіпобаричної переривчастої гіпоксії на зазначений стан.

Ключові слова: гіпобарична гіпоксія, статевонезрілі самці та самиці щурів, пероксидація ліпідів, антиоксидантні ферменти.

ПОЛОВАЯ ЗАВИСИМОСТЬ РЕАКЦИИ ТКАНЕЙ ДЕСЕН НА ПРЕРЫВИСТУЮ ГИПОКСИЮ У ПОЛОВОНЕЗРЕЛЫХ КРЫС

Г. И. Ходоровский, Р.Р. Дмитренко, Е. И. Ясинская

Резюме. В эксперименте показано, что в тканях десен существуют различия в интенсивности процессов перекисного окисления липидов (ПОЛ) и активности антиоксидантных ферментов интактных половонезрелых самцов и самок. У самцов интенсивность ПОЛ значительно ниже чем у самок, а антиоксидантная активность выше у самок по сравнению с самцами. Гипобарическая прерывистая гипоксия 4000метров над уровнем моря (2 часа в день 14 дней) у самок снижает ПОЛ и повышает антиоксидантную активность, у самцов не оказывает влияния на ПОЛ и снижает уровень антиоксидантных ферментов. В данном исследовании в тканях десень установлены половые различия в состоянии прооксидантной и антиоксидантной ферментной систем у интактных половонезрелых крыс, а также особенности реагирования этих систем на гипоксию.

Ключевые слова: гипобарическая гипоксия, неполовозрелые самцы и самки крыс, липидная пероксидация, антиоксидантные ферменты.

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Clin. and experim. pathol.- 2013.- Vol.12, №3 (45).-P.197-200

Надійшла до редакції 03.09.2013

Рецензент - проф. О.Б.Бєлоус