

Cognitive processing speed as a function of growth hormone treatment in short stature children: a multiple regression analysis.

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Aim

The aim was to observe the cognitive functioning of 99 pre-pubertal, short children during the initial 24 months of GH treatment, Table 1.

Methods & statistics

Cognitive testing was carried out using the Wechsler Scales of Intelligence at baseline, 3, 12 and 24 months.

The population included children with isolated growth hormone deficiency (IGHD) (N=41) and idiopathic short stature (ISS) (N=58).

Effect sizes were calculated. Cohen's d: **low effect = 0.20–0.50**; **medium effect = 0.50–0.80**; high effect = >0.80.

Results

A significant increase in **full-scale IQ (FSIQ)** was found for the whole group following 24 months of GH treatment ($p < .05$; **Cohen's d=0.27 low effect**).

The ISS subgroup increased in **Perceptual Organisation** ($p < .001$; **Cohen's d=0.53 medium effect**).

The IGHD subgroup increased in **FSIQ** ($p < .001$; **Cohen's d=0.63 medium effect**); **Performance IQ** ($p < .001$; **Cohen's d=0.65 medium effect**) and **Processing Speed Index (PSI)** ($P < .005$; **Cohen's d=0.71 medium effect**).

Multivariate regression

40% of the variance in **PSI** (IGHD population) was found to be related to **GHmax** and **IGF-ISDS** at baseline.



Conclusions

- ❖ IQ improves over GH treatment period.
- ❖ Children with the lowest GH levels have the highest increase in IQ.
- ❖ Cognitive processing speed and performance IQ increase more than other IQ variables indicating improvements in fluid intelligence.

Patients

Table 1. Characteristics of the study population at baseline and 24 months (n=99).

| | Mean±SD | Median | Range |
|---|------------|--------|-------------|
| At GH baseline | | | |
| Age, years | 7.3± 2.07 | 7.1 | 3.1 – 11 |
| Height _{SDS} | -2.7± 0.43 | -2.6 | -3.6 – -1.8 |
| diffH-MPH _{SDS} | -1.7± 0.56 | -1.7 | -3.0 – -0.6 |
| IGF-I _{SDS} | -1.1± 1.08 | -1.1 | -3.8 – 1.5 |
| GH _{max} AITT, mU/L | 18.6±10.90 | 15.9 | 1.1 – 62.9 |
| GH _{max} 24h, mU/L | 25.5±12.09 | 23.7 | 0.8 – 58.1 |
| At 24 months of GH | | | |
| Height _{SDS} | -1.3±0.65 | -1.4 | -2.8 – 0.2 |
| Delta Height _{SDS} 24-0 months | 1.3±0.48 | 1.3 | 0.2 – 2.7 |
| diffH-MPH _{SDS} | -0.4±0.53 | -0.5 | -2.2 – 0.9 |
| IGF-I _{SDS} | 1.5±1.14 | 1.6 | -1.5 – 4.2 |
| Delta IGF-I _{SDS} 24-0 months | 2.6±1.22 | 2.6 | -0.2 – 6.7 |

Table 2. Significant increases were found in most IQ areas.

| | GHD | | GHD within-groups | | | GHD | | GHD within-groups | |
|-----------------------|----------------|--------------|-------------------------|-----------|--------------------------------------|----------------|----------------------|-------------------------|--|
| | Mean (SD) | p-value | Effect size (95% CI) | Mean (SD) | | p-value | Effect size (95% CI) | | |
| Full-scale IQ | | | | | Perceptual Organisation Index | | | | |
| Baseline | 97.02 (13.93) | | | | Baseline | 95.00 (14.76) | | | |
| 12 months | 97.92 (14.65) | 0.681 | 0.06 (0.00;0.36) | | 12 months | 97.15 (14.83) | 0.774 | 0.06 (0.00;0.40) | |
| 24 months | 102.52 (14.54) | 0.001 | 0.63 (0.29;0.97) | | 24 months | 100.00 (16.81) | 0.123 | 0.33 (0.00;0.74) | |
| Performance IQ | | | | | Verbal Comprehension Index | | | | |
| Baseline | 96.41 (15.50) | | | | Baseline | 93.50 (11.38) | | | |
| 12 months | 98.95 (16.52) | 0.170 | 0.22 (0.00;0.53) | | 12 months | 95.12 (12.87) | 0.528 | 0.13 (0.28;0.54) | |
| 24 months | 104.15 (16.48) | 0.001 | 0.65 (0.30;0.99) | | 24 months | 99.43 (11.29) | 0.055 | 0.41 (0.00;0.82) | |
| Verbal IQ | | | | | Processing Speed Index | | | | |
| Baseline | 97.70 (13.36) | | | | Baseline | 91.80 (18.08) | | | |
| 12 months | 97.45 (14.33) | 0.675 | 0.07 (0.24;0.38) | | 12 months | 96.96 (19.21) | 0.723 | 0.08 (0.00;0.49) | |
| 24 months | 100.53 (12.57) | 0.033 | 0.35 (0.02;0.67) | | 24 months | 100.51 (20.88) | 0.005 | 0.71 (0.23;1.19) | |

Abbreviations

| | |
|-----------------------|--|
| AITT | Arginine-insulin tolerance test |
| GHD | Growth hormone deficiency |
| GH _{max} 24h | Maximum GH level during a spontaneous 24h GH profile |
| IGF-I | Insulin-like growth factor I |
| ISS | Idiopathic short stature |
| MPH _{SDS} | Mid-parental height SDS |

References

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