

## Evaluation of long term soccer playing caused growth hormone deficiency: a pilot study

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### Objective

Our aim was to evaluate a possible connection between multiple mild head trauma or repetitive heading during long term soccer playing and growth hormone deficiency in a prospective study.

Despite a possible link between mild, but repetitive head traumas and partial or complete pituitary dysfunction is likely, but the diagnosis is difficult to be confirmed. The gold standard stimulation test to assess GH secretory capacity is the insulin tolerance test (ITT), but it has certain disadvantages (e.g. life threatening hypoglycemia). Other options are the GHRH-arginin test and glucagon test. These tests are expensive and require several blood samples for GH determination.

An alternative approach is the consideration of additional pituitary hormone deficiencies plus IGF-I levels as a probable diagnostic procedure. According to the literature data the GH-IGF-I axis and the LH-testosterone axis are the most vulnerable part of the pituitary.

Before performing these systematic procedures, a pilot study seems to be the best approach to plan a prospective study design for repetitive head traumas caused GH or hypogonadism. This screening requires cheap and easy assays, and therefore we have chosen insulin-like growth factor I (IGF-I), luteinizing hormone (LH) and total testosterone (TT) determinations and the QoL-AGHDA (Quality of Life Assessment of Growth Hormone Deficiency in Adults) scoring as a reliable non-invasive additional test to prove the existence of GH deficiency.

### Patients and methods

28 retired previously professional male soccer players were investigated. Nine of them had sport related head injuries. Mean age: 48.7 years (range 36-70; SD 7.4); mean sport duration (professional and senior activity): 27.4 years (SD 8.17).

The assays were used according to the manufacturer's instruction:

•IGF-I (Cisbio Bioassay I-125 immunoradiometric assay /IRMA/ calibration: 1<sup>st</sup> IRR WHO 87/518) – age dependent standard deviation score was calculated (normal range 0-2),

•luteinizing hormone (LH) (ABBOTT chemoluminescent microparticulate immunoassay, calibration: WHO 80/552 2<sup>nd</sup>) (normal range 0.57-12.07 IU/L)

•total testosterone (TT) (ABBOTT chemoluminescent microparticulate immunoassay; calibration internal reference standard) (normal range 5.76-30.4)

QoL-AGHDA scoring –official validated Hungarian form of this questionnaire. The upper limit of normal range of the test was declared at 5 (i.e. <6)

StatsDirect Version3 program was applied for the statistical calculation (descriptive statistics and Student's T test).

### Results

1. The mean IGF-I was 376.87 ng/ml (range 214.30-503.26 ng/ml SD 81.42), the mean IGF-I standard deviation score (SDS) value was 2.19 (range 0.74-3.02). None of them had less, than 0 IGF-I SDS.
2. The mean LH was 4.12 IU/L (range 1.68-6.84 IU/L SD 1.25), mean TT was 17.44 nmol/L (range 2.22-34.99 SD 7.03).
3. The mean QoL – AGHDA score showed normal value 2,4 points (range 0-12 SD), but only four from 28 players received more, than 5 points (normal <6) and only two of them had head trauma. The vast majority of the patients declared 0 or 1 score (meaning completely normal quality of life).
4. No significant difference (P>0.05 in all cases) were found between players with or without head injuries in IGF-1 (385.99 ng/ml 85.9 vs. 368.41 ng/ml 81.21), in SDS (2.23 vs. 2.13), in LH (3.36 1.08 vs 4.42 1.19), TT (16.64 nmol/l 7.94 vs 17.92 nmol/l 6.59) and in QoL-AGHDA (3.2 vs 2.0).
5. All the mean levels of investigated hormones and the QoL-AGHDA remained in the normal range (see table).

### Conclusions

1. To our knowledge, this is the first consecutive pilot study focused on traumatic brain injuries among retired soccer players.
2. Based on the literature data we supposed that IGF-I SDS around the upper limit of the normal range (0-2) and QoL-AGHDA below 5 scores most probably exclude the adult onset growth hormone deficiency (AOGHD).
3. The mean IGF-I and IGF-I SDS values in combination with the QoL-AGHDA scores suggest that among this investigated population AOGHD could not be detected.
4. The only one soccer player who showed both high QoL-AGHDA and low TT and LH underwent head to head contact related brain injury, but his IGF-I SDS was still above 2 which does not confirm the suspicion of GH deficiency, however it needs further investigation (e.g. insulin tolerance test) in this case.
5. We have not found any tendency of deviation from the normal population in IGF-I SDS value, LH, TT levels and QoL-AGHDA score.
6. Although the dynamic tests (ITT or GHRH-arginin test) in a larger population would result more reliable data, but according to our pilot study repetitive mild head traumas did not cause any disorders in the investigated pituitary functions, therefore **long term soccer playing is safe and does not need further preventive intervention.**

name	age (years)	duration of active + senior sportcarreer (years)	sport connected head injuries	additional head injuries	IGF-I (ng/ml)	SDS	LH (IU/L)	testosterone ( nmol/L)	QoL-AGHDA
CL	58	12	no	no	405,91	2,6	4,86	22,4	0
TL	36	12	nasal fracture	traffic accident	503,26	3	3	30,07	5
RA	48	13	head to head contact	no	487,31	3	1,68	2,22	11
FC	39	18	no	no	348,34	1,9	6,1	11,2	2
KS	53	20	no	no	361,17	2,2	3,92	34,99	0
BJ	52	21	no	no	320,49	1,8	2,81	13,56	0
BA	50	22	no	no	223,66	0,7	4,06	8,51	1
SL	70	22	no	no	324,01	2,1	5,81	15,25	1
SG	56	23	cranial fracture	no	424,85	2,7	2,74	12,53	0
SL	56	24	no	no	431,19	2,8	5,74	15,23	9
GK	50	27	concussion	yes	330,17	1,9	3,41	10,46	0
SM	44	27	no	no	395,35	2,3	4,85	20,58	0
FT	57	28	no	no	395,43	2,5	3,51	7,95	12
CJ	47	29	head to head contact	no	289,83	1,5	3,31	19,95	2
CD	44	30	no	no	477,67	2,9	4,15	25,74	0
DA	40	30	concussion	no	389,53	2,2	4,47	21,6	2
MT	42	30	no	no	440,2	2,6	4,98	21,07	2
SZ	42	30	no	no	495,8	3	3	17,22	3
WL	44	30	no	no	285,52	1,4	2,9	22,6	0
ZG	48	30	head to head contact	no	260	1,2	2,66	14,28	7
HF	42	32	no	no	468,15	2,8	6,84	11,69	5
ST	42	32	head to head contact	no	445,37	2,7	3,57	21,05	2
BS	45	35	no	traffic accident	432,37	2,6	4,11	21,22	1
SJ	49	35	head to head contact	yes	343,6	2	5,43	17,67	0
NZ	52	38	no	yes	331,05	1,9	3,58	13,2	0
KJ	49	39	no	no	424,15	2,6	6,18	17,14	0
PL	60	50	no	no	214,3	0,8	3,89	13,77	0
DB	48		NA	NA	303,68	1,6	3,8	25,27	3
MEAN	48.67	27.4			376.87	2.19	4.2	17.44	2.4

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