# The Blood Oxidant System and Insulin Resistance in Girls with Turner Syndrome after 1 Year of Growth Hormone Therapy

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## BACKGROUND

The effects of recombinant growth hormone (GH) therapy on development of oxidative stress and insulin resistance in girls with Turner Syndrome (TS) were observed

## OBJECTIVES

The aim of this study is to examine the longitudinal relationships of oxidative stress markers with the development of insulin resistance during GH treatment in girls with Turner Syndrome (TS)

## METHODS

**The parameters of the blood prooxidant and antioxidant systems (spectrophotometric data)**

| Parameters | Substance function |
|---|---|
| ***Total antioxidant capacity of plasma (TAC)*** | total antioxidant capacity (TAC) of plasma was evaluated by FRAP (ferric reducing antioxidant power or ferric reducing ability of plasma), the TAC value proportional to the reducing power of the mainly nonenzymatic antioxidants in the plasma, mainly uric and ascorbic acids, but don't detect reduced glutathione and liposoluble antioxidants (e.g. carotinoids) |
| ***Non-Protein Thiols, (NT)*** | Proportional to reduced glutathione's level, take action in hydrogen peroxide utilization in blood |
| ***Thiobarbituric acid reactive substances (TBARS)*** | Proportional to the level MDA as end product of lipid peroxidation, one of the main markers of oxidative stress in plasma |
| ***Erythrocyte superoxide dismutase activity (SOD)*** | Utilization of superoxide anion radicals in erythrocytes with the formation of hydrogen peroxide (in blood) |
| ***Erythrocyte catalase activity (CAT)*** | Catalyzes of the decomposition of hydrogen peroxide to water and oxygen (in blood) |
| ***Ceruloplasmin (CP)*** | Converts of superoxide anion radicals in plasma into water without formation of hydrogen peroxide, and plays a role in the transport, distribution and metabolism of Cu and Fe initiating generation of ROS |

10 prepubertal girls (aged 12-14 yr; median 13.0 yr) with TS were included in the study. All of them have not been treated with GH before. Blood antioxidant system was examined using activity of superoxide dismutase and catalase, thiobarbituric acid reactive substances (TBARS), ceruloplasmin level and total antioxidant capacity (TAC) of plasma. Levels of lipids, glucose, insulin, $Hb_{A1c}$ and IGF-1 were measured in blood plasma before and after 1 year of GH treatment (0.05 mg/kg/day). The insulin resistance assessed using the homeostasis model assessment of insulin resistance (HOMA-IR).

## RESULTS

The concentration of plasma insulin level in girls with TS after 1 year treatment GH was significantly higher than before (7.2±3.4 VS 14.5±4.9 mU/L, p=0.003). The values of HOMA-IR in girls with TS after treatment GH was significantly higher than before (1.6±0.8 VS 3.2±1.22, p=0.008). Before treatment value of HOMA-IR was less than 3.2 (upper reference limit) from all patients, after treatment it was more than 3.2 in 5 of 10 patients (max value of HOMA-IR was 4.7). Also after treatment the value of TBARS was significantly greater (about 40%) and the catalase activity was significantly lower (about 30%) than before treatment

**The clinical data**

statistical significance between parameters of case group before and after rGH treatment, value was evaluated using T- test, p<0.05

| Parameters | Before treatment mean±SD | After treatment mean±SD | Significance level, p<0.05 |
|---|---|---|---|
| Height SDS | -3.40±1.00 | -3.01±0.86 | 0.00012 |
| Height velocity, cm/years | 3.73±0.31 | 8.08±0.76 | 0.00000 |
| IGF-1, nMol/L | 241±84 | 573±197 | 0.00014 |
| Total Cholesterol, mMol/L | 4.5±0.6 | 4.1±0.3 | 0.08958 |
| Glucose, mMol/L | 4.77±0.35 | 4.77±0.48 | 1.00000 |
| Plasma insulin level , mU/L | 7.43±3.47 | 14.03±4.92 | 0.00032 |
| $Hb_{A1c}$, % | 5.26±0.25 | 5.41±0.29 | 0.13362 |
| HOMA-IR | 1.6±0.8 | 3.0±1.2 | 0.00076 |

**The antioxidant status parameters**

| Parameters | Before treatment mean±SD | After treatment mean±SD | Significance level, p<0.05 |
|---|---|---|---|
| Total antioxidant capacity of plasma, µmol/L | 819±227 | 925±179 | 0.23888 |
| TBARS, nMol/mL | 3.0±0.3 | 3.0±0.6 | 0.00445 |
| Superoxide Dismutase (SOD), Units/g Hb | 19.5±6.0 | 14.2±3.7 | 0.11554 |
| Catalase (Cat), k/g Hb | 208±42 | 162±10 | 0.03360 |
| Ceruloplasmin, µkg/mL | 582±150 | 568±124 | 0.69814 |

## CONCLUSIONS

So GH treatment in girls with TS after 1 year GH treatment promoted insulin resistance accompanied by the development of mild form of oxidative stress

Authors have nothing to disclose

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