Preliminary findings on the association between attachment patterns and levels of growth hormone in a sample of children with non-organic failure to thrive

Risultati preliminari sull’associazione tra stili di attaccamento e livelli di ormone della crescita in un campione di bambini affetti da deficit di crescita non organico

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SUMMARY. Introduction. Deficiency of growth hormone (GH) in absence of pituitary injuries is one of the causes of short stature and of the non organic failure to thrive (NOFTT) condition. Advances in developmental psychology have highlighted the role of emotions and caregiving behaviors in the organization of child’s personality and psychobiology, with the mother-son attachment bond being considered a fundamental developmental experience. The objective of the present preliminary study was to assess whether there are significant correlations between attachment patterns and GH levels in a sample of children with NOFTT. Methods. Overall, 27 children (mean age 9.49±2.63 years) with NOFTT were enrolled. Perceived attachment security was assessed through the Security Scale (SS) and its subscales focused on maternal and paternal security. Pearson partial correlation was used to test associations between GH levels and SS measures adjusting for confounding factors (i.e. age, gender and body mass index). Results. Across all subjects, GH was significantly positively correlated with general security (r=0.425; p=0.038) and maternal security (r=0.451; p=0.027) and not significantly correlated with paternal security (r=0.237; p=0.264). Discussion. These findings preliminarily suggest that the association between GH levels and perceived attachment security may play a role in the pathophysiology of NOFTT and add to the accumulating evidence that attachment patterns may be related with specific psychoendocrine underpinnings.

KEY WORDS: growth hormone, non organic failure to thrive, children, attachment style.

RIASSUNTO. Introduzione. La riduzione dell’ormone della crescita (GH) in assenza di lesioni ipofisarie è una delle cause di bassa statura e della condizione clinicale di deficit di crescita non organico, nota come “non-organic failure to thrive” (NOFTT). I progressi nell’ambito della psicologia dello sviluppo hanno messo in evidenza il ruolo delle emozioni e dei comportamenti del caregiver nell’organizzazione della personalità e della psicobiologia del bambino, considerando il legame di attaccamento madre-figlio come un’esperienza fondamentale nello sviluppo. Il presente studio preliminare si pone come obiettivo quello di valutare l’esistenza di correlazioni significative tra modelli di attaccamento e livelli di GH in un campione di soggetti affetti da NOFTT. Metodi. Sono stati arruolati nello studio 27 bambini (età media: 9,49±2,63) con NOFTT. La sicurezza della percezione di attaccamento è stata valutata attraverso la Scala di Sicurezza (SS) e le sottoscale inerenti il grado di sicurezza materna e paterna. La correlazione parziale di Pearson è stata usata per indagare le associazioni tra i livelli di GH e le misure SS, covariando per i fattori confondenti (ossia età, sesso e BMI). Risultati. In tutti i soggetti, il valore di GH era positivamente correlato in modo statisticamente significativo alla sicurezza generale (r=0,425; p=0,038) e della sicurezza materna (r=0,451; p=0,027) e non significativamente correlato con la sicurezza paterna (r=0,237, p=0,264). Discussione. Questi dati suggeriscono preliminarmente che l’associazione tra i livelli di GH e la sicurezza nella percezione dell’attaccamento possano svolgere un ruolo nella fisiopatologia del NOFTT, e si aggiungono al filone di evidenze inerenti il fatto che certi modelli di attaccamento possano essere associati a condizioni psico-endocrine specifiche.

PAROLE CHIAVE: ormone della crescita, deficit di crescita non organico, bambini, stile di attaccamento.
organic (medical) and non-organic (social or environmen-
tal)\textsuperscript{2}. Increasing evidence suggests that in many children the
etiology of FTT is multifactorial, including biological, psy-
chosocial, and environmental contributors\textsuperscript{2}. Epidemiological
researches have shown that only 20-25\% of infants and chil-
dren with FTT receive the diagnosis of organic FTT (OFTT),
while in the majority of cases it is not possible to identify a
specific organic cause of FTT (i.e. the so-called non-organic
FTT - NOFTT)\textsuperscript{4}. The condition of NOFTT does not fulfill
the criteria for being considered a medical diagnosis, but
rather it represents a standardized description of a pattern of
growth\textsuperscript{4}.

In absence of clear organic causes, i.e. in the condition
of NOFTT, several different psychosocial conditions may play a
role in explaining the FTT phenotype, such as children’s im-
paired affect regulation and temperamental characteristics,
inadequate children’s nutritional intake, a vicious circle of
maladaptive behavioral interaction between caregiver and
infant, caregivers’ unsure attachment styles, psychosocial
stress and psychopathology\textsuperscript{5}.

Advances in developmental psychology have highlighted
the role of emotions and caregiving behaviors in the organi-
zation of children’s personality and psychobiology, with the
mother-son attachment bond being considered a fundamen-
tal developmental experience\textsuperscript{6-9}. According to the attach-
ment theory, attachment styles have typically been classified
into three types: secure, anxious, and avoidant\textsuperscript{7,8}. These types
not only describe individual’s behavioral patterns but also
represent the organization through the expectations of oth-
ers in response to comfort or reassurance seeking\textsuperscript{7,8}. The early
attachment characteristics have been shown to play an im-
portant role in influencing psychopathological outcomes in
adulthood\textsuperscript{9}, and the presence of insecure attachment (i.e.
anxious or avoidant) in children has been suggested to in-
crease vulnerability towards several psychiatric diseases\textsuperscript{10}.

Further, preliminary studies evidenced a link between at-
tachment styles and certain patterns of endocrine and im-
mune functions\textsuperscript{11-15}.

Early studies exploring the conditions of childhood emo-
tional deprivation and mistreatments had identified a syn-
drome defined as “psychosocial dwarfism” or “reversible
hypopituitarism syndrome” characterized by short stature
often associated with a reversible deficit of growth hor-
mone (GH) and with a range of psychiatric and behavioural
disturbances such as eating disorders, insomnia, depres-
sion, bedwetting, poor cognitive performance\textsuperscript{16}. The au-
thors postulated that the emotional deprivation could act on
the hypothalamus-pituitary gland and alter the release of
GH as well as of somatomedins and other endocrine fac-
tors\textsuperscript{16}.

Reduced levels of GH (i.e. pituitary dwarfism or GH deficien-
cy - GHD) in absence of pituitary injuries are nowadays considered one of the causes of NOFTT\textsuperscript{7}. The
objective of the present preliminary study was to assess, for
the first time in psychoendocrinological research, whether
there are significant correlations between patterns of at-
tachment and GH levels in a sample of subjects with
NOFTT. A deeper understanding of psychobiological cor-
relates of NOFTT could potentially lead to the develop-
ment of better diagnostic and therapeutic strategies for in-
dividuals with this condition.

METHODS

Recruitment procedures and study participants

The institutional review board of Sapienza University of
Rome approved the study. All subjects provided written, informed
consent prior to commencing their involvement in the trial.

Patients with NOFTT (characterized by short stature or re-
duced annual growth rate) were recruited among those attending
the Centre for the Diagnosis and Therapy of GHD at the Depart-
ment of Experimental Medicine of Policlinico Umberto I Univer-
sity Hospital (Rome, Italy).

The following auxological criteria were considered as inclusion
criteria: (i) age range between 6 and 15 years, (ii) stature <3 SD or
stature <2 SD from the mean value, and (iii) annual growth ve-
locity <1 SD from the mean value evaluated after at least 6
months of clinical observation.

The exclusion criteria were: (i) presence of any chronic sys-
temic disease (malabsorption syndrome, Fanconi anemia, cardiac,
renal and metabolic disorders), (ii) endocrine and psychiatric dis-
orders diagnosed according to DSM-5\textsuperscript{18}, (iii) use of any pharma-
cological therapy, (iv) presence of brain and pituitary injuries as
assessed by cerebral magnetic resonance imaging.

Each patient underwent blood examinations to measure GH
levels and psychopathological evaluation (through the Security
Scale - SS) to assess attachment. The SS is a self-report measure
which assesses children’s perceptions of security in parent-child
relationships and consists in 15 items\textsuperscript{19}. The SS has two sets of
specular items focused on the attachment relationship about their
mothers and their fathers, in order to get an overall picture of chil-
dren’s attachment perception. The instrument assesses to which
degree children perceive their parents as being responsive and
available, their tendency to rely on them in times of distress and
their ease and interest in communicating with their parents. Each
item is scored from 1 to 4, with higher scores representing greater
perception of attachment security. The SS has three subscales: the
first subscale assesses the degree of security perception in moth-
er-child relationship (SSPSM); the second subscale assesses the
degree of security perception in father-child relationship (SSPSP);
the third subscale is derived from the sum of the two previously
described subscales and assesses the overall perception of secu-
ritiy (SSPSC). Serum GH levels were measured using immunora-
diometric assays\textsuperscript{6}.

Statistical analyses

All tests were 2-tailed with an $\alpha=0.05$. GH was non-normally
distributed, thus it was transformed using Ln transformation.
Pearson partial correlation was used to test correlations between
GH and the assessment measures of attachment (i.e. SSPSM, SSP-
SP and SSPSC) adjusting for age, gender and body mass index
(BMI; weight in kilograms divided by the square of height in me-
ters) because of (i) their known associations with GH secretion and
function, and (ii) the significant inverse correlations between
age and GH ($r=-0.485$, $p=0.010$) observed in our sample.

RESULTS

Overall, 21 males and 6 females (mean age 9.49±2.63
years) were included in the study. Among them, 19 patients
had NOFTT associated with non-organic GHD, while 8 pa-
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Patients had NOFTT not associated with GHD. Demographic and clinical characteristics of the subjects are presented in Table 1.

Across all subjects, GH was significantly positively correlated with SSPSM (r=0.451; p=0.027) and SSPSC (r=0.425; p=0.038) (Figure 1) and not significantly correlated with SSPSP (r=0.237; p=0.264).

**DISCUSSION**

To the best of our knowledge, this is the first study testing the association between GH levels and psychological measures of attachment in a sample of children with NOFTT. The results of this preliminary investigation showed a significant positive correlation between GH levels and perceptions of children’s attachment to their parents in terms of partial scores (attachment to the mother) and of total scores (mother and father). The correlation was not significant for the perception of attachment to the father.

Our findings are consistent with previous evidence suggesting a link between early affective dysregulation, altered physical development and the condition of NOFTT, and add specificity to this field of exploration through (i) the quantitative measurement of GH levels and the degree of perceived attachment, and (ii) the enrollment of children who were not using any medication, thus with low levels of biological confounders. Further, our findings add to the accumulating evidence suggesting meaningful associations of attachment patterns with endocrine and immune functions.

In the reported significant relationship between GH levels and perceived security of attachment, both the directions of causality may be postulated. On the one hand, it is possible that the degree of perceived attachment towards the parents can contribute to psychobiologically affect the functioning of the hypothalamic-pituitary-adrenal axis with subsequent hormonal alterations of GH levels. On the other hand, it is possible that the conditions of less efficient endocrine functioning and short stature in children can induce anxiety in their parents that might interfere with reliable and consistent parenting and thus facilitate a maladaptive development of inter-personal relationships in children.

The major limitation of the present preliminary study is the small sample size, which partially results from the rarity of the NOFTT clinical condition. Future studies, including ongoing projects of our research team, will need to include a larger number of subjects, a control group, and a more comprehensive set of explored psychopathological and end-
Endocrine assessments. Overall, these preliminary findings suggest that the association between GH levels and perceived attachment security may play a role in the pathophysiology of NOFTT and add to the accumulating evidence that attachment patterns may be related with specific psychoneuroendocrine underpinnings.

Conflict of interest: none declared.

REFERENCES


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