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Quality of life and exercise capacity in obesity and growth hormone deficiency

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Abstract

OBJECTIVES: A great similarity exists between growth hormone (GH) deficiency and obesity in terms of disturbances of organ morphology and function. The aim of the study was to compare health-related quality of life (HR-QoL) as well as exercise capacity and its subjective assessment in adult patients with GH deficiency and in adult patients with obesity.

METHODS: Ten (10) GH-deficient, thirty (30) obese, and thirty (30) healthy subjects participated in the study. HR-QoL comprised two parameters: QoL measured by using the Quality of Life Assessment of Growth Hormone Deficiency in Adults (QoL-AGHDA) questionnaire, and subjective evaluation of general health state by using the Visual Analogue Scale. The exercise capacity was determined in Six Minute Walking Test and it was subjectively assessed by Borg Scale for Rating Perceived Exertion and the modified Medical Research Council scale.

RESULTS: Decreased HR-QoL (both parameters) was observed in both GH-deficient and obese patients, with that effect being much more pronounced in the former group. Both, GH-deficient and obese patients, revealed decreased exercise capacity, which was also subjectively assessed as decreased, especially by GH-deficient patients. Positive relationships between HR-QoL and exercise capacity or its subjective assessment, observed in healthy subjects, partially lost their significance in obese, whereas they completely disappeared in GH-deficient subjects.

CONCLUSION: A decrease in HR-QoL is more pronounced in GH-deficient than in obese patients, whereas exercise capacity is unfavourably affected by both disorder to a similar extent, with the lack of clear relationship between these two parameters especially in GH-deficient patients.

Abbreviations:

ANOVA	- one-way analysis of variance
BMI	- Body Mass Index
GH	- Growth Hormone
HR-QoL	- Health-Related Quality of Life
ITT	- Insulin Tolerance Test
MRC	- Medical Research Council
QoL	- Quality of Life
QoL-AGHDA	- Quality of Life Assessment of Growth Hormone Deficiency in Adults
RPE	- Rating Perceived Exertion
RRs	- systolic blood pressure
RRd	- diastolic blood pressure
SEM	- Standard Error of the Mean
6-MWT	- Six Minute Walking Test
VAS	- Visual Analogue Scale

INTRODUCTION

Growth hormone (GH) deficiency in adults is a recognised clinical entity, which leads to impairment in body composition and function. The major metabolic disturbances, which occur in GH-deficient adults include increased fat mass, reduced muscle mass, increased waist-hip ratio, insulin resistance, adverse lipid profile, increased procoagulant factors and impaired endothelial function and integrity. The latter three factors in particular, result in a higher risk of atherosclerosis and cardiovascular disease, potentially contributing to increased mortality (Doga *et al.* 2006; Gotherstrom *et al.* 2007). GH deficiency (Hána 2004; Webb & Badia 2007), as well as GH excess (Ruchala *et al.* 2010), are associated with decreased quality of life (QoL). GH-deficient adults are psychosocially disadvantaged in terms of depression, self-esteem, mental fatigue, lack of energy, emotional lability, low mood and social isolation (Hána 2004; Webb & Badia 2007).

Obesity is a disorder of body composition defined as the presence of an abnormal absolute amount or relative proportion of body fat, and commonly assessed in clinical practice by measurement of the body mass index (BMI). Obesity is highly correlated with low cardiorespiratory fitness and several chronic diseases, most notably hypertension, type 2 diabetes, dyslipidemia, ischaemic heart disease, gallbladder disease, osteoarthritis, cancers (endometrial, breast, prostate, and colon cancer), and also sleep apnea (Pischon *et al.* 2008; Renehan *et al.* 2008). Similarly to GH deficiency, obesity is also associated with decreased QoL (Duval *et al.* 2006).

A great similarity exists between GH deficiency and obesity in terms of disturbances of organ and system morphology and function. Main key features shared by these two entities comprise abdominal visceral obesity, impaired glucose tolerance, insulin resistance, proatherogenic lipid profile and increased carotid intimal thickness, leading to an increased risk of cardiovascular disease (Janssen & van der Lely 2004; Rasmussen 2010; Scacchi *et al.* 2007). Additionally, obesity is associated with an impairment of spontaneous and stimulated GH secretion, due to reduced frequency of GH secretory episodes and daily GH synthesis rate (Rasmussen 2010; Scacchi *et al.* 2007).

The aim of the study was to compare health-related QoL (HR-QoL) in adult patients with GH deficiency and in adult patients with obesity, by the use of two instruments: the Quality of Life Assessment of Growth Hormone Deficiency in Adults (QoL-AGHDA) questionnaire (McKenna *et al.* 1999) and the Visual Analogue Scale (VAS) (Grunberg *et al.* 1996). Another aim of the study was to evaluate exercise capacity and its subjective assessment in both groups.

MATERIALS AND METHODS

The procedures, used in the study, were approved by the Ethical Committee of the Medical University of Łódź (the approval number RNN/312/06/KB), and fully informed, written consent was obtained from the patients.

Ten (10) adult patients with severe GH deficiency (mean age ± SEM: 36.40 ± 5.07 yrs; 6 females and 4 males), thirty (30) adult patients with obesity (mean age ± SEM: 40.43 ± 2.48 yrs; 18 females and 12 males), and thirty (30) healthy volunteers (Controls) (mean age ± SEM: 38.93 ± 2.45 yrs; 18 females and 12 males) were enrolled in the study (Table 1). Both studied groups (patients with GH deficiency and patients with obesity) and healthy volunteers were well matched at baseline in terms of sex and age (no statistically significant differences between groups were found when evaluated by χ^2-test of concordance and a one-way analysis of variance, followed by Student-Newman-Keuls' test, respectively). Three control subjects and three obese patients were matched to one GH-deficient patient.

Body mass and body height were measured to calculate BMI in each subject. BMI ≥ 30.0 kg/m^2 constituted the criterion for enrollment to obese patient group.

The diagnosis of severe GH deficiency was confirmed on the basis of insulin-induced hypoglycemia during insulin tolerance test (ITT). Using conventional guidelines, a peak GH response of <9 mU/L was regarded as GH deficiency (Ghigo *et al.* 2008).

Evaluation of the health-related QoL

QoL was measured by using polish validated version of Quality of Life Assessment of Growth Hormone Deficiency in Adults (QoL-AGHDA questionnaire) (Karbownik-Lewińska *et al.* 2008). The Polish validated version was used according to the ethnicity (Karbownik-Lewińska *et al.* 2008). The QoL-AGHDA is a disease-specific instrument designed to measure QoL in adult patients with GH deficiency (McKenna *et al.* 1999). QoL-AGHDA consists of 25 items that evoke yes/no answers, related to dislike of body image, low energy, poor concentration and memory, and increased irritability (McKenna *et al.* 1999; Webb & Badia 2007). The QoL-AGHDA score is computed by summing a number of recognized problems, i.e. each "yes" answer is assigned a score of 1, and therefore a high (above 10) numerical QoL-AGHDA score denotes poor QoL (Ghigo *et al.* 2008; McKenna *et al.* 1999).

Additionally, the general health state was evaluated by using Visual Analogue Scale (VAS) (0–100), in which a point “0” means the worst, and a point “100” – the best subjective assessment of general health state (Grunberg *et al.* 1996).

Evaluation of the exercise capacity

The exercise capacity was determined by the Six Minute Walking Test (6-MWT). During 6-MWT, the distance and blood pressure [systolic (RRs) and diastolic (RRd)] in three time points, i.e. before (1), directly after (2) and 2 minutes after (3) physical exercise, were measured.

A subjective evaluation of exercise capacity was assessed by Borg Scale for Rating Perceived Exertion (RPE) (Borg 1982) and the modified Medical Research Council (MRC) scale (Martínez-Moragón *et al.* 2003). Borg scale is a 15 point scale, which gives a score from 6 to 20 with descriptions of RPE (Borg 1982). The modified MRC scale is a 5 point (from 0 to 4) scale, in which a point “0” means that, subjectively, theres is no evidence of dyspnoea during physical exercise, and a point “4” means that, subjectively, physical exercise is connected with very intense dyspnoea, which results in discontinuation of the effort (Martínez-Moragón *et al.* 2003).

Statistical analysis

The data were statistically analyzed, using a one-way analysis of variance (ANOVA), followed by Student-Newman-Keuls’ test – for comparison of the mean values of measured parameters, or by χ^2-test of concordance – for the frequency of events. The Pearson’s correlation coefficient was calculated to assess correlations between the analysed parameters. Statistical significance was determined at the level of $p<0.05$.

Statistica for Windows 7.0 software was used for the statistical analysis.

RESULTS

According to the enrollment criteria, BMI was higher in obese than in healthy subjects. In turn, BMI of GH-deficient patients did not differ from that one in Controls but was lower than in obese patients (Table 1).

Decreased QoL (expressed as increased QoL-AGHDA score) (Figure 1) and decreased subjective assessment of general health state (expressed as decreased VAS score) were observed in both GH-deficient and obese patients, with those effects being much more pronounced in the former group (Figure 2).

The distance during 6-MWT was shorter in both obese and GH-deficient patients than in Controls (Figure 3A).

Exercise capacity was assessed by both studied groups as decreased (expressed as increased score) to a similar degree when used Borg Scale (Figure 3B).

When used the modified MRC scale, exercise capacity was assessed by both groups as decreased (expressed as increased score), with this effect being more pronounced in GH-deficient patients (Figure 3C).

The highest values of RRs and RRd during 6-MWT (before, directly after and 2 minutes after physical exercise) were found in patients with obesity, and the lowest – in GH-deficient patients, although some differences did not reach the border of statistical significance (Table 1).

Correlations evaluated between parameters, such as age, BMI, QoL-AGHDA score, VAS score, distance during 6-MWT, grade in Borg scale, grade in the modified MRC scale, are presented in Table 2. Positive correlations were found between age and BMI in all studied subjects. Whereas age negatively correlated with QoL (positive correlation with QoL-AGHDA score) in healthy and obese patients, such a correlation was not found in GH-deficient patients. In turn, negative correlation between age and VAS observed in Controls disappeared in both studied groups, obese and GH-deficient patients.

Whereas BMI correlated negatively with QoL (positive correlation with QoL-AGHDA score) in Controls, positive relationship was found between these two parameters in GH-deficient subjects.

Positive relationship between QoL and Visual Analog Scale (negative correlation with QoL-AGHDA score) was found only in healthy subjects.

Concerning exercise capacity and its subjective assessment, they positively correlated with QoL or VAS only in healthy subjects but not in GH-deficient subjects (in obese patients the positive correlation was found only between VAS and the distance).

Correlations between measured parameters and values of blood pressure are presented in Table 3. Age positively correlated with all values of blood pressure only in obese patients. BMI positively correlated with all values of blood pressure in obese patients, whereas such a dependance was found in healthy and GH-deficient subjects only for systolic blood pressure. Exercise capacity and its subjective evaluation correlated negatively with systolic blood pressure in obese patients again. In turn, better QoL (lower QoL score) was associated with higher values of systolic and diastolic blood pressure in GH-deficient patients, but not in healthy or obese subjects.

DISCUSSION

Whereas exclusively one questionnaire is valid specifically designed to measure QoL in adult GH-deficient subjects (QoL-AGHDA questionnaire) (McKenna *et al.* 1999), for measurement of QoL in obese patients numerous questionnaires are accepted to be used and further validation is still suggested as a task for future research (Duval *et al.* 2006).

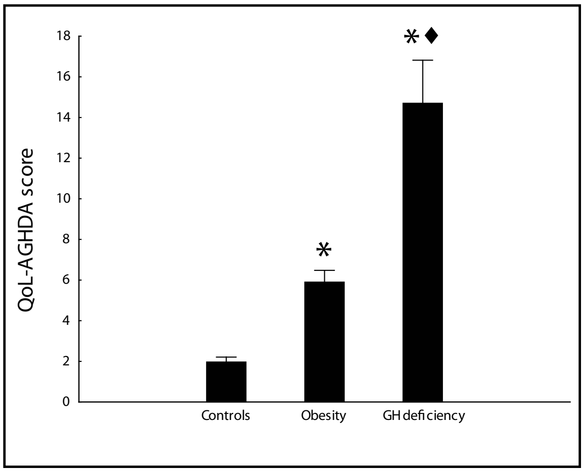

Fig. 1. Mean (± SEM) values of QoL-AGHDA score in Controls, in the patients with obesity, and in the patients with GH deficiency. *$p<0.05$ vs. Controls; ♦$p<0.05$ vs. patients with obesity.

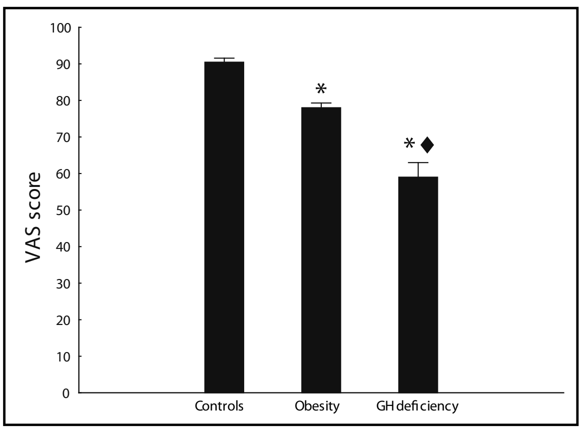

Fig. 2. Mean (± SEM) values of VAS score in Controls, in the patients with obesity, and in the patients with GH deficiency. *$p<0.05$ vs. Controls; ♦$p<0.05$ vs. patients with obesity.

Tab. 1. Sex distribution and mean (± SEM) values of age, body mass index (BMI), systolic (RRs) and diastolic (RRd) blood pressure before (1), directly after (2) and 2 minutes after (3) physical exercise during the 6-Minute Walking Test in Controls, in the patients with obesity, and in the patients with GH deficiency. *$p<0.05$ vs. Controls; ♦$p<0.05$ vs. patients with obesity.

	Controls (n=30)	**Obesity** (n=30)	**GH deficiency** (n=10)
Women [%]	18/30 (60%)	18/30 (60%)	6/10 (60%)
Age [years]	38.93 ± 2.45	40.43 ± 2.48	36.40 ± 5.07
BMI [kg/m^2]	23.33 ± 0.27	31.97 ± 0.74*	23.64 ± 1.19♦
RRs (1)	118.83 ± 1.69	134.17 ± 3.00*	109.00 ± 6.27*♦
RRd (1)	76.83 ± 1.58	82.00 ± 1.64	68.00 ± 4.78*♦
RRs (2)	122.00 ± 1.62	138.77 ± 3.56*	115.00 ± 6.91♦
RRd (2)	78.50 ± 1.50	85.83 ± 1,83*	72.00 ± 4.36♦
RRs (3)	121.33 ± 1.62	138.00 ± 3.35*	112.00 ± 6.55♦
RRd (3)	77.67 ± 1.45	86.67 ± 2.05*	70.50 ± 4.62*♦

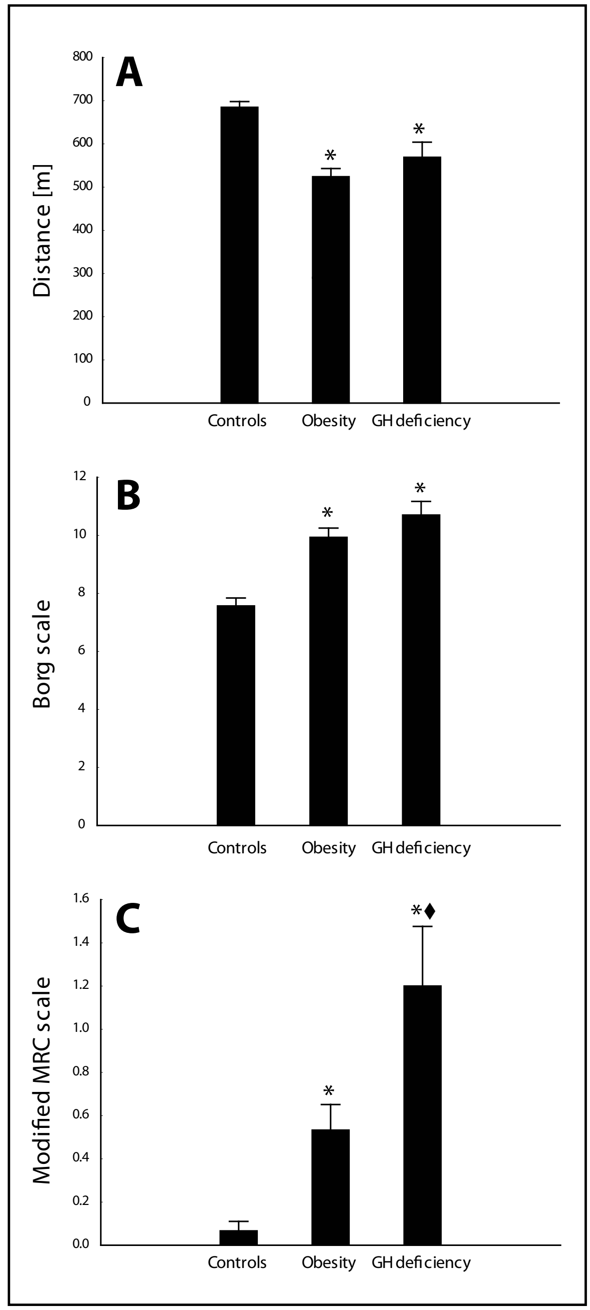

Fig. 3. Mean (± SEM) values of distance during 6-MWT (A), grade in Borg scale (B) and grade of modified MRC scale (C) in Controls, in patients with obesity, and in patients with GH deficiency. *$p<0.05$ vs. Controls; ♦$p<0.05$ vs. patients with obesity.

According to expectation, not only in GH-deficient but also in obese patients, QoL (evaluated by QoL-AGHDA) and also subjective assessment of general health state (evaluated by VAS) were found to be decreased. Although QoL assessed by AGHDA was significantly lower in GH-deficient than in obese patients, it may be assummed that the use of questionnaire specific for obesity would reveal opposite effect.

Tab. 2. Correlations, expressed as Pearson's correlation coefficients, between age, BMI, QoL-AGHDA score, VAS, distance, grade in Borg scale, grade in the modified MRC scale in Controls, in obese and in GH-deficient patients. The level of statistical significance (*p*) is given in italic. *$p<0.05$.

	Age [years]	**BMI** [kg/m2]	**QoL-AGHDA score**	**VAS**	**Distance** [m]	**Borg scale**	**Modified MRC scale**
Controls (n=30)							
Age [years]	-	0.64* *0.000*	0.57* *0.001*	-0.73* *0.000*	-0.79* *0.000*	0.72* *0.000*	0.30 *0.102*
BMI [kg/m2]	-	-	0.39* *0.031*	-0.38* *0.041*	-0.50* *0.005*	0.32 *0.081*	0.12 *0.521*
QoL-AGHDA score	-	-	-	-0.62* *0.000*	-0.32 *0.087*	0.47* *0.009*	0.31 *0.091*
VAS	-	-	-	-	0.52* *0.003*	-0.66* *0.000*	-0.45* *0.012*
Distance [m]	-	-	-	-	-	-0.78* *0.000*	-0.30 *0.108*
Borg scale	-	-	-	-	-	-	0.25 *0.192*
Modified MRC scale	-	-	-	-	-	-	-
Obesity (n=30)							
Age [years]	-	0.59* *0.001*	0.39* *0.032*	-0.27 *0.150*	-0.80* *0.000*	0.74* *0.000*	0.70* *0.000*
BMI [kg/m2]	-	-	0.27 *0.145*	-0.04 *0.819*	-0.60* *0.000*	0.60* *0.000*	0.58* *0.000*
QoL-AGHDA score	-	-	-	0.03 *0.855*	-0.11 *0.574*	0.25 *0.176*	0.17 *0.371*
VAS	-	-	-	-	0.40* *0.029*	-0.29 *0.126*	-0.22 *0.237*
Distance [m]	-	-	-	-	-	-0.74* *0.000*	-0.73* *0.000*
Borg scale	-	-	-	-	-	-	0.72* *0.000*
Modified MRC scale	-	-	-	-	-	-	-
GH deficiency (n=10)							
Age [years]	-	0.74* *0.014*	-0.34 *0.336*	-0.04 *0.908*	-0.68* *0.032*	0.66* *0.038*	0.51 *0.135*
BMI [kg/m2]	-	-	-0.66* *0.038*	0.03 *0.928*	-0.61 *0.060*	0.53 *0.113*	0.42 *0.233*
QoL-AGHDA score	-	-	-	-0.42 *0.233*	-0.06 *0.878*	-0.42 *0.233*	0.08 *0.820*
VAS	-	-	-	-	0.50 *0.146*	-0.10 *0.792*	-0.48 *0.158*
Distance [m]	-	-	-	-	-	-0.49 *0.151*	-0.39 *0.269*
Borg scale	-	-	-	-	-	-	0.20 *0.578*
Modified MRC scale	-	-	-	-	-	-	-

Nevertheless, observations from the present work confirm decreased QoL in obese patients and suggest that QoL-AGHDA questionnaire worked out specifically for GH-deficiency may be suitable for the evaluation of QoL also in obesity, and possibly may be helpful to design one decisive obesity-specific QoL questionnaire.

Additionally our results suggest similar mechanisms contributing to the decrease of QoL in obese and in GH-deficient subjects.

Tab. 3. Correlations, expressed as Pearson's correlation coefficients, between systolic (RRs) or diastolic (RRd) blood pressure at all three time points of 6-Minute Walking Test: before (1), directly after (2) and 2 minutes after (3) physical exercise in Controls, in obese and in GH-deficient patients. The level of statistical significance (p) is given in italic. **p*<0.05.

	RRs (1) [mmHg]	**RRd (1)** [mmHg]	**RRs (2)** [mmHg]	**RRd (2)** [mmHg]	**RRs (3)** [mmHg]	**RRd (3)** [mmHg]
Controls (n=30)						
Age [years]	0.04 *0.830*	0.33 *0.079*	0.19 *0.306*	0.30 *0.109*	0.18 *0.355*	0.28 *0.136*
BMI [kg/m^2]	0.28 *0.127*	0.16 *0.395*	0.46* *0.011*	0.11 *0.558*	0.40* *0.031*	0.10 *0.583*
QoL-AGHDA score	0.01 *0.955*	0.13 *0.508*	0.04 *0.853*	−0.04 *0.849*	0.06 *0.743*	0.01 *0.964*
VAS	0.29 *0.119*	−0.28 *0.131*	0.17 *0.375*	−0.18 *0.334*	0.17 *0.360*	−0.23 *0.224*
Distance [m]	0.03 *0.855*	−0.12 *0.523*	−0.03 *0.866*	−0.11 *0.548*	0.003 *0.990*	−0.08 *0.675*
Borg scale	−0.06 *0.757*	0.12 *0.520*	−0.02 *0.908*	0.09 *0.622*	−0.03 *0.871*	0.04 *0.834*
Modified MRC scale	−0.26 *0.166*	−0.06 *0.763*	−0.21 *0.255*	−0.12 *0.542*	−0.19 *0.306*	−0.09 *0.632*
Obesity (n=30)						
Age [years]	0.69* *0.000*	0.49* *0.006*	0.69* *0.000*	0.47* *0.009*	0.69* *0.000*	0.50* *0.005*
BMI [kg/m^2]	0.74* *0.000*	0.39* *0.033*	0.79* *0.000*	0.51* *0.004*	0.80* *0.000*	0.62* *0.000*
QoL-AGHDA score	0.20 *0.295*	−0.02 *0.929*	0.23 *0.227*	0.01 *0.943*	0.25 *0.191*	0.11 *0.575*
VAS	−0.15 *0.416*	0.01 *0.957*	−0.20 *0.278*	0.10 *0.587*	−0.18 *0.340*	0.03 *0.872*
Distance [m]	−0.54* *0.002*	−0.34 *0.069*	−0.57* *0.001*	−0.33 *0.071*	−0.57* *0.001*	−0.34 *0.065*
Borg scale	0.57* *0.001*	0.18 *0.352*	0.58* *0.001*	0.15 *0.419*	0.59* *0.001*	0.21 *0.256*
Modified MRC scale	0.47* *0.008*	0.21 *0.255*	0.49* *0.006*	0.19 *0.327*	0.50* *0.005*	0.20 *0.302*
GH deficiency (n=10)						
Age [years]	0.40 *0.250*	−0.10 *0.789*	0.46 *0.186*	0.01 *0.987*	0.43 *0.212*	0.03 *0.935*
BMI [kg/m^2]	0.72* *0.019*	0.30 *0.393*	0.76* *0.012*	0.35 *0.320*	0.75* *0.012*	0.34 *0.344*
QoL-AGHDA score	−0.87* *0.001*	−0.75* *0.013*	−0.85* *0.002*	−0.74* *0.015*	−0.90* *0.000*	−0.73* *0.017*
VAS	0.39 *0.271*	0.53 *0.117*	0.35 *0.316*	0.54 *0.105*	0.35 *0.320*	0.49 *0.151*
Distance [m]	−0.14 *0.710*	0.39 *0.271*	−0.23 *0.532*	0.36 *0.305*	−0.14 *0.696*	0.41 *0.234*
Borg scale	0.53 *0.119*	−0.05 *0.888*	0.55 *0.098*	0.01 *0.989*	0.52 *0.126*	−0.02 *0.963*
Modified MRC scale	−0.02 *0.960*	−0.23 *0.490*	−0.00 *1.00*	−0.17 *0.645*	0.04 *0.923*	−0.05 *0.892*

The following two mechanisms may substantially contribute to results obtained in the present study. The first is associated with the fact that GH deficiency and obesity share features, potentially affecting a general health state, such as those mentioned in the introduction, leading to increased cardiovascular risk, and additionally decreased physical activity resulting from lack of energy in GH deficiency and from increased total body mass in obesity (Janssen & van der Lely 2004; Rasmussen 2010; Scacchi *et al.* 2007). Alongside with the above, increased oxidative damage to macromolecules occur in GH-deficient (Kokoszko *et al.* 2006) and obese (Demirbag *et al.* 2006) patients, the change being reversed with recombinant human GH (rhGH) replacement in GH-deficient subjects (Karbownik-Lewińska *et al.* 2008) and still required to be examined in obese patients. The second mechanism is associated with the fact that in case of both entities, GH deficiency and obesity, GH concentrations are decreased, obviously with much lower values in the former (Scacchi *et al.* 2007).

It is worth mentioning that just as in GH-deficient patients QoL improves with rhGH replacement therapy (Deepak *et al.* 2008; Gotherstrom *et al.* 2007), in obese patients QoL does improve with body mass reduction (Yancy *et al.* 2009).

It is worth stressing that similarly to discussed above QoL, also subjective assessment of general health state (evaluated by VAS) was the lowest in GH-deficient patients. Thus, it is not excluded that severe GH deficiency (without rhGH replacement therapy) is just associated with lower HR-QoL, when compared to obesity, independent of the test used, but that should be proved in other clinical trials.

According to expectation, again, exercise capacity and its subjective evaluation was decreased in both, obese and GH-deficient patients, when compared to healthy subjects. However, these parameters did not differ between the two examined groups as clearly as in case of HR-QoL. That may suggest that GH deficiency more strongly affects HR-QoL than exercise capacity.

Of importance is the observation that significant relationship between HR-QoL and exercise capacity or its subjective assessment, observed in healthy subjects, was only weakly marked in obese patients, whereas completely disappeared in GH-deficient patients. One can speculate that serious organ and cellular disturbances, other than exercise capacity, contribute stronger to decreased HR-QoL in GH-deficient subjects. It is well known that age affects HR-QoL negatively (Butler & Ciarrochi 2007). However, whereas such a relationship was observed in the present work in healthy subjects, it completely disappeared in GH-deficient patients and was only partially marked in obese patients. Thus, again, age is less important factor contributing to decreased HR-QoL in GH-deficient and also obese patients when compared to probable effects of numerous organ and cellular disturbances.

Negative correlation between BMI and QoL, observed in healthy subjects, was expected. In GH-deficient subjects such a correlation was not only lost but even BMI did positively influence QoL. In agreement, not increased body mass is typical for GH deficiency but abnormal proportion of fat and lean body mass (Doga *et al.* 2006), which was confirmed in the present study (by BMI remaining in normal ranges).

Of importance is the observation that age, BMI, decreased exercise capacity and its lower subjective evaluation clearly contributed to increase of blood pressure only in obese patients. This finding may suggest that obesity enhances unfavourable effects of age, BMI and of decreased exercise activity (and capacity) on arterial vessels. In fact, obesity has been found to be associated with abnormal vascular reactivity already at young age (Karpoff *et al.* 2009).

Positive relationship between QoL and blood pressure, observed in GH-deficient subjects, was expected, as the tendency to decreased blood pressure is typical for this disease (Fideleff & Boquete 2004). In turn, such a relationship was not expected in healthy and, especially, in obese patients, and that was, again, confirmed in the present study.

CONCLUSIONS

A decrease in HR-QoL is more pronounced in GH-deficient than in obese patients. QoL-AGHDA questionnaire may be suitable in adult obese patients. Whereas exercise capacity was decreased in both GH-deficient and obese subjects to a similar degree, its subjective assessment was lower in the former group. HR-QoL does not depend on exercise capacity and its subjective assessment in GH-deficient patients, whereas such a dependance – to a certain extent – still exists in obese subjects.

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