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ASSOCIATIONS BETWEEN ALEXITHYMIA AND MENTAL WELL-BEING IN ADOLESCENTS

by

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ABSTRACT

Alexithymia signifies a personality construct that represents reduced ability to identify and describe feelings, a limited imagination, and externally oriented thinking. The objective of this study was to assess the associations between alexithymia and psychiatric symptoms, as well as to evaluate the significance of childhood developmental factors for alexithymia. The study population was recruited from a sample of adolescents, who had participated in previous studies investigating eating disorder symptoms (n=320), and a group of matched controls (n=640). Altogether 729 individuals (78%) participated in the study by answering the questionnaire. Of the sample, 74% were female and 26% male, and the mean age was 19 years at the time of the data were collected. The material also included child welfare centre check-up records since birth for all subjects.

The prevalence of alexithymia was 8.2% for females and 8.5% for males. No significant gender difference was observed in the mean 20-item Toronto Alexithymia Scale (TAS-20) total scores (44.7 for females and 46.0 for males). Alexithymia was found to be associated with eating disorder symptoms in adolescents. Eating disorder symptoms were measured using the SCOFF ("Sick", "Control", "One", "Fat", "Food") questionnaire. The mean SCOFF scores and the proportion of the SCOFF positive individuals (scoring 2 or more) were significantly higher among the alexithymic subjects. The association between alexithymia and anxiety symptoms was also assessed. Anxiety was measured using the State-Trait Anxiety Inventory (STAI), and in order to assess the association reliably, depression and alcohol consumption were included as covariates. The alexithymic subjects had significantly higher mean STAI scores than the non-alexithymic subjects. Highly anxious alexithymic subjects also presented a significantly higher level of depressive symptoms and they used more alcohol, as compared with their equally anxious non-alexithymic peers.

The associations of alexithymia with perceived social support and parental attitude were explored using the Multidimensional Scale of Perceived Social Support and Parental Bonding Instrument scales. Alexithymia was significantly associated with a lower degree of experienced social support – particularly from friends – and higher parental overprotection both in females and males. The significance of childhood developmental factors for alexithymia in late adolescence was assessed using data from the child welfare centre check-ups at the age of five years, thus avoiding recall bias. The results suggested speech development to be a significant factor in the developmental process of alexithymia, at least in males.

According to this study, alexithymic late adolescents have significantly more mental disorder symptoms compared with their peers. Since alexithymia is also in adolescents likely to predict poorer outcome in several different mental disorders, the possibility of alexithymia should be explored efficiently. Moreover, the increasing amount of evidence on the aetiology of alexithymia may enable earlier identification and intervention in individuals at a high risk to develop a mental disorder.

Keywords: adolescent, alexithymia, anxiety, eating disorder, mental health, parenting, social support, speech development

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TIIVISTELMÄ

Aleksitymialla tarkoitetaan persoonallisuuden piirteistöä, jolle on tyypillistä heikko kyky tunnistaa ja ilmaista tunteita sekä vähäinen mielikuvitus ja konkreettinen, ulkokohtainen ajattelutapa. Tämän tutkimuksen tarkoituksena on tarkastella aleksitymian yhteyttä psyykkiseen oireiluun nuorilla sekä tutkia aleksitymian kehittymiselle altistavia yksilöllisiä lapsuudenaikaisia tekijöitä. Tutkimusaineisto koostui aiempaan nuorten syömishäiriöoireilua tarkastelevaan tutkimukseen osallistuneista nuorista (n = 320) ja heille satunnaisotannalla poimituista verrokeista (n = 640). Seurantakyselyssä käytettiin vastaajan itsensä täytettäviä mittareita ja aineisto kerättiin postikyselynä. Yhteensä 729 henkilöä (78 %) palautti lomakkeen täytettynä, muodostaen näin lopullisen tutkimusaineiston. Tyttöjä vastanneista oli 74 % ja poikia 26 %. Aineiston keski-ikä oli 19 vuotta tämän tutkimuksen aikaan. Aineistosta oli käytettävissä neuvolatiedot syntymästä lähtien.

Tutkimusaineistossa todettiin aleksitymian yleisyydeksi tytöillä 8,2 % ja pojilla 8,5 %. Sukupuolten välillä ei todettu eroa 20-osioisella Toronto Alexithymia Scale-kyselyllä (TAS-20) pistemäärissä (tytöillä 44.7 ja pojilla 46.0). Syömishäiriöoireiden todettiin olevan yleisempiä aleksityymisillä nuorilla verrattuna ei-aleksityymisiin. Syömishäiriöoireita mitattiin SCOFF-mittarilla (“Sick”, “Control”, “One”, “Fat”, “Food”). Aleksityymisten nuorten keskimääräinen SCOFF-pistemäärä oli merkitsevästi korkeampi kuin ei-aleksityymisten ja SCOFF-positiivisten (pistemäärä vähintään 2) osuus oli aleksityymisten ryhmässä kolminkertainen ei-aleksityymisten ryhmään verrattuna. Myös ahdistuneisuuden todettiin olevan yhteydessä aleksitymiaan nuorilla. Ahdistuneisuutta mitattiin State-Trait Anxiety Inventory-mittarilla (STAI) ja lisäksi mitattiin masennusoireita ja alkoholinkäyttöä. Aleksityymisten nuorten STAI-pisteet olivat merkitsevästi korkeammat kuin ei-aleksityymisten. Ahdistuneet aleksityymiset nuoret olivat myös yleisemmin masentuneita ja käyttivät runsaammin alkoholia kuin yhtä ahdistuneet ei-aleksityymiset nuoret.

Tutkimuksessa selvitettiin aleksitymian yhteyttä sosiaaliseen tukeen sekä koettuun vanhempien hoivaan ja ylisuojelevaisuuteen. Käytetyt mittarit olivat Multidimensional Scale of Perceived Social Support ja Parental Bonding Instrument. Aleksitymia oli merkitsevästi yhteydessä sekä heikompaan koettuun sosiaaliseen tukeen – erityisesti ystäviltä saatavaan – että korkeampaan vanhempien ylisuojelevaisuuteen. Tutkimuksessa käytettiin 5-vuotisneuvolatarkastuksen tietoja sen arviointiin, mitkä kehitykselliset tekijät saattavat olla yhteydessä aleksitymian ilmenemiseen. Puheenkehityksen ongelmien todettiin olevan miehillä selvästi yhteydessä aleksitymiaan.

Tutkimuksen perusteella aleksityymisillä nuorilla esiintyy ei-aleksityymisiin ikätovereihin verrattuna selvästi yleisemmin psyykkisiä oireita. Koska aleksitymia heikentää hoitovastetta todennäköisesti myös nuorilla, tulisi aleksitymian mahdollisuus selvittää tehokkaasti psyykkisesti oireilevilla nuorilla. Lisääntyvä tutkimustieto aleksitymian kehittymisestä mahdollistaa riskitapausten varhaisemman tunnistamisen ja tilanteeseen puuttumisen.

Avainsanat: ahdistuneisuus, aleksitymia, mielenterveys, nuori, puheenkehitys, sosiaalinen tuki, syömishäiriö, vanhemmuus

CONTENTS

ABBREVIATIONS

ACC	Anterior cingulate cortex
AUDIT	Alcohol Use Disorders Identification Test
BDI	Beck Depression Inventory
BIQ	Beth Israel Hospital Psychosomatic Questionnaire
BVAQ	Bermond-Vorst Alexithymia Questionnaire
BDNF	Brain-derived neurotrophic factor
CAQ-AP	California Q-Set Alexithymia Prototype
CFS	Chronic fatigue syndrome
CNS	Central nervous system
COMT	Catechol-O-methyltransferase
DDF	Difficulty describing feelings
DIF	Difficulty identifying feelings
ED	Eating disorder
EOT	Externally oriented thinking
fMRI	Functional magnetic resonance imaging
HPA	Hypothalamic-pituitary-adrenal (axis)
MSPSS	Multidimensional Scale of Perceived Social Support
PBI	Parental Bonding Instrument
PET	Positron emission tomography
RBDI	Raitasalo Beck Depression Inventory
SCL	Somatic Complaints List
SCOFF	“Sick”, “Control”, “One”, “Fat”, “Food” questionnaire
STAI	State-Trait Anxiety Inventory
TAS	Toronto Alexithymia Scale
TAS-20	20-item Toronto Alexithymia Scale
TAS-26	26-item Toronto Alexithymia Scale
TSIA	Toronto Structured Interview for Alexithymia
YSR	Youth Self-Report

LIST OF ORIGINAL PUBLICATIONS

The dissertation is based on the following original publications, which are referred to in the text by Roman numerals I–IV.

I Karukivi M, Hautala L, Korpelainen J, Haapasalo-Pesu KM, Liuksila PR, Joukamaa M, Saarijärvi S. Alexithymia and eating disorder symptoms in adolescents. Eat Disord 2010;18:226–238.

II Karukivi M, Hautala L, Kaleva O, Haapasalo-Pesu KM, Liuksila PR, Joukamaa M, Saarijärvi S. Alexithymia is associated with anxiety among adolescents. J Affect Disord 2010;125:383–387.

III Karukivi M, Joukamaa M, Hautala L, Kaleva O, Haapasalo-Pesu KM, Liuksila PR, Saarijärvi S. Does perceived social support and parental attitude relate to alexithymia? A study in Finnish late adolescents. Psychiatry Res 2010, in press.

IV Karukivi M, Joukamaa M, Hautala L, Kaleva O, Haapasalo-Pesu KM, Liuksila PR, Saarijärvi S. Deficit in speech development at the age of five years predicts alexithymia in late adolescent males. Compr Psychiatry 2011, in press.

1. INTRODUCTION

Alexithymia signifies a personality construct that represents reduced ability to identify and describe feelings, a limited imagination, and a concrete, externally oriented way of thinking. The concept of alexithymia was introduced in the early 1970s on the basis of observations made in psychosomatic patients (Sifneos 1973). Initially, when the concept was introduced, it was thought to be a common personality pattern typical for psychosomatic patients and the early studies were focused on this patient group.

There are a few studies suggesting that genetic factors have an impact on alexithymic characteristics (Heiberg & Heiberg 1977, Valera & Berenbaum 2001, Jørgensen et al. 2007). Modern imaging technology has also increased the knowledge of the neurobiological basis of alexithymia, and certain parts of the central nervous system (CNS), such as amygdala (Kugel et al. 2008) and anterior cingulate cortex (ACC) (Kano et al. 2003, Karlsson et al. 2008), have been suggested to be connected with alexithymia. In population studies, several socio-demographic factors have also been associated with alexithymia. For example, male gender (Mattila et al. 2006, Franz et al. 2008), low socio-economical status (Salminen et al. 1999), rural dwelling area (Horton et al. 1992), low social support (Fukunishi et al. 1995), and general psychopathology in the family (Lumley et al. 1996, Joukamaa et al. 2003) have been linked with alexithymia. Previous research also indicates that the development of emotion regulation may be impaired due to inadequate parenting (Taylor et al. 1997a, Picardi et al. 2005a), and parental bonding as well as childhood adversities have been found to be associated with alexithymia (Honkalampi et al. 2004a, De Panfilis et al. 2008).

Especially the work of McDougall (1989) has influenced the psychodynamic approach to alexithymia, in which alexithymic features are understood as an arrested and infantile psychic structure developed to protect the individual from overwhelming emotions rooting in early neglect

or other childhood adversities. The theory that alexithymia could develop as a consequence of a trauma of some kind is supported by Freyberger (1977), who introduced the concept of primary and secondary alexithymia. Primary alexithymia was defined as a personality feature, and secondary alexithymia as a defence mechanism, as depicted above. Krystal (1982) suggested that extreme stress, particularly during maturation could facilitate alexithymic features in order for an individual to avoid experiencing a painful affect. However, on the basis of later research, alexithymia is, currently understood more as a relatively stable feature (Salminen et al. 2006, de Timary et al. 2008) although, due to its complexity, it is likely that alexithymia includes both state and trait components (Lumley et al. 2007).

According to population studies, the prevalence of alexithymia in adult population is approximately 10% (Salminen et al. 1999, Mattila et al. 2006, Franz et al. 2008). Current research suggests that alexithymia can be observed and measured even in children (Fukunishi et al. 1998, Rieffe et al. 2006). However, one methodological problem lies in the facts that alexithymic features are, to some extent, normal in childhood and that anxiety-provoking situations typically evoke psychosomatic symptoms in children (Nemzer 1996). It is not until the later development of cognitive capacity and abstract thinking that individuals are able to properly label and verbalize emotions associated with an anxiety-provoking situation. Therefore, it can be hypothesized that early adolescents are innately somewhat more commonly alexithymic than late adolescents, which is also supported by population studies among Finnish adolescents (Joukamaa et al. 2007, Säkkinen et al. 2007, Honkalampi et al. 2009). On the basis of these studies, the prevalence of alexithymia appears to be at the same level as a whole in adolescents as in adults, but unlike adults, adolescent males have not been found to be more alexithymic than adolescent females. The main findings in earlier studies in non-clinical adolescent samples are described in Table 1.

Table 1. Earlier studies on alexithymia in non-clinical adolescent samples

Author, year of publishing and country	Sample size and age of subjects	Measures	Prevalence of alexithymia	Main findings
Rieffe et al. 2006 The Netherlands	N=740 11 to 13-year-olds	TAS-20* SCL Mood Questionnaire[6]	Not assessed	Alexithymia can be measured also in this age group using the TAS-20 scale.
Säkkinen et al. 2007 Finland	N=882 12 to 17-year-olds	TAS-20	All=15.9% Females=17.3% Males=14.6%	The TAS-20 scale is a psychometrically sound instrument to be used also in adolescent populations.
Joukamaa et al. 2007 Finland	N=6000 15 to 16-year-olds	TAS-20 Questionnaire on sociodemographic factors	Females=9.5% Males=6.9%	The prevalence of alexithymia in adolescents is similar compared with adults. However, no clear gender difference was noted. As in adults, alexithymia appears to be associated with poor social situation.
Honkalampi et al. 2009 Finland	N=7087 13 to 18-year-olds	TAS-20 YSR BDI AUDIT	All=7.3% Females=9.4% Males=4.9%	Alexithymia in adolescents is associated with several mental problem symptoms and difficulties in social relationships.

N = number of subjects, TAS-20 = 20-item Toronto Alexithymia Scale[1], SCL = Somatic Complaints List[2], YSR = Youth Self-Report[3], BDI = Beck Depression Inventory[4], AUDIT = The Alcohol Use Disorders Identification Test[5]

*Rewritten items for children

[1]Bagby R, Parker J, Taylor G. The 20-item Toronto Alexithymia Scale, I: item selection and cross-validation of the factor structure. J Psychosom Res 1994a;38:23–32., Bagby R, Taylor G, Parker J. The 20-item Toronto Alexithymia Scale, II: convergent, discriminant and concurrent validity. J Psychosom Res 1994b;38:33–40.

[2,6]Rieffe C, Meerum Terwogt M, Bosch JD. Emotie-identificatie en rapportage lichamelijke klachten bij kinderen. Kind en Adolescent 2002;23:154–169.

[3]Achenbach TM. Manual for Youth Self-Report and 1991 profile. Burlington, VT: University of Vermont Department of Psychiatry 1991.

[4] Beck AT, Beck RW. Screening depressed patients in family practice. A rapid technic. Postgrad Med 1972;52:81–85.

[5]Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption. II. Addiction 1993;88:791–804.

As regards the developmental factors possibly linked with alexithymia, one interesting aspect is speech development. It has been found that alexithymic individuals are by no means completely unaware of their emotions, and even appear to possess adequate vocabulary for expressing their emotions but lack the ability to label or verbalize them properly (Irwin & Melbin-Helberg 1997, Taylor et al. 1997b). Alexithymic individuals and individuals with impaired speech development are often short of adequate communication and regulation skills on an emotional level, which results in analogical difficulties in social situations and relationships (Craig & Washington 1993, Brinton & Fujiki 1999, Way et al. 2007). One factor in this regard probably is that both groups often experience difficulties interpreting emotional vocal and facial cues (Kano et al. 2003, Timler 2003, Spackman et al. 2005).

In adult populations, a vast amount of studies suggest alexithymia to be significantly associated with several somatic diseases and mental disturbances (Mattila 2009). Although alexithymia has been proven to be a significant phenomenon also in adolescents, with approximately the same prevalence as in adults, up to date there are only few studies evaluating these associations in adolescents, particularly in non-clinical, population drawn samples. Therefore, one aim of the present study was to increase the knowledge on the association of alexithymia with mental disorders among adolescents. As described above, different hypotheses on the aetiology of alexithymia have been suggested, but in most studies, the assessment is limited by recall bias. In the present study, by using the records from the child welfare centre check-ups at the age of five years, it was possible to assess the role of developmental factors in association with alexithymia.

2. REVIEW OF THE LITERATURE

2.1 The concept of alexithymia

The concept of alexithymia was coined by psychiatrist Peter Sifneos to describe the lack of emotional skills in psychosomatic patients (Sifneos 1973). Alexithymia signifies a personality construct typically represented by reduced ability to identify and verbalize feelings, a less vivid imagination, and an externally oriented, concrete way of thinking. Literally, alexithymia stands for "no words for feelings" and is a neologism based on three Greek words: *a* = 'lack', *lexis* = 'word', and *thumos* = 'emotion or mood'.

The history of psychosomatic disorders is strongly intertwined with the psychoanalytic tradition. Freud introduced the term "conversion hysteria", in which intolerable internal psychological distress and anxiety resulted in somatic symptoms (Breuer & Freud 1895, Gottlieb 2003). In the mid-1900s, on the basis of, for example, Alexander (1943), the following seven illnesses were classified as psychosomatic: bronchial asthma, Graves' disease, essential hypertension, peptic duodenal ulcer, regional enteritis, rheumatoid arthritis, and ulcerative colitis. However, the aspiration to explain the specific psychodynamic conflict characterizing the individuals suffering from these psychosomatic illnesses led to the rise of the mind-body dilemma and to the subsequent widening of the concept of psychosomatic illness (Halliday 1948).

The mind-body dilemma became to be of great interest in the psychoanalytic tradition. Based on his work among psychosomatic patients, Ruesch (1948) described them as having "infantile personality", that is, that these patients were immature in terms of lacking self-expression. The excessive tension without adequate expression was suggested to result in chronic tension and, thus,

in psychosomatic illnesses. MacLean (1949) introduced the term "visceral brain" to describe the tendency of individuals with psychosomatic illnesses to lack of capability of identifying and verbalizing their feelings, instead, they communicate in a sort of an "organic language". The concrete, pragmatic way of thinking observed in many physically ill patients also led Marty and M'Uzan of the famous Paris Psychoanalytical Society to introduce the term "*pensée operatoire*" ('operative thinking') in the 1960s (Marty and Debray 1989). Later on, however, they preferred to use the term "*vie operatoire*" ('operative life') to better describe the comprehensive nature of this state in psychosomatic patients.

Before introducing the term "alexithymia", Sifneos had, with his colleague Nemiah, published an analysis of interviews with patients suffering from psychosomatic illnesses. They outlined the core characteristics of these patients to be unawareness of emotions or incapability of verbalizing the feelings they were experiencing, poor fantasy life, and a detailed recounting of their own actions and events in their environment (Nemiah & Sifneos 1970). Based on these studies, the alexithymia construct was thought to be a common personality pattern for psychosomatic patients. Sifneos was interested in finding new ways of treating these patients, because there often was a lack of response for psychodynamic psychotherapy.

In the 1980s, McDougall developed further the psychological explanations of alexithymia, associating it with certain disturbances in the mother-infant-relationship. She stated that, since infants are unable to identify or verbalize their emotions, they have to be comprehended to be alexithymic. She introduced the term "disaffectation" to represent psychogenic alexithymia, developed on the basis of some overwhelming emotion at some point that has attacked strongly the individual's sense of integrity and identity, and thus, led to rejecting all emotions from consciousness (McDougall 1989). Accordingly, alexithymic features can be understood as an

arrested and infantile psychic structure influenced by early neglect, inadequate bonding, or the incapability of the caretaker to recognize or distinguish the emotional expressions of the child.

The concepts of "primary" and "secondary" alexithymia were introduced by Freyberger (1977), defining primary alexithymia as a disposition factor and secondary alexithymia as a defence mechanism. Krystal (1982) further suggested that an individual may develop alexithymia in response to extreme stress in order to avoid experiencing a painful affect. The hypothesis is supported by several studies (Shipko et al. 1983, Zeitlin et al. 1993). There are studies suggesting that the level of alexithymia is reduced along with the alleviation of depression symptoms (De Groot et al. 1995, Honkalampi et al. 2000a), but on the other hand, an increasing amount of evidence speaks for the idea that alexithymia is rather a stable personality trait (Salminen et al. 2006, de Timary et al. 2008). Recently, Lumley et al. (2007) have suggested that, alexithymia is a complex manifestation which includes both "trait" and "state" components. The trait-type alexithymia could be explained as a result of deficient psychological development and state-type alexithymia as a reactive regression of emotional development against overwhelming affects in the form of trauma or severe psychiatric illness.

According to the contemporary understanding, alexithymia should be comprehended as a construct with a wide spectrum and varying degree of difficulty, rather than simply a construct that either exists or does not exist. It is also essential to emphasize that individuals with alexithymia are not totally unaware of their feelings or completely unable to express them verbally, although, for them, emotions are often poorly differentiated and therefore difficult to identify or verbalize (Taylor et al. 1997b). Alexithymic individuals are indeed capable of suffering from, for example, depression or anxiety disorders and actually, as presented later, in several studies have shown higher prevalence regarding these disorders.

After almost four decades of studies on alexithymia, the concept still remains somewhat unclear. However, the principal goal of the alexithymia research is the same as Sifneos had when introducing the concept in the first place: investigating alexithymia and further sharpening the picture of the concept is the hope to improve the treatment of alexithymic individuals and the disorders they may possess.

2.2 Aetiology of alexithymia

Since the introduction of the concept, over 1,300 original articles have been published on alexithymia. Despite the substantial amount of research, it is still inadequately understood, how and why alexithymic features develop in an individual. Several theories have been suggested regarding the development of alexithymia, but none of them has been reliably verified. The theories regarding the background and aetiology of alexithymia are mostly based on a psychosocial or neurobiological approach. Future research will probably give essential information regarding the question whether, these theories can be combined into one systemic theory explaining why children who possess a certain neurological predisposition and are exposed to parental neglect or otherwise pathological environment, develop alexithymic features in adolescence or adulthood (Kooiman et al. 2002, Taylor & Bagby 2004).

The feasibility of measuring alexithymia in children and adolescents was doubted for a long time, but current research suggests that alexithymia can be observed and measured also in these developmental phases (Fukunishi et al. 1998, Rieffe et al. 2006). Rieffe et al. (2006) studied a sample (n = 740) of children and adolescents (aged 9 to 15 years) and concluded that the core features of alexithymia – difficulty in identifying emotions and describing them – can be identified

in childhood, although the method of measurement has to be simpler than in adults. Children typically present psychosomatic symptoms when facing anxiety-provoking circumstances, such as bullying or quarrelsome atmosphere at home (Nemzer 1996). In terms of normal development of emotion regulation in childhood, it is the later development of cognitive capacity and abstract thinking that facilitates the proper identification and expression of emotions associated with the anxiety-provoking situation.

However, the research in this area is quite scarce and partly controversial. Recently, Jellesma et al. (2009) compared a group of children (n = 35, mean age 11 years) with numerous somatic complaints with a group that presented only few somatic complaints (n = 34, mean age 11 years), but did not find support for the hypothesis that children with a larger number of somatic complaints would present more alexithymic features. Nevertheless, given that alexithymic features are, to some extent, normal in childhood, the question is, whether these infantile features simply persist in alexithymic individuals through adolescence and adulthood or if they actually develop *de novo* in certain specific phase or circumstances.

2.2.1 Genetic theories

The genetic background of alexithymia has been studied surprisingly scarcely. The inheritance of alexithymic characteristics was first suggested in a Norwegian twin-study in the 1970s (Heiberg & Heiberg 1977), but the method they used to measure alexithymia cannot be considered appropriate according to the current standards. However, only few studies on the subject have been published since. Valera and Berenbaum (2001) studied 45 monozygotic and 32 same-gender dizygotic twin pairs and found that of the alexithymic features, external oriented thinking was associated with genetic factors, whereas the difficulty identifying emotions and difficulty describing them were influenced by shared environmental factors. Jørgensen et al. (2007) studied a very large population

sample of 8,785 twin pairs, and the results suggested that genetic factors have a significant impact on all facets of alexithymia. Up to date, two gene studies have been conducted on alexithymia (Ham et al. 2005, Walter et al. 2010). Ham et al. (2005) found a possible association between alexithymia and the catechol-O-methyltransferase (COMT) Val108/158Met gene polymorphism. It is noteworthy that the COMT pathway is very active in the frontal lobe functioning. Recently, Walter et al. (2010) published a study, in which they found functional variants of the brain-derived neurotrophic factor (BDNF) and DRD2/ANKK1 gene polymorphism to be associated with alexithymia. This is suggested to be related with the reduced activation of the ACC. The link between the ACC and alexithymia is discussed further in the following chapter.

2.2.2 Neurobiological factors associated with alexithymia

Modern brain imaging technologies, such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), have led to an increasing amount of knowledge on the parts of the CNS associated with emotion regulation. The frontal lobe and limbic system, in particular, are associated with emotion regulation, which is portrayed by, for example, numerous studies reporting on damages to the frontal lobes and the resulting blunted emotional experiences and impaired control over emotional expression (Paradiso et al. 1999, Hornak et al. 2003). In adolescence, the development of higher cognitive functions is associated with significant changes in the central nervous system (Paus et al. 2008). In alexithymia research, the main interest has been focused on the regions of the CNS connected with emotion regulation.

“Split brain” is a term that stands for the result of cerebral commissurotomy, that is, when the corpus callosum connecting the brain hemispheres is cleaved either completely or partially, resulting in reduced transfer between the two brain hemispheres. Already in the 1970s, split-brain patients were found to possess alexithymic features and this association has been of interest since

then (TenHouten et al. 1986). These patients were reported to use fewer words to describe their emotions, their verbal expressions were flat and their fantasy life bland, in other words, their symptoms were very similar to the characteristics of severe alexithymia (TenHouten et al. 1986, Hoppe & Kyle 1990). This led the researchers to hypothesize if alexithymia actually manifests a deficit in the interhemispheric transfer. However, it must be borne in mind that in the above-mentioned studies the commissurotomy was conducted as a treatment for epilepsy and the significance of this illness regarding the alexithymic features in the patients was not assessed. At least in males, the hypothesis is supported by later studies (Parker et al. 1999, Lumley & Sielky 2000). On the other hand, later studies are a bit discordant on this issue, some suggesting that the association with alexithymia is based on facilitated transcallosal inhibition (Grabe et al. 2004) or reduced transcallosal inhibition (Romei et al. 2008).

Hemispheric lateralisation has also been of interest in alexithymia studies. Functional asymmetry of the hemispheres has been associated with alexithymia or lower emotional awareness in several studies (Parker et al. 1992, Jessimer & Markham 1997, Lumley & Sielky 2000, Kano et al. 2003). In all of the above-mentioned studies, the left hemisphere appeared to be dominant in alexithymic individuals. Interestingly, in one study among abstinent cocaine abusers, the activity of the right hemisphere was associated with alexithymia (Li & Sinha 2005). In studies made among individuals with a head injury, a traumatic injury of the right hemisphere has been associated with impairment of perception of facial emotion (Cicero et al. 1999, Mandal et al. 1999).

Amygdala is a nucleus in the limbic system, which is essential in recognition of facial expression and processing of emotional stimuli. Lower activity in the processing of facial emotion has been associated with alexithymia (Kugel et al. 2008). In fact, in alexithymic individuals, several anatomical and functional aberrations in the parts of CNS involved in emotion regulation have been

reported. These aberrations have been observed particularly in the ACC, in which abnormal function has been reported, for example, when perceiving facial expression or stimulating different emotional states (Lane et al. 1997, Kano et al. 2003, Karlsson et al. 2008, McRae et al. 2008). A significant finding in the study of Karlsson et al. (2008) was that the motor and somatosensoric cortices were more active in alexithymic individuals when processing emotional stimuli, which may be associated with the higher susceptibility of alexithymic individuals for somatisation (Karlsson et al. 2008).

2.2.3 Socio-demographic factors associated with alexithymia

In population studies, several socio-demographic factors have been associated with alexithymia. Low educational level and low socio-economical status have been repeatedly associated with alexithymia (Salminen et al. 1999, Franz et al. 2008). Several environmental factors are also connected with alexithymia, such as mother's low educational level, parents' divorce, and living in a rural area (Horton et al. 1992). In a prospective study, Joukamaa et al. (2003) found that alexithymia in young adulthood was more common in individuals coming from rural dwelling areas and it was also associated with being an unwanted child or being born into a family with many children. It has been shown that there is more psychopathology in families of alexithymic individuals during their childhood, and the mother's alexithymia has been established to be related with a child's alexithymic features (Lumley et al. 1996).

2.2.3.1 Alexithymia and parenting

One of the earliest means for an infant to perceive the surrounding environment is to interpret facial expressions of other people. If the parents express their emotions in an abnormal way, the infant is suggested to be exposed to developing a deficiency in recognizing facial expressions. The

development of emotion regulation can be hindered in several ways. Parents may teach the child impractical means of emotional regulation through their own example, or the parents may insufficiently identify and entitle the emotions the child is expressing, or the family's negative emotional atmosphere may alter this by itself (Morris et al. 2007). Previous research indicates that the development of emotion regulation may be impaired due to inadequate parenting, thus having an impact on the development of alexithymia (Taylor et al. 1997a, Picardi et al. 2005a,). Lumley et al. (1996) studied a sample of young adults and their mothers, and found an association between alexithymic features and general family pathology. The alexithymic features in the young adults were also significantly correlated with their mothers' alexithymia. In a study by Honkalampi et al. (2004a), alexithymia was associated with childhood adversities, most prominently harsh discipline and unhappiness of the childhood home. De Panfilis et al. (2008) found an association between altered parental bonding, particularly where the mother was overly intrusive and protective, and the core alexithymic feature of difficulty describing feelings. In a Turkish study among male substance-dependent inpatients, history of childhood emotional abuse was found to be the only determinant for alexithymia (Evren et al. 2009). Also, on the basis of self-report material, if one parent is neglecting the child, the other parent's optimal parenting style appears to protect the child from the development of alexithymia (Kooiman et al. 2004).

There are few studies using the Parental Bonding Instrument (PBI) for measurement of experienced parental care and overprotection during the period of growing up. Fukunishi et al. (1997) studied two samples of college students and found low maternal care to be correlated with alexithymic features, and this association was attributed mainly to the difficulty to describe feelings. Mason et al. (2005) found a negative correlation between experienced parental care and alexithymic characteristics, particularly the difficulty to identify and verbalize emotions. However, the results were based mainly on correlations and the study design did not allow the assessment of the possible

impact of, for example, socio-demographic factors on this relation (Mason et al. 2005). On the other hand, there are also studies ending up finding no relation in this regard. Kooiman et al. (1998) found practically no association between perceived parental care and alexithymia. In a sample of psychiatric outpatients, associations were established between overprotective father and alexithymic features. The association mainly concerned difficulty in identifying feelings, but being somewhat weak, the observed associations between parental attitudes and alexithymic features led the authors to question whether individuals who indeed are victims of parental neglect, are suitable persons to be studied with self-report instruments, as they may resort to primitive defence mechanisms, such as splitting and idealizing (Kooiman et al. 1998).

Since the studies are almost invariably cross-sectional, it is difficult to establish whether lacking parental bonding has influenced the development of alexithymia or, in contrast, if the primary alexithymic features possessed by the child have affected the child-parent relationship negatively. As stated above, the risk for recall bias is obvious, especially when assessing the experiences during the early years. Therefore, it is difficult to assess causality on the basis of these studies.

2.2.3.2 Alexithymia and social support

The causal relationship between alexithymia and low social support is still quite unclear. On one hand, alexithymic features may reduce social support by hindering the building of relationships through lack of emotional recognition and expression. On the other hand, alexithymic individuals may not be able to utilize social support adequately because they neither recognize the others' emotions nor respond to them appropriately (Kojima et al. 2003). Research in this area is relatively scarce. Fukunishi et al. (1995) found alexithymia to be associated with low social support and poor response to stress. Posse et al. (2002) studied a sample of 1,032 females and assessed the

relationships between alexithymia, social stress, and mental health. A clear difference was observed between alexithymic and non-alexithymic individuals regarding the experienced level of social support; having a low level of social support was 3.5 times more common in alexithymic than in non-alexithymic individuals. Additionally, alexithymic individuals with low social support and without any (stressful) life events were significantly worse off in terms of mental health (Posse et al. 2002).

2.2.4 Speech development and alexithymia

Children learn to speak through a complex process which involves different aspects of development. On the basis of studies published up to date, the idea that children would learn a language solely from the language they are exposed to in their environment has been invalidated, and it is evident that fundamental linguistic skills are not only learnt but they are also to some extent inherited (MacWhinney 2004, Ramscar & Yarlett 2007). From a developmental point of view, the first words representing emotions usually emerge at the age of two years (Bretherton & Beeghly 1982). By school age, children have learnt to differentiate certain basic emotions, such as happiness, sadness, and anger, and at this age, children are also able to describe their emotions in simple words, discuss the reasons that cause them, and verbally provoke certain emotions in others (Bretherton & Beeghly 1982, Dunn et al. 1991).

As discussed previously, alexithymic individuals are not totally unaware of their feelings, although the feelings are poorly differentiated (Taylor et al. 1997b). They also appear to possess adequate vocabulary for their feelings, but lack the ability to identify or verbalize them properly (Irwin & Melbin-Helberg 1997, Taylor et al. 1997b). A recent study assessed the significance of receptive language skills regarding later psychosocial outcome and mental health in adulthood (Schoon et al. 2010). Poor language skills at the age of five years predicted a significantly lower level of adult

mental health and psychosocial adjustment. Interestingly, already in childhood, impaired speech development appears to result in similar difficulties as are related with alexithymic features (Way et al. 2007). In parallel to alexithymic individuals, children with impaired speech development often struggle in various social situations and, owing to their lacking communication and regulation skills on an emotional level, it is difficult for them to bond deep and gratifying relationships with the peers (Craig & Washington 1993, Brinton & Fujiki 1999). This is assumed to be related with the fact that children with impaired speech development experience difficulties interpreting emotional vocal and facial cues (Timler 2003, Spackman et al. 2005). Likewise, there is evidence suggesting that individuals with alexithymia process facial expressions differently from people without alexithymia (Kano et al. 2003).

However, the association between alexithymia and speech development has been scarcely studied. Kokkonen et al. (2003) studied, in a prospective setting, the association between the ability to speak at the age of one and with adulthood alexithymia. Children were classified in three groups according to whether they spoke no words, one or two words, or three or more words at the age of one year, and it was found that, those who spoke at least one word had significantly less commonly alexithymia 30 years later in adulthood. Lagging speech development was mainly associated with externally oriented thinking (Kokkonen et al. 2003). To what extent impaired speech development is associated with alexithymia remains for the time being an open question.

2.3 Measuring alexithymia

The scarcity of prospective studies concerning alexithymia is partly explained by practical reasons: no reliable methods for measuring alexithymia were available until the 1990s. In the early days of alexithymia research, several methods, including the Beth Israel Hospital Psychosomatic

Questionnaire (Sifneos 1973) and Schalling-Sifneos Personality Scale (Apfel & Sifneos 1979), were used to measure alexithymia. However, the validity of these methods has later proven to be poor (Gardos et al. 1984, Bagby et al. 1988). In the 1980s, a Toronto-based group of researchers began to develop, on the basis of a careful psychometric analysis, a new instrument for measuring alexithymia, the Toronto Alexithymia Scale (TAS). Its first version, the TAS-26 scale, comprised twenty-six items. The third version, the TAS-20, is a twenty-item self-report questionnaire that no longer includes the factor measuring reduced daydreaming. The TAS-20 scale has become the standard in alexithymia research (Bagby et al. 1994a, 1994b). The scale consists of three subscales: Difficulty Identifying Feelings (DIF), Difficulty Describing Feelings (DDF) and Externally Oriented Thinking (EOT).

The psychometric properties of the global TAS-20 scale have proven good in all of the over 20 different language versions, including Finnish (Bagby et al. 1994a, 1994b, Joukamaa et al. 2001, Parker et al. 2003, Taylor et al. 2003). The Finnish version of the scale has recently been validated in two separate and representative adolescent population samples (Joukamaa et al. 2007, Säkkinen et al. 2007). On the basis of these studies, the TAS-20 appears to be a valid measure for alexithymia in adults and adolescents alike. This is also supported by Rieffe et al. (2006), suggesting that the core characteristics of alexithymia are identifiable already in childhood. However, in a recent study by Parker et al. (2010) the psychometric properties of the TAS-20 scale in younger adolescents were questioned. The authors suggested much of this to be associated with difficulties in reading the scale.

The validity of the DIF and DDF subscales has been shown to be good, whereas the validity of the EOT subscale is only moderate (Bagby et al. 1994a, 1994b, Parker et al. 2003, Taylor et al. 2003). The lower validity of the EOT subscale and its partly weak correlation with the other two subscales

have induced criticism regarding the subscales. Additionally, TAS-20 does not at all include one of the core characteristics of alexithymia, namely, the limited imagination (Kooiman et al. 2002). Since the labelling and describing of emotions is difficult for alexithymic individuals, by definition, their ability to adequately assess their personality characteristics and thus to provide reliable answers in self-report instruments has been questioned (Lane et al. 1996, Kupfer et al. 2000).

To improve the diagnostic accuracy of alexithymia, several other methods of measuring alexithymia have been developed, including both self-report questionnaires and rating scales. The most notable of these are the Bermond-Vorst Alexithymia Questionnaire (BVAQ) (Vorst & Bermond 2001), California Q-Set Alexithymia Prototype (CAQ-AP) (Haviland & Reise 1996), and Observer Alexithymia Scale (Haviland et al. 2000). The BVAQ is a self-report measure based on an earlier version called the Amsterdam Alexithymia Scale. It consists of two parallel versions, a 20-item and a 40-item version, and the scale appears to be a psychometrically sound instrument, correlating well with the TAS-20 scale (Berthoz et al. 2007, Verissimo & Bermond 2009). Developed by Haviland and Reise (1996), the CAQ-AP is a rating scale based on an earlier 100-item California Q-Set. The Observer Alexithymia Scale is a shorter, 33-item rating scale (Haviland et al. 2000). However, the results concerning its the appropriateness and validity are somewhat discordant (Berthoz et al. 2007, Meganck et al. 2010).

The most promising of the newer methods of measuring alexithymia seems to be the Toronto Structured Interview for Alexithymia (TSIA) (Bagby et al. 2006), which was developed by the same research group as the TAS-20 scale. It is a semi-structured interview method and it has been shown to correlate well with the TAS-20 scale (Bagby et al. 2006) and its reliability and validity appear to be good (Grabe et al. 2009). Due to its swiftness and clarity, the TAS-20 scale continues to be highly applicable, particularly for studying larger samples and none of the newer measures has been

able to receive similar footing in alexithymia research. However, the rating scale and interview methods allow a possibility for a multi-methodological approach to assess alexithymia especially in smaller samples.

2.4 Epidemiology of alexithymia

In Finland, population studies concerning alexithymia have been carried out since the late 1990s. The first Finnish study on the prevalence of alexithymia in general population was conducted by Salminen et al. (1999). In the sample drawn from the general population (n = 1,285), the prevalence of alexithymia was 12.8% with normal distribution. Men were found to be clearly more frequently alexithymic as compared with women; the prevalence of alexithymia was 16.6% in males and 9.6% in females. As soon as the following year, the prevalence of alexithymia was assessed in a study involving slightly larger Finnish adult population (n = 2,018), where 10.3% of the sample were classified as alexithymic (Honkalampi et al. 2000b). Also in this study, the prevalence of alexithymia was higher among men (12.8%) than in women (8.2%). The observed difference in the frequency of alexithymia between genders was supported by the findings of Kokkonen et al. (2001) the following year. They published a large cohort study (n = 5,028) among young adults, in which the prevalence of alexithymia was 9.4% in males and 5.2% in females. In a general population sample representing Finnish inhabitants aged 30 years and older, Mattila et al. (2006) found the prevalence of alexithymia to be 9.9% in all subjects, 11.9% in males and 8.1% in females.

Prevalence studies with population samples have also been carried out in Germany and Japan. Franz et al. (2008) studied the prevalence of alexithymia in German general population (n = 1,859) and reported a 10% prevalence of alexithymia in all subjects, 11.1% in males and 8.9% in females. No

significant difference between genders was noted in either the prevalence of alexithymia or the TAS-20 total scores. Neither did Moriguchi et al. (2007) find any gender difference in the TAS-20 total scores in a normative community sample (n = 2,718) of 14 to 84-year-olds.

In a population sample of 72-year-olds, Joukamaa et al. (1996) found the prevalence of alexithymia to be as high as 34%, but the results are not fully comparable with later studies as in this study alexithymia was measured using the TAS-26 scale. Lane et al. (1998) also suggested alexithymia to be associated with older age. Mattila et al. (2006) measured the prevalence of alexithymia in a sample representing a wide age range (30 to 97-year-olds) and also they found that alexithymia was more common in older subjects. However, there are also discordant results in this respect; in a random population sample and using TAS-26 scale, Gunzelmann et al. (2002) found no difference in the prevalence of alexithymia between the age groups of over and under 60 years. In a Japanese population study among 14 to 84-year-old subjects, alexithymic features appeared to decrease from middle adolescence to the 30s, after which the prevalence of alexithymia did not change significantly along with the age (Moriguchi et al. 2007).

To summarize, according to the population studies in different countries, the prevalence of alexithymia in adult population is approximately 10% and appears to be, to some extent, more common in males. The fact that the population studies of alexithymia have mostly been carried out in Finland poses one central problem; it is not possible to make reliable comparisons between populations in different countries. Various aspects, for example, culture, history, and socio-economical circumstances are quite distinctive for each nation and inevitably have an impact on the way populations have developed in each country. For example, times of war or recession have affected the lives of certain generations which may be reflected in the prevalence of alexithymia on a population level. These factors must be considered in assessing the generational differences in the

prevalence of alexithymia and, for the purposes of reliable comparisons between countries, more population studies are needed.

2.4.1 Alexithymia in adolescents

Already almost two decades ago, Horton et al. (1992) published a study on the prevalence of alexithymia in 264 adolescents. They reported a frequency of 23.5 % for alexithymia, but contrary to the later studies in adult populations, the frequency was higher in females (29 %) than in males (18%). In a Finnish population study 15 years later, Säkkinen et al. (2007) assessed alexithymia in a sample of 12 to 17-year-old adolescents (n = 882). The prevalence of alexithymia was 15.9% in all subjects, 14.6% in males and 17.3% in females, but the gender difference was not statistically significant. Similarly, in a cohort study in Finnish adolescents (n = 6,000), the prevalence of alexithymia was higher in females (9.5%) than in males (6.9%), but the mean TAS-20 total score was higher among males than females (Joukamaa et al. 2007). When comparing these two Finnish studies, it must be pointed out that the study of Joukamaa et al. (2007) is based on a birth cohort sample and thus, the age range is narrower (15 to 16-year-olds). The wider age range may be the reason for the notably higher prevalence of alexithymia in the study of Säkkinen et al. (2007). This is further supported by the previous cohort study in young adults aged 31 years (Kokkonen et al. 2001), in which the prevalence was 9.4%, in other words, quite comparable to the study of Joukamaa et al. (2007).

Honkalampi et al. (2009) studied alexithymia in another cohort sample of 13 to 18-year-old adolescents (n = 7087), in which the prevalence of alexithymia was 7.3% in all subjects; 4.9% in males and 9.4% in females. The prevalence was higher in females in all age groups. However, no significant gender difference regarding the TAS-20 total score was observed in this study either. As a whole, the prevalence of alexithymia appeared to be higher in the younger age groups than in late

adolescents. Interestingly, this is the case also in the study of Säkkinen et al. (2007), who found a significant difference in the prevalence of alexithymia between the youngest (12 to 13-year-olds) and oldest (15 to 17-year-olds) groups.

As discussed above in connection with the aetiology of alexithymia, alexithymic features are, to some extent, normal in childhood, wherefore it is understandable that younger adolescents are "by nature" are more alexithymic than older adolescents. In this regard, age and the developmental phase have a major impact on the prevalence of alexithymia in adolescents. On the basis of literature published up to date, the overall prevalence of alexithymia appears to prevail at the same level as a whole, but it is unsure if there is a genuine difference between the genders regarding the prevalence of alexithymia. Unlike adults, adolescent males have not been found to be more alexithymic than females. Research is needed before any firm conclusions can be drawn in this respect. One possible element is the pronounced changes in the hormonal levels during adolescence and their undisputed impact on the development of the central nervous system (Sisk & Foster 2004). Since there are clear gender differences in the timing of central nervous system maturation, it is very likely to also have an impact on the prevalence of alexithymia.

2.5 Alexithymia and mental disorders in adolescents

2.5.1 Alexithymia and depression

There is a significant amount of evidence suggesting an association between alexithymia and various mental disorders in adult population (Mattila 2009). In this regard, the association with depression is probably the most widely studied. Several studies among adults report on an association between alexithymia and depressive symptoms both in different patient groups suffering

from depression (Honkalampi et al. 1999) and in general population (Honkalampi et al. 2000b, Le et al. 2007). However, causation has been difficult to establish. In a sample of pregnant women with major depression, Marchesi et al. (2008) found that alexithymia appeared not to represent a personality trait that increases the risk of a depressive episode, instead, their results rather supported the hypothesis that alexithymia is a state-dependent phenomenon. In a recent prospective population-based study by Honkalampi et al. (2010), alexithymic features did not predict the diagnosis of a major depressive disorder, a personality disorder, or alcohol use disorders. The fact that alexithymia was closely linked with concurrent depressive symptoms, led the authors to ask if depressive symptoms act as a mediator between alexithymia and psychiatric morbidity.

Depression is very likely to emerge the first time during adolescence, and hence, it is probable that alexithymia is associated with depressive symptoms in the youth as well. However, there are only few representative studies published that assess the association in this age group. In a 1-year longitudinal study, poor emotion identification skills have been found to be related with depression, along with anxiety and somatic illnesses (Ciarrochi et al. 2008). Likewise, in a large sample (n = 7,087) of Finnish 13 to 18-year-old adolescents, alexithymia was found to be associated with depressive symptoms (Honkalampi et al. 2009).

Alexithymia has also been studied in association with suicidality. According to the available studies, alexithymia appears not to be an independent risk factor for suicidality, but rather, suicidality is primarily related with depressive symptoms, which correlate with alexithymic features (Taiminen et al. 1996, Sayar et al. 2003, Hintikka et al. 2004). However, in a 12-month follow-up study in general population, alexithymic features were found to have an additive impact on the risk of suicidal ideation (Hintikka et al. 2004). Alexithymia and suicidality have not been studied in adolescents, but in their recent study among secondary school students in New Zealand, Garisch et

al. (2010) reported that certain stressors in the social environment, such as bullying, are more likely to induce deliberate self-harm if the adolescent is experiencing mood difficulties and has poor emotion regulation and communication skills.

2.5.2 Alexithymia and anxiety

In several studies among adult populations, alexithymia has been associated with anxiety disorders, such as post-traumatic stress disorder (Kupchik et al. 2007), panic disorder (Marchesi et al. 2005), social anxiety disorder (Turk et al. 2005), and generalized anxiety disorder (Turk et al. 2005), but the causation is still somewhat unclear. It has been presented that individuals with alexithymic features are more susceptible to anxiety (Devine et al. 1999). Berthoz et al. (1999) suggested that alexithymia is influenced by anxiety directly, whereas the influence of depression would be indirect and mediated through anxiety (Berthoz et al. 1999). It has also been suggested that anxiety sensitive individuals may repress their emotions to avoid experiencing uncomfortable anxiety-related bodily sensations (Marchesi et al. 2005). However, it has also been hypothesized that, depression or anxiety could result in reactive regression of emotional development and thus evoke alexithymic features (Honkalampi et al. 2000a), which, as stated previously, can be comprehended as an infantile psychic structure. Nevertheless, associations between alexithymia and anxiety disorders have been scarcely studied among adolescents. Burba et al. (2006) studied a sample of 12 to 17-year-old adolescents with persistent somatoform pain disorder and found that adolescents with this disorder had higher levels of alexithymia and anxiety in comparison with the healthy controls of matching age, but the groups did not differ significantly in terms of depressive symptoms.

2.5.3 Alexithymia and eating disorders

Eating disorders (ED) constitute a challenging group of mental disorders that is associated with a wide range of psychiatric and somatic problems and increased mortality (Schmidt et al. 1993, Berkman et al. 2007). EDs can potentially lower the patient's quality of life to a considerable extent and even lead to premature death (Taylor et al. 1996, De Berardis et al. 2007). Like several other mental disorders (Paus et al. 2008), EDs emerge typically in adolescence (Fairburn & Harrison 2003). The association between alexithymia and EDs has been studied mostly in different patient samples among adults. It has been shown in a number of studies that alexithymic features have a higher prevalence in patients with anorexia nervosa (Cochrane et al. 1993, Schmidt et al. 1993), and this appears to be the case also in adolescents (Zonnevylle-Bender et al. 2002). Indeed, the prevalence of alexithymia is suggested to be within the same range in adolescent as in adult patients with anorexia nervosa (Zonnevylle-Bender et al. 2004).

According to previous research, bulimia nervosa and binge-eating disorder patients also possess abundantly alexithymic features (Cochrane et al. 1993, de Groot et al. 1995, Pinaquy et al. 2003). As compared with anorexia nervosa, bulimic and binge-eating symptoms have been studied slightly more widely also in non-clinical samples (van Strien et al. 2007, Hayaki 2009). In their study among non-clinical undergraduate women, De Berardis et al. (2007) found that a higher risk for ED symptoms was mostly associated with two core alexithymic features, namely the difficulties identifying and verbalizing emotions.

It has been suggested that, at least partly, the association between alexithymia and binge eating is related to insufficient means to modulate negative affect and the emotional relief provided by eating (Whiteside et al. 2007). Since a growing amount of evidence indicates that alexithymia may have an effect on the development of EDs (Taylor et al. 1996, De Berardis et al. 2007, Fassino et al. 2007),

a more profound understanding of this association and early recognition of alexithymia may open new ED treatment approaches. Alexithymia may also act as a negative prognostic factor for the outcome of eating disorders (Speranza et al. 2007) and therefore the identification of alexithymia in ED patients is highly important. Treatment strategies for alexithymic ED patients should encourage identification and expression of emotions (Speranza et al. 2007) with particular attention given to aggression, due to its often self-destructive character in ED patients (Fassino et al. 2007).

2.5.4 Alexithymia and other mental disorders

In previous studies, alexithymia has also been associated with substance misuse (Speranza et al. 2004) and most notably with alcohol misuse; approximately half of the patients with alcohol use disorders are suggested to be alexithymic (Loas et al. 1997, Evren et al. 2008, 2009). However, causation has not been established in this respect, and it is unclear whether alcohol use disorders in some way promote the emergence of alexithymic features or whether alexithymia itself exposes individuals to higher alcohol consumption. One explanation has been that, due to their lacking social skills, alexithymic individuals are susceptible to feel uncomfortable in social situations and thus, may use alcohol as a coping mechanism (Uzun et al. 2003). In any case, it remains unclear if alexithymic features expose individuals to alcohol misuse, and if so, what the relevant mechanisms are, so a better understanding on this subject is needed (Thorberg et al. 2009). For understandable reasons, alcohol use disorders – and their association with alexithymia – have been scarcely studied in the youth. However, there are some studies on other substance misuse in association with alexithymia. In one study, adolescent and young adult cannabis abusers have been found to possess more alexithymic features compared with controls (Dorard et al. 2008).

Alexithymia is suggested to be associated with personality disorders (Bach et al. 1994, Sexton et al. 1998, Rogstad & Rogers 2008). De Panfilis et al. (2008) studied a sample of 265 psychiatric

outpatients with a diagnosed personality disorder and found that an abnormal parental bonding in childhood may be a mediating factor between alexithymia and personality disorders. Overprotective mother, in particular, was suggested to have an impact on the development of alexithymic characteristics, most notably difficulty in verbalizing emotions. In another study by Picardi et al. (2005a), the same feature, namely, difficulty verbalizing emotions was associated with certain personality traits, denoting difficulty to be warm, cooperative, sensitive, and sociable. Thus, it is plausible that maternal overprotection, manifested as denial of psychological autonomy and obtrusiveness, may contribute to impairment in verbalizing emotions, which portrays the alexithymic feature of difficulty describing feelings.

Impairment in emotional processing has been observed in both early-onset and adolescence-onset conduct disorders (Fairchild et al. 2008), and there appear to be similarities on a neurobiological level between alexithymia and conduct disorders. In a sample of 9 to 14-year-old children with conduct disorders, Stadler et al. (2007) found that, in response to negative affective pictures, the subjects' ACC activated significantly less than it did in controls. This is interesting because similar findings have been made among alexithymic individuals (Lane et al. 1997, Karlsson et al. 2008). Moreover, the findings made on the structure and function of amygdala, show similarities between adolescents with conduct disorders and alexithymic individuals. Adolescents with conduct disorders present an aberrant amygdale structure and function when exposed to emotion-provoking stimuli, but the results concerning whether there is a reduced or enhanced function of amygdala in response to negative affective stimuli, are somewhat discordant probably due to the differences between an early-onset and adolescence-onset conduct disorder (Sterzer et al. 2005, Herpertz et al. 2008, Passamonti et al. 2010).

Impaired recognition and expression of feelings is also associated with disorders of the autism spectrum, and therefore, it is no surprise that in some studies a relation between autistic syndromes and alexithymia has been suggested. There appears to be some overlap in the aetiology of alexithymia and Asperger syndrome (Tani et al. 2004, Fitzgerald & Bellgrove 2006, Silani et al. 2008) and a higher prevalence of alexithymic features in the parents of children with autism spectrum disorders has been reported (Szatmari et al. 2008). However, alexithymia and Asperger syndrome are considered to be two different constructs, although it is possible that alexithymic features are an idiosyncratic trait in individuals with Asperger syndrome (Paula-Pérez et al. 2010).

Dissociation is suggested to be a coping mechanism for an individual to alleviate experiencing painful emotions, which, as stated previously, is also one of the hypotheses of alexithymia. In adults, an association between alexithymia and dissociation has been observed (Grabe et al. 2000). In adolescents, this association has been studied, up to date, in three studies, with one finding no relation (Sayar & Kose 2003) and two finding an association (Sayar et al. 2005, Tolmunen et al. 2010). Although there is some overlap between these two phenomena, they are considered to be separate constructs (Tolmunen et al. 2010), but the susceptibility of alexithymic individuals for dissociation may be elevated (Sayar et al. 2005).

2.5.5 Considerations on alexithymia and somatic illnesses

In adult population, alexithymia has been associated with a number of somatic illnesses, such as hypertension (Jula et al. 1999, Consoli et al. 2010, Grabe et al. 2010), diabetes mellitus (Topsever et al. 2006, Chatzi et al. 2009), psoriasis (Picardi et al. 2005b, Masmoudi et al. 2009), and asthma (Plaza et al. 2006, Vasquez et al. 2010). There are different hypotheses regarding how this connection is mediated, but none of them has been reliably verified. Several studies have suggested a deregulation in the autonomic nervous system to be related with alexithymia (Friedlander et al.

1997, Waller & Scheidt 2006), although there are also studies with discordant results in this regard (Franz et al. 2003, Connelly & Denney 2007). A variety of irregularities in the immunity system have been associated with alexithymia and certain aberrant immune responses have led to suggestions that alexithymic individuals may suffer from unnoticed chronic stress (Guilbaud et al. 2003). Over-activation of the hypothalamic-pituitary-adrenal (HPA) axis has also been suggested as the connection between alexithymia and somatic illnesses (van Middendorp et al. 2005). To summarize, on the basis of current research, it is likely that the impairment of emotion regulation causes varied alterations in the autonomic nervous and immune systems, thus contributing to the vulnerability for different kinds of somatic illnesses.

In adolescents, the associations between alexithymia and somatic illnesses have been assessed only in very few studies. In a study by Burba et al. (2006), adolescents with somatoform disorders were found to have higher levels of alexithymia compared with healthy controls. In a study on adolescents with chronic fatigue syndrome (CFS), alexithymia was not found to correlate with CFS or to be a prognostic factor for recovery of the CFS illness (Van de Putte et al. 2007). Bellinger (2008) hypothesized that children with congenital cardiac malformations have a higher risk for neurodevelopmental morbidities affecting social cognition and thus, also for alexithymic characteristics, such as impairment in identifying and verbalizing their own internal states. Meunier et al. (2008) studied Belgian families with, at least, one Type 1 diabetic child aged 6 to 18 years and found both maternal perception of family cohesiveness and maternal alexithymia to be predictors of glycaemic control in children and adolescents. During the follow-up period, maternal alexithymia predicted the number of hospitalizations for hyperglycaemia. The finding that parental alexithymia is associated with glycaemic control in children is supported by another recent study by Housiaux et al. (2010). Alexithymic features have also been associated with tension-type headache in a study in 8 to 15-year-old juveniles (Gatta et al. 2010).

It is noteworthy that alexithymic individuals often themselves assess their overall health to be poorer, as compared with non-alexithymic individuals. In two Finnish population studies by Honkalampi et al. (2000b, 2004b), alexithymia was associated with poor subjective health, and in the population study by Mattila et al. (2006), individuals with alexithymia rated their overall health being poor significantly more commonly than the non-alexithymic individuals did. Posse et al. (2002) also found a significant difference in the lack of well-being between the alexithymic and non-alexithymic subjects, with alexithymics being clearly worse off. The same finding has been made even in adolescents; in a study by Honkalampi et al. (2009), alexithymic youths aged 13 to 18 assessed their health relatively good less commonly than their non-alexithymic peers did.

2.5.6 Treatment of alexithymia

In adults, alexithymic characteristics have been shown to predict poorer outcome in a variety of disorders, including depression (Honkalampi et al. 2007), eating disorders (Speranza et al. 2007), and alcohol dependence (Loas et al. 1997). Since alexithymia is not a mental illness or a personality disorder *per se*, the research on the treatment of alexithymia has mainly focused on the assessment of such issues as to what extent alexithymic characteristics may impair the response to the treatment of the primary mental disorder, or if using a certain treatment method also alleviates alexithymic features. Alexithymia is assumed likely to respond poorly to psychological treatments (Lumley et al. 2007), but there are also studies suggesting that alexithymia does not weaken the compliance (Äärelä et al. 1997) or even outcome (Rufer et al. 2010) of these treatments. Rufer et al. (2010) treated a sample of panic disorder patients using cognitive-behavioural group therapy and found that – in addition to the fact that the outcome did not appear to be negatively affected by alexithymia – difficulty to identify and verbalize emotions were reduced following the treatment. Interestingly, also the previous studies successfully reducing alexithymic features involve in most

cases group-based therapies (Beresnevaite 2000, Grabe et al. 2008, Ogrodniczuk 2010). Up to date, treatment of alexithymia in adolescents has not been studied systemically. However, as in adults, the treatment outcome in different disorders is probably affected by alexithymic characteristics, wherefore they should be assessed preferably before starting the psychological treatment, but at the latest, if the outcome is not the expected.

2.6 Summary of the reviewed literature

Based on various frames of references, there exist different hypotheses regarding the aetiology of alexithymia. The psychodynamic theory suggests that alexithymia is an arrested and infantile psychic structure developed to protect the individual from overwhelming emotions rooting in early neglect or other childhood adversities. Thus, it supports the hypothesis that alexithymic features may develop secondarily, as a response to a traumatic experience. The still scarce genetic studies indicate that alexithymic characteristics are, to some extent, inherited. Several socio-demographic factors, such as low socio-economical status and general psychopathology in the family, have been firmly associated with alexithymia. Certain neurobiological aberrations in the parts of the CNS associated with emotion regulation have been suggested to be related with alexithymia, and through modern imaging technologies, some of these associations have gained more support, leading to novel hypotheses. Despite the multitude of hypotheses, none of them has been reliably verified and it still remains an open question whether these theories can be combined into a single systemic theory. Based on the currently available literature, alexithymia appears to be a complex manifestation which includes both trait and state components and varies extensively in its degree of difficulty.

Alexithymia has been associated with low social support. However, causality is difficult to establish because on one hand, impaired emotional recognition and expression may make bonding of supportive relationships more difficult and, on the other hand, alexithymic individuals may not be able to utilize social support adequately. This association, for example, regarding peer relationships, has not practically at all been studied in adolescents. Alexithymic features of young adults have been found to correlate with their mothers' alexithymic characteristics. Several studies indicate that the development of emotion regulation may be impaired due to inadequate parenting. For example, harsh discipline, childhood abuse and maternal intrusiveness have been associated with alexithymia. However, it appears that the other parent's optimal parenting style protects a child from developing of alexithymic features, if one parent is neglecting the child.

One aspect of particular interest is the association of alexithymia with speech development. Alexithymic individuals and individuals with impaired speech development often lack communication and regulation skills on an emotional level and, in both groups, this has been suggested to be associated with difficulties interpreting emotional vocal and facial cues. Both groups have similar difficulties in acting in various social situations and in bonding deep, gratifying peer relationships. However, alexithymia is not only a sequel of impaired speech development, and alexithymic individuals have been found to possess adequate vocabulary to describe their emotions. It appears rather that their emotions are poorly differentiated, making it difficult to label and verbalize them. One central issue in assessing these factors occurring the early years of childhood is the difficulty to establish causality; there is an obvious risk for recall bias. To shed more light on the aetiology of alexithymia, longitudinal studies that profoundly evaluate different individual and environmental factors in this process are needed.

According to population studies among adolescents, the prevalence of alexithymia is approximately 10%, which is the same as in adults. However, contrary to the finding in adult populations that males are more commonly alexithymic than females, no gender difference in the prevalence of alexithymia among adolescents has been reliably shown yet. In children alexithymic features are to some extent innate and in that developmental phase the cognitive abilities do not enable proper identifying and verbalizing emotions *per se*. In this regard it is understandable that younger adolescents present more commonly alexithymic features than the adolescents approaching adulthood do, which is supported by studies comparing the prevalence of alexithymia between different age groups in adolescence. However, longitudinal studies, in particular, are needed to clarify, whether these child-like alexithymic features simply persist in alexithymic individuals or if they develop *de novo* in certain phase or circumstances.

In adults, alexithymia has been firmly associated with several somatic illnesses and mental disorders and there is evidence that suggests similar associations to exist also in adolescents. However, the amount of studies in adolescents regarding these associations is limited, particularly in non-clinical populations. Up to date, in adolescents, most prominent proof has been found on the associations between alexithymia and depression, anxiety, and eating disorders. As in adults, alexithymia appears also to be associated with poor subjective health and well-being. Since many mental disorders emerge in adolescence and alexithymia appears to be related with several of them, possibly even being a predisposing factor for some of them, more profound understanding of the development and associations of alexithymia in the youth may open new possibilities for preventing these illnesses.

3. AIMS OF THE STUDY

The aims of the present dissertation are as follows:

1. To analyse the association between alexithymia and eating disorder symptoms in adolescents. (Study I)
2. To assess the association between alexithymia and anxiety symptoms in adolescents, taking into account depression and alcohol consumption as covariates. (Study II)
3. To evaluate the significance of perceived social support, as well as parental care and overprotection in the development of alexithymia. (Study III)
4. To explore comprehensive developmental factors in association with alexithymia without recall bias by using data records from the child welfare centre check-up at the age of five years. (Study IV)

4. MATERIAL AND METHODS

4.1 Study design and subjects

The present study was part of the wider *Lapsesta nuoreksi aikuiseksi* ("From a child to a young adult") study. The study population for the present study was recruited from two initial samples of students (total n = 1,892) who had participated in previous studies investigating self-reported ED symptoms among adolescents (14 to 16-year-olds) in Finnish-speaking secondary schools in the City of Turku during the school years 2003–2005. The results of these studies are reported elsewhere (Hautala et al. 2006, 2008, 2009). The main data were collected during the period 10/2008–01/2009 by using a questionnaire, which was sent by mail to the eligible participants. Data concerning child welfare centre check-ups at the age of five years were collected from the subjects' medical records. The final data material was compiled on the basis of the completed questionnaires and the subjects' medical records. The study design is cross-sectional in Studies I–III, while Study IV is retrospective and longitudinal.

4.1.1 Subjects in Studies I–III

For Studies I–III, the sample included those who in the previous studies had reported one or more ED symptoms as measured by means of the SCOFF questionnaire (n = 320), and a double-sized group of controls with no self-reported ED symptoms (n = 640). The controls were matched with the ED symptomatic participants for school, grade, and gender. Of the potential participants, two (0.2%) had died, four (0.4%) had moved abroad, and 19 (2.0%) were not located, thus leaving 935 individuals eligible for the present study. Of them, 729 (78.0%) participated in the study by returning the completed questionnaire, while 206 (22.0%) refused to participate. The mean age of

the sample was 19 years (range 17−21 years) and 74.0% of subjects were female. The participation rate was higher among females (p<0.001), controls (p<0.001), and younger subjects (p=0.04).

4.1.2 Subjects in Study IV

The sample in Study IV included those 723 subjects from the basic sample in Studies I−III who had completed the TAS-20 questionnaire correctly. Also in this sample the mean age was 19 years (range 17−21 years), and 74.0% of the subjects were female and 26.0% were male. Likewise, the participation rate was higher among females (p<0.001), controls (p<0.001), and younger subjects (p=0.02).

4.1.3 Ethical approval

All subjects gave their written informed consent to participate in the study. The study protocol was approved by the Ethical Committee of the Turku University Hospital.

4.2 Measures

4.2.1 Alexithymia

In Studies I-IV, the 20-item Toronto Alexithymia Scale (Bagby et al. 1994a, 1994b) was used for the assessment of alexithymic features. It is a twenty-item self-report scale that consists of three subscales measuring three core characteristics of alexithymia: difficulty identifying feelings (DIF), difficulty describing feelings (DDF) and externally oriented thinking (EOT). Each item is rated on a five-point Likert-type scale ranging from “strongly disagree” to “strongly agree”. The minimum

total score for the scale is 20 and the maximum is 100. The internal consistency, reliability and validity for the TAS-20 scale as a whole have been shown to be good in more than 20 versions in different languages (Bagby et al. 1994a, 1994b, Parker et al. 2003, Taylor et al. 2003). The Finnish version of the scale has been validated in adult population (Joukamaa et al. 2001), as well as in two different and representative adolescent population samples (Joukamaa et al. 2007, Säkkinen et al. 2007). Regarding the various subscales, the validity of the DIF and DDF subscales have been shown to be good, whereas the validity of the EOT subscale is only moderate (Bagby et al. 1994a, 1994b, Parker et al. 2003, Taylor et al. 2003).

Due to the extensive use of the TAS-20 scale worldwide, it has become the standard in alexithymia research. As recommended by the developers of the scale, a cut-off score of 61 points or more was used in the present study for classifying a subject as alexithymic (Bagby & Taylor 1997). The suggested cut-off score is based on a relatively small sample of students and its validity has been questioned later on, but nevertheless, it has been used in the vast majority of studies with only few exceptions, using the TAS-20 scale in different languages. Therefore, to facilitate prevalence comparisons with other studies, this original cut-off score was used in Studies I–IV. For the three subscales there are no suggested cut-off scores.

Subjects who had answered at least 80 % of questions (16/20) were included in the analyses for Studies I–IV. The missing values were estimated, using the mean value of the questions answered, and the calculated TAS-20 scores were rounded to the nearest integer. For the purposes of several statistical analyses, the TAS-20 total score was also treated as a continuous variable.

4.2.2 Eating disorder symptoms

In Study I, eating disorder symptoms were assessed using the SCOFF (“Sick”, “Control”, “One”, “Fat”, “Food”) questionnaire (Morgan et al. 1999). SCOFF is a self-report questionnaire developed originally for use in community samples to raise a suspicion of a potential eating disorder (Morgan et al. 1999, Cotton et al. 2003). It consists of five simple eating-related items, focusing on the core symptoms of anorexia nervosa and bulimia nervosa. Each of the items has two response options (“yes” or “no”). and the responses are scored by giving one point for a positive answer and zero for a negative. The developers of the scale have suggested a cut-off score of two or more points to raise a suspicion of a probable eating disorder (Morgan et al. 1999). The scale appears to be a highly effective screening instrument for eating disorders (Hill et al. 2010). It has shown a good sensitivity and specificity in adolescents and young adults (Rueda Jaimes et al. 2005) and it has also been validated in a sample of Finnish 20 to 35-year-old young adults (Lähteenmäki et al., 2009). All in all, it has proven to be a feasible instrument for screening ED symptoms in adolescents (Hautala et al., 2009). For the present study, a cut-off score of two or more points was used for classifying a subject as SCOFF positive and, in the statistical analyses, the SCOFF score was treated as a continuous variable.

4.2.3 Depression

In Study II, the Raitasalo Beck Depression Inventory (RBDI) (Raitasalo 2007) was used for the measurement of depressive symptoms. RBDI is a Finnish modification of the short form of the Beck Depression Inventory (Beck & Beck 1972). It consists of 14 questions: the first 13 questions measure depressive symptoms and the final question measures anxiety. The final question is not included in the total score. Each item is rated on a five-point Likert-type scale, where reply options 1 and 2 give no points, reply option 3 counts as one point, 4 as two points and, 5 as three points.

Thus, the minimum total score is 0 and the maximum total score is 39. A score of 0 to 4 represents absent or only very mild depression, 5 to 7 mild, 8 to 15 moderate, and 16 to 39 severe depression (Beck & Beck 1972).

The reliability and validity of the scale have been shown to be good for major depressive disorder (Raitasalo 2007). The scale has proven to be applicable to adolescents as well (Kaltiala-Heino et al. 1999). For the present study, the responses with five or more omitted items of a total of 13 were excluded from the analyses. The mean value of the questions answered was used as an estimate for any missing values, and the adjusted scores thus calculated were rounded to the nearest integer.

4.2.4 Anxiety

In Study II, anxiety symptoms were measured using the State-Trait Anxiety Inventory (STAI) (Spielberger et al. 1983). STAI consists of two twenty-item scales: the STAI-State and STAI-Trait anxiety scales. The STAI-State scale measures current anxiety symptoms and STAI-Trait how anxious the subject generally feels. Each item is rated on a four-point Likert-type scale and the total score range is from 20 to 80. The psychometrical properties of the STAI instrument have been established as good (Spielberger et al. 1989, Barnes et al. 2002).

The normative data provided by Spielberger and Vagg (1984) were collected over 25 years ago and, due to the obvious cultural differences, they were evaluated as not being applicable to Finnish adolescents in the present study. In addition to using the STAI-State and STAI-Trait scores as continuous variables, the subjects were categorized according to their STAI scores into two groups; those who were highly anxious and those showing milder anxiety symptoms. Separate cut-off scores for each gender and scale were used. Basend on the 75th percentile scores, the applicable cut-off scores were >44 for both the STAI-State and STAI-Trait for females, and >36 for STAI-

State and >38 for STAI-Trait for males. For the present study, the responses with three or more omitted items were excluded from the analyses. The missing values were estimated, using the mean value of the items answered, and the scores thus calculated were rounded to the higher integer.

4.2.5 Alcohol misuse

In Study II, alcohol consumption and misuse was assessed with the Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al. 1993). It is a ten-item scale for screening excessive drinking and in assessing hazardous alcohol consumption. The items are multiple-choice questions about recent alcohol use, symptoms indicating alcohol dependence, and alcohol-related problems. The total score range is from 0 to 40. The instrument has been studied extensively, and it has shown a good validity and reliability in several different populations and clinical samples (Allen et al. 1997). As recommended by the developers of the scale, subjects with a score of 8 or more were defined as AUDIT positive, suggesting potentially hazardous drinking habits. Only responses with no omitted items were used in the analyses.

4.2.6 Perceived parental attitude

In Study III, Parental Bonding Instrument (PBI) was used to evaluate perceived parental attitude. PBI is a 25-item self-report questionnaire that is divided in two subscales, one measuring experienced care (12 items) and the other overprotection (13 items). The subject is asked to score each parent as remembered during the first 16 years of his or her life. Each item is rated on a 4-point Likert-type scale and scored on a scale from 0 to 3. Thus, for the care subscale, the minimum sum score is 0 and maximum is 36 and for the overprotection subscale the minimum sum score is 0 and maximum is 39. Both the care and overprotection subscales have bipolar dimensions. As regards the care subscale, the positive (high) pole represents affection, emotional warmth and

closeness, while the negative (low) pole stands for emotional coldness and rejection. Correspondingly, for overprotection, the positive (low) pole represents promotion of autonomy, while the negative (high) pole is characterized by intrusion, infantilization and excessive contact. The reliability and validity of the instrument have been established as good (Parker et al. 1979, Parker 1989). The PBI sum score was treated as a continuous variable. The answers for the care and overprotection subscales were examined also separately, and those subjects who did not answer to at least 80% of the questions in both the care (10/12) and overprotection subscales (10/13) were omitted.

4.2.7 Social support

In Study III, subjective experienced social support was assessed with the Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al. 1988). MSPSS is a 12-item self-report questionnaire, which measures experienced social support from three sources: Family, Friends and Significant Other. Each item is rated on a 7-point Likert-type scale ranging from "strongly disagree" to "strongly agree". The minimum total score is 12 and the maximum 84 for the whole 12-item questionnaire, and the sum scores for each of the three subscales range from 4 to 28. The scale has shown good internal reliability and validity, both as a whole and for each of its subscales (Zimet et al. 1988, 1990). The psychometrical properties of the scale have proven to be good also in adolescents in several studies (Canty-Mitchell et al. 2000, Bruwer et al. 2008, Ramaswamy et al. 2009), and accordingly, it appears to be a sound instrument to be used with adolescent populations.

4.2.8 Sociodemographic factors

In addition to the above-mentioned scales, the subjects were asked to answer several questions concerning their sociodemographic situation. The following variables were used in Studies I–IV:

gender (male/female), dwelling (with parent[s]/other), main occupation (student/other), number of siblings, parents divorced (yes/no), mother deceased (yes/no), father deceased (yes/no), smoking (yes/no), perceived health (good or fairly good/moderate or fairly poor), and sports activities (regularly/rarely or none).

4.2.9 Child welfare centre examination

In Study IV, child welfare centre check-up data were used. Generally, in the Finnish child welfare centre regime, there are nine check-ups from birth to one-year-old and thereafter six check-ups before the child starts the school at the age of seven years. For the present study, the data concerning the check-up at the age of five years were collected from the subjects' medical records. At this check-up, the children undergo a comprehensive examination by a nurse in a local child welfare centre. The variables used in the present study were based on this examination, as well as, the information collected from the parents regarding the familial situation, pregnancy, and birth. The variables based on the nurse's assessment were the following: whether anything abnormal has been noted during previous child welfare centre visits, the child's conduct during the check-up, screen for speech development (based on 13 tasks), screen for gross motor development (six tasks), screen for visuo-motor development (five tasks), health status, and overall socio-emotional and cognitive development. Correspondingly, the variables based on the information received from the parents are as follows: relationship of the biological parents, whether there was any abnormality during the postpartum period in hospital, parents' assessment as to whether there was anything abnormal during the child's first year, and parents' assessment of the child's current conduct and life situation.

4.3 Statistical methods

In Studies I–IV, the data were analysed using the SAS software, version 9.2. Basic summary statistics were used in the characterization of the data. The TAS-20 total scores and subscale scores were confirmed for normal distribution, both statistically and graphically. Two-sample t-test and chi-square test(s) were applied for basic comparisons.

Due to the study design, certain degree of intra-class correlation for observations from the same school was expected. Ignoring the intra-class correlation may result in too small estimates of standard errors or too small p-values in tests. Generalized linear mixed models (glimmix) were used, which offers a comprehensive tool for analysis of data of this type. The explanatory variable(s) of main interest were included as fixed effect(s) in the models, with the school as a random effect. In these models, the response variable is assumed to be normally distributed. The associations with the alexithymia scales were first analysed separately for each explanatory variable. Finally the significant explanatory variables were included into the multivariate analysis. For all of the multivariate models, the variables of interest were forced (without any stepwise technique) into the model.

A confirmatory factorial analysis was carried out for the TAS-20 and MSPSS scales, and the psychometric properties of both scales were shown to be satisfactory. The acceptable scores for the confirmatory factorial analysis are suggested by the developers of the TAS-20 scale, based on an analysis of the reliability and factorial validity of the scale in almost 20 countries (Taylor et al. 2003). For the TAS-20 scale, the goodness-of-fit index (GFI) was 0.93, with a score ≥0.85 being acceptable, and the adjusted goodness-of-fit index (AGFI) was 0.89, with a score ≥0.80 being acceptable. The root-mean-square residual (SRMR) was also satisfactory at 0.04 (a score ≤ 0.10 is acceptable), as well as, the Steiger's root mean square error of approximation (RMSEA) was 0.07 (a

score ≤ 0.08 is acceptable). Correspondingly, for the MSPSS scale, GFI was 0.93, AGFI 0.90, SRMR 0.03, and RMSEA 0.08.

The Cronbach's coefficient alpha scores for the PBI care and overprotection subscales showed good internal consistency, both for the maternal and paternal scales. The values were as follows: 0.92 for PBI maternal care, 0.85 for PBI maternal overprotection, 0.93 for PBI paternal care, and 0.85 for PBI paternal overprotection. The Cronbach's coefficient alpha scores for the AUDIT (0.83), RBDI (0.88), and STAI (0.96) scales also showed good internal consistency.

In Studies I–III, the significance level was set at $p<0.05$ in all analyses. In Study IV, due to the lack of comparative studies, the subject was approached exploratorily. Thus, all variables were included in the univariate analyses. Because of the multiple testing procedure, the significance level was set at $p<0.01$ in order to avoid Type 1 error.

5. RESULTS

5.1 Alexithymia and eating disorder symptoms in adolescents

Owing to incomplete responses, the actual number of subjects varied between 714 and 729 for the different variables. The mean TAS-20 total score was 45.0 (95% CI 44.26–45.74) in the whole sample. The mean TAS-20 total scores were 44.7 (95% CI 43.8–45.5) in females and 46.0 (95 % CI 44.7–47.3) in males, and the difference was not statistically significant. Of the females, 8.2% and of the males 8.5% were classified as alexithymic, with no significant difference between the genders.

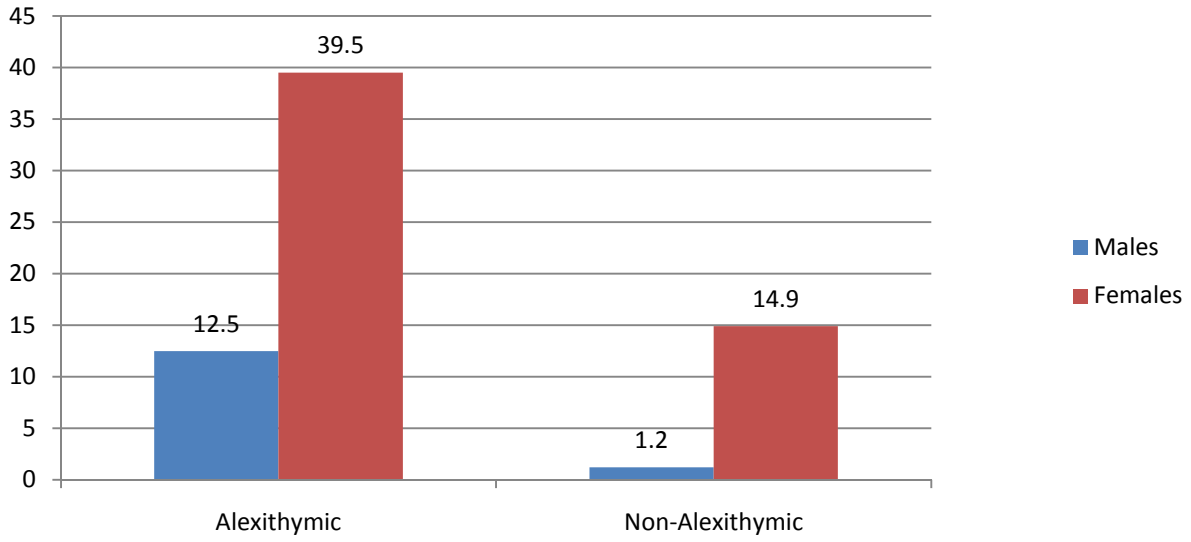
The mean SCOFF score was 0.5 in all subjects. Eating disorder symptoms were significantly ($p<0.001$) more common in females than in males: the mean score was 0.6 in females and 0.2 in males. Using the cut-off point of two or more positive answers, a total of 13.1% of the subjects were classified as SCOFF positive. Females presented clearly more frequently eating disorder symptoms: 17.0% of females and 2.1% of males were classified as being SCOFF positive.

In the univariate analyses, the TAS-20 total score was statistically significantly associated with the SCOFF sum score ($p<0.001$). The associations of the TAS-20 and its subscales with the various socio-demographic factors were also assessed by means of univariate analyses, and the following variables were found to be associated with the TAS-20 total score: smoking ($p=0.03$), perceived health ($p<0.001$), and sports activities ($p=0.02$). Smokers and those with a sedentary lifestyle had a higher TAS-20 total score. Similarly, those who rated their current health moderate or fairly poor had a higher TAS-20 total score. Regarding the TAS-20 subscales, perceived health was negatively associated with all of them (DIF $p<0.001$, DDF $p<0.001$, EOT $p=0.009$). The DIF score was significantly higher in females ($p<0.001$) and in smokers ($p=0.03$). However, the EOT score was

higher among males (p<0.001) and those with a sedentary lifestyle (p<0.001). EOT was also higher among those, whose main occupation was other than student (p=0.007). The associations of the SCOFF score with the TAS-20 subscales and the socio-demographic factors were assessed using multivariate analysis. The SCOFF score was positively associated with DIF (<0.001) and DDF (p=0.03), as well as female gender (p<0.001) and a sedentary lifestyle (p=0.01). Those whose father had deceased had lower SCOFF scores than others (p=0.03).

There was a statistically significant (p<0.001) difference between the alexithymic and non-alexithymic groups: the mean SCOFF score was 0.9 for the alexithymic and 0.4 for the non-alexithymic group. The proportional shares of SCOFF positive subjects in the alexithymic and non-alexithymic groups are presented in Figure 1.

Figure 1. The percentage of SCOFF positive (SCOFF score ≥2) subjects in the alexithymic and non-alexithymic groups



5.2 Alexithymia and anxiety among adolescents

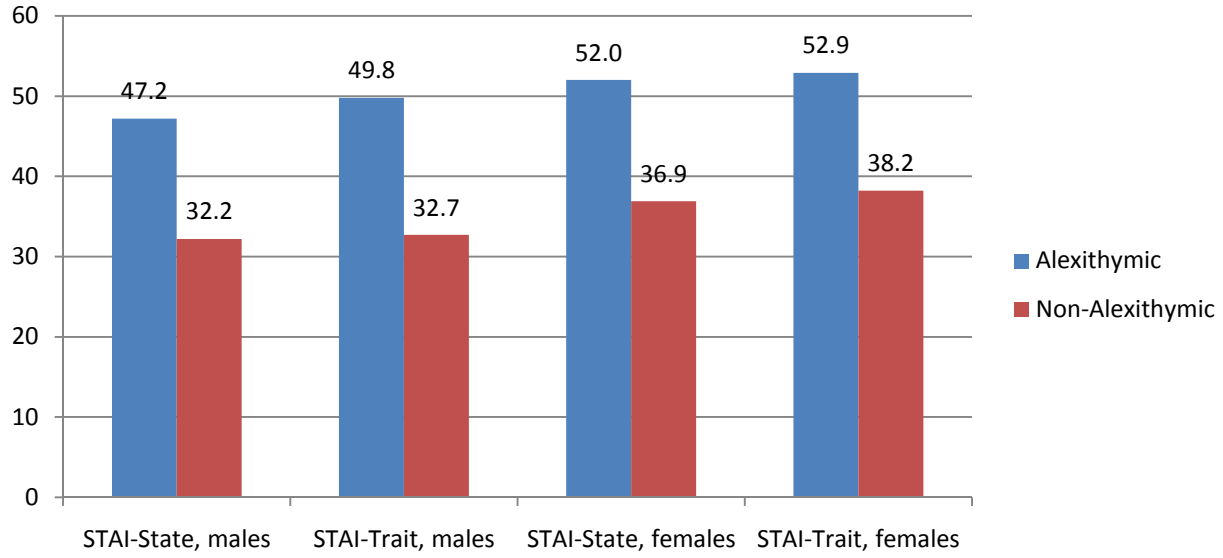
Owing to incomplete responses, the actual number of subjects varied between 716 and 729 for different variables. The mean STAI total score was 67.4 (95% CI 64.9–69.9) in males and 77.5 (95% 75.8–79.3) in females. The difference was statistically significant ($p<0.001$). Females also had significantly ($p<0.001$) higher mean scores than males both in the STAI-State (38.1 vs. 33.4) and STAI-Trait (39.4 vs. 34.0) scales. A statistically significant ($p=0.002$) difference was found between the genders also regarding the RBDI scores: the mean score was 1.7 (95% CI 1.2–2.2) in males and 2.9 (95% 2.5–3.3) in females. Altogether 88.9% of males and 78.8% of females had a score of 0 to 4, and consequently, they were classified as having no or only very mild depression symptoms. Mild depression was observed in 7.4% of males and 8.7% of females, and 3.7% of males and 12.5% of females suffered from at least moderate depression. The mean AUDIT score was 8.3 (95% CI 7.5–9.1) in males and 7.7 (95% CI 7.2–8.2) in females, no gender difference was found. With a score of 8 or more, 48.7% of males and 42.6% of females were classified as AUDIT positive, suggesting that they may have problems in alcohol consumption.

In the univariate analyses, the TAS-20 total score was significantly ($p<0.001$) associated with the AUDIT, RBDI, STAI-State, and STAI-Trait scores in all subjects, with a higher score in all of these scales being positively associated with the TAS-20 total score. Both the DIF and DDF scores were also significantly ($p<0.001$) associated with the AUDIT, RBDI, STAI-State, and STAI-Trait scores, whereas the EOT score was only associated with the AUDIT score ($p=0.02$). The associations of the AUDIT, RBDI, STAI-State, and STAI-Trait scores with the TAS-20 and its subscales were assessed with multivariate analyses, taking into account the socio-demographic factors as well. The STAI-State and STAI-Trait scores remained significantly ($p<0.001$) associated with the TAS-20 total score and DIF score. The DDF subscale score was associated with the STAI-Trait score ($p<0.001$)

and gender (p=0.003). However, EOT was associated with STAI-State score (p=0.04) and, as explained above (in Chapter 5.1), also with gender (p<0.001), main occupation (p=0.007), perceived health (p=0.001), and sports activities (p=0.001)

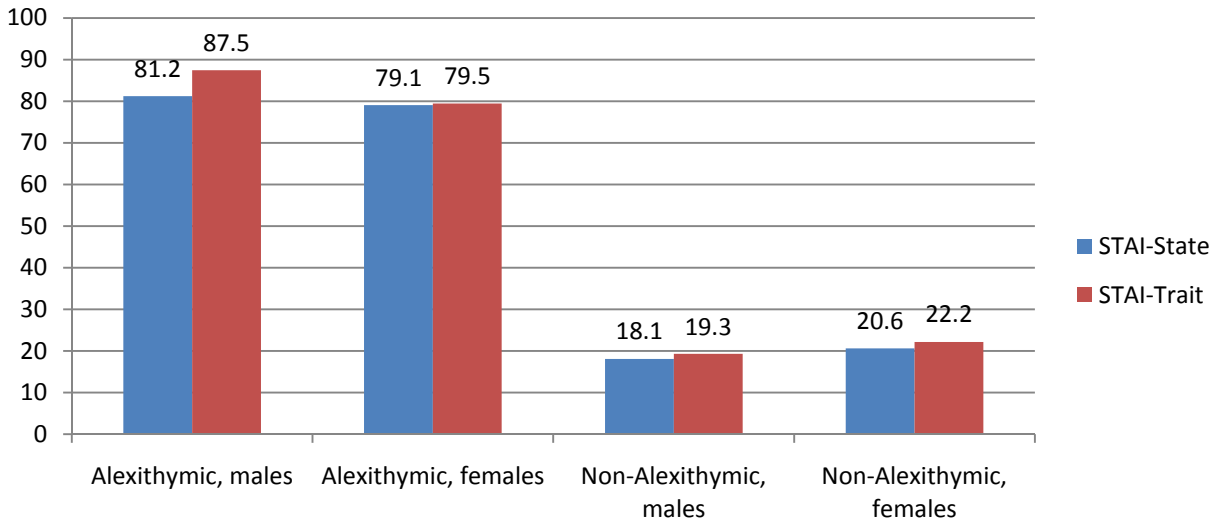
Due to the gender difference observed in the STAI scores, the analyses concerning the association of alexithymia with anxiety were carried out separately for males and females. In both genders, the alexithymic subjects had overall significantly (p<0.001) higher mean scores compared to the non-alexithymic subjects. The mean scores in the STAI subscales are presented in Figure 2.

Figure 2. The mean scores in the STAI-State and STAI-Trait scales by gender



A difference (p<0.001) was observed in the distribution of the highly anxious subjects in both genders and a clear majority of the alexithymic subjects were highly anxious, as compared to the non-alexithymic subjects. The distribution of the highly anxious subjects is presented in Figure 3.

Figure 3. The percentages of highly anxious (STAI score in the highest quartile) subjects in the alexithymic and non-alexithymic groups



In the univariate analyses, the highly anxious alexithymic subjects had significantly higher RBDI and AUDIT scores in comparison to the highly anxious non-alexithymic subjects. However, in the multivariate analyses, only the differences in the RBDI scores remained significant: in alexithymic vs. non-alexithymic females, the RBDI mean scores were 10.3 vs. 6.1 for STAI-State ($p<0.001$) and 10.3 vs. 6.6 for STAI-Trait ($p<0.001$), respectively, whereas the AUDIT mean scores were 13.7 vs. 8.3 for STAI-State (p=non-significant), and 14.2 vs. 8.7 for STAI-Trait ($p=0.03$), respectively, Correspondingly, in alexithymic vs. non-alexithymic males, the RBDI mean scores were 7.9 vs. 2.8 for STAI-State ($p<0.001$) and 7.6 vs. 3.4 for STAI-Trait ($p<0.001$), respectively, whereas the AUDIT mean scores were 14.0 vs. 8.5 for STAI-State (p=non-significant) and 12.4 vs. 7.2 for STAI-Trait (p=non-significant), respectively.

5.3 The relationship between social support and perceived parental attitude with alexithymia

Owing to the incomplete responses, the actual number of subjects varied between 679 and 729 for different variables. The MSPSS total score was 68.4 (95% CI 66.6–70.2) in males and 71.7 (95% CI 70.8–72.7) in females (p=0.001). MSPSS Family score was 23.1 (95% CI 22.4–23.8) in males and 22.7 (95% CI 22.3–23.1) in females, and no significant difference was observed between the genders. However, a statistically significant gender difference (p<0.001) between genders was found in the scores for the MSPSS Friends and MSPSS Significant other scales. The scores were as follows: MSPSS Friends 22.4 (95% CI 21.7–23.1) in males and 24.1 (95% CI 23.7–24.5) in females, and MSPSS Significant Other 23.0 (95% CI 22.3–23.8) in males and 25.0 (95% CI 24.6–25.3) in females.

Males and females differed significantly (p=0.001) in the PBI scores for paternal care and overprotection. The PBI paternal care score was 28.0 (95% CI 27.1–28.9) in males and 26.1 (95% CI 25.4–26.8) in females, and correspondingly, the PBI paternal overprotection score was 7.0 (95% CI 6.2–7.7) in males and 8.6 (95% CI 8.0–9.1) in females. The PBI maternal care score was 31.1 (95% CI 30.4–31.9) in males and 30.1 (95% CI 29.5–30.6) in females, with a statistically significant difference (p=0.02). However, no significant gender difference was observed in the PBI maternal overprotection scores which were: 10.8 (95% CI 9.8–11.7) in males and 10.1 (95% CI 9.6–10.7) in females.

In pair-wise analyses, there was a statistically significant difference between alexithymic and non-alexithymic subjects in all of the MSPSS and PBI scores, except for the PBI paternal overprotection scale. Alexithymic subjects had lower scores in all the other scales, but the PBI maternal and

paternal PBI overprotection subscales indicated that, alexithymic individuals had experienced more overprotection. Gender interacted with some of the variables (the MSPSS total score, and the Friends and Significant Other subscale scores), and therefore, the analyses were carried out separately for females and males.

The MSPSS total score, as well as the Family, Friends and Significant Other subscale scores were significantly associated with the TAS-20 total score and the DIF and DDF subscale scores in pair-wise analyses. These associations were strong in both males ($p=0.001$) and females ($p<0.001$). However, EOT was associated with the MSPSS scores only in females ($p=0.04$). A lower level of experienced social support was associated with a higher amount of alexithymic features.

Furthermore, in pair-wise analyses, the maternal and paternal PBI care and overprotection scores were significantly associated with the TAS-20 total score ($p<0.001$) and the DIF ($p<0.001$) and DDF ($p<0.001$) subscale scores in females. In males, the maternal PBI care and overprotection scores correlated significantly with the TAS-20 total score ($p=0.005$) and the DIF ($p<0.001$) and DDF ($p=0.008$) subscale scores. However, the paternal PBI care and overprotection scores were associated only partly with alexithymia in males: paternal overprotection with the TAS-20 total score ($p=0.02$) and DIF ($p<0.001$), and paternal care with the DIF ($p=0.005$). Higher PBI care scores were associated with fewer alexithymic features, while higher PBI overprotection scores were positively related with alexithymia.

Multivariate analyses were carried out, taking into account those socio-demographic variables that had shown an association with alexithymic features in the pair-wise analyses carried out in Study I, that is, dwelling, parents' divorce, smoking, occupation, and perceived health. Of the various MSPSS scores, the MSPSS Friends score remained most significantly associated with alexithymia.

In females, it was associated with the TAS-20 total score ($p<0.001$), and the DIF ($p<0.001$) and DDF ($p<0.001$) subscale scores. The MSPSS Friends score was associated with DDF ($p=0.009$) in males as well. Regarding the experienced parental attitude, high maternal overprotection remained associated with the TAS-20 total score, and the DIF and DDF scores in both genders. High paternal overprotection was associated with the TAS-20 total score ($p=0.046$) and the DIF score ($p=0.011$) in females, as well as with the DIF score ($p=0.042$) in males. Parental care remained poorly associated with alexithymia: paternal care alone was associated with DIF ($p=0.019$) and EOT ($p=0.011$), and in females solely.

5.4 Speech development at the age of five years and alexithymia in late adolescents

To evaluate possible associations between speech development in early childhood and alexithymia in late adolescence, the developmental factors assessed comprehensively during the child welfare centre check-up at the age of five years were evaluated against the TAS-20 scale scores measured in late adolescence. The assessed developmental factors are listed in the Measures-section (4.2.9).

Statistically significant ($p<0.01$) associations were found in the univariate analyses between the developmental variables at the age of five years and the alexithymic features in adolescence. In all subjects, the TAS-20 total score was associated with the ability to comply with multi-part instructions (ACMPI) ($p=0.007$), and the EOT score was associated with the screen for speech development ($p<0.001$), narrative speech ($p=0.009$), repeating of sentences ($p=0.001$), kinetic skills in pronouncing words ($p<0.001$), articulation ($p=0.009$), counting from nine to five ($p<0.001$), naming the colours of five different blocks ($p<0.001$) and ACMPI ($p=0.002$). Overall socio-emotional development was also related with the EOT ($p=0.002$). In females, the following

developmental variables were associated significantly with the EOT: the screen for speech development (p=0.006), kinetic skills in pronouncing words (p=0.004), and naming the colours of five different blocks (p=0.008). Overall socio-emotional development was also related with EOT (p=0.005). In males, the associations were quite unequivocal: ACMPI was associated with the TAS-20 total score (p<0.001), DIF (p=0.003) and EOT (p=0.002). Overall cognitive development was only associated with DDF (p=0.005). Uneven socio-emotional or cognitive development was associated with a higher amount of alexithymic features. Thus, the variables measuring speech development were clearly emphasized in association with alexithymic features and failing in these tasks was related with later alexithymic features.

Those variables that showed a statistically significant association in the univariate analyses were included in the multivariate analyses, as were also those socio-demographic variables that had in Study I been shown to be associated with alexithymia in this material. In the multivariate analyses, the association between speech development and alexithymia remained only in males: ACMPI was associated with the TAS-20 total score (p<0.001) and EOT (p=0.002). In all subjects, perceived health was the only that remained associated with the TAS total score (p<0.001) and EOT (p=0.003). In males, perceived health was also associated with DIF (p<0.001). Poor perceived health was positively associated with alexithymic features. In females, no significant associations emerged in the multivariate analyses.

6. DISCUSSION

6.1 Alexithymia and eating disorder symptoms in adolescents

In the present study, the overall prevalence of alexithymia was roughly the same as in the previous studies reporting on Finnish adolescent populations (Joukamaa et al. 2007, Säkkinen et al. 2007). Of the subjects, 8.2% received a TAS-20 score of 61 or more, and were thus classified as alexithymic. No significant gender difference was observed either in the prevalence of alexithymia or the TAS-20 mean scores, which further adds to the confusion regarding the existence of a possible gender difference in the prevalence of alexithymia in adolescents. Contrary to adults, adolescents males have not been found to be more alexithymic than females (Joukamaa et al. 2007, Säkkinen et al. 2007, Honkalampi et al. 2009).

According to the results of the present study, various eating disorder symptoms, as measured with the SCOFF questionnaire, were strongly associated with alexithymia. Not surprisingly, eating disorder symptoms were more common in females than in males. However, the association of the SCOFF score with alexithymic features was equally significant in both genders. The association was attributed to the DIF and DDF subscales, whereas the EOT subscale was not associated with eating disorder symptoms. This supports the previous findings by De Berardis et al. (2007), who reported that difficulty to identify and describe feelings was associated with a higher risk for ED symptoms in a sample 254 undergraduate females.

Owing to the methods used, there are no fully comparable studies published up to date. Additionally, the association between alexithymia and eating disorders has been scarcely studied in adolescents. There are several studies in adult populations suggesting an association between eating

disorders and alexithymia in different patient samples (Cochrane et al. 1993, Schmidt et al. 1993, Zonnevylle-Bender et al. 2002, 2004) and also a few evaluating this association in non-clinical samples (De Berardis et al. 2007, Van Strien et al. 2007, Hayaki 2009). However, in these studies, eating disorder symptoms have been measured with other scales, such as the 26-item Eating Attitudes Test (De Berardis et al. 2007). This was the first time the SCOFF questionnaire was used to measure eating disorder symptoms specifically in association with alexithymia, so it was not possible to compare the results of the SCOFF questionnaire with, for example, those of the above mentioned studies. However, the findings appear to be in agreement with previous studies. Thus, due to its simplicity and brevity, the SCOFF questionnaire can be considered to be a feasible method to measure eating disorder symptoms in association with alexithymia.

6.2 Alexithymia and anxiety in adolescents

In the present study, alexithymic features were found to be significantly associated with anxiety symptoms. This association remained strong also when various socio-demographic factors, as well as depression and alcohol consumption were taken into account. The highly anxious individuals were clearly more alexithymic than the others, they were more depressed, and their drinking habits were more hazardous.

Females presented significantly more depressive and anxious symptoms compared with males, but there was no significant difference between males and females as regards their alcohol consumption. To my best knowledge, there are no previous studies among adolescents that would evaluate the association of alexithymia with anxiety using the STAI scale. In fact, there is only one single study on the relation of alexithymia with anxiety in this age group, showing that adolescents

suffering from a persistent somatoform pain disorder had higher levels of alexithymia when compared with controls (Burba et al. 2006). Thus, there is a clear lack of comparable studies.

For both trait and state anxiety, the association with alexithymia was attributed to DIF. Additionally, trait anxiety was associated with DDF, and state anxiety with EOT. However, at the same time, several socio-demographic factors were also associated with EOT. The association of anxiety with difficulty identifying and describing feelings is supported also by previous studies (Devine et al. 1999). Depressive symptoms and drinking were associated with alexithymia in the univariate analyses, but these associations were no longer significant in the subsequent multivariate analyses. Although the results do not allow to evaluate, whether these associations were, in fact, mediated by anxiety, depressive symptoms have also in previous research been found to be indirectly associated with alexithymia, whereas anxiety has shown a direct relation with alexithymia (Berthoz et al. 1999). It is also noteworthy that, the highly anxious alexithymic subjects differed significantly from the equally anxious non-alexithymic subjects in terms of depressive symptoms and drinking.

Owing to the cross-sectional setting in the present study, causality is difficult to establish. On one hand, the results allow to speculate if alexithymic individuals use more alcohol to alleviate their anxiety. Previous studies have suggested the use of alcohol in social situations to be a coping mechanism (Uzun et al. 2003), but the underlying cause exposing alexithymic individuals to higher alcohol consumption is still unclear. In this regard, depressive symptoms may be associated with anxiety or the higher alcohol consumption. On the other hand, it has been suggested that sensitivity to anxiety may lead to repressing of emotions and thereby to alexithymic features (Marchesi et al. 2005). These individuals repress their emotions to avoid experiencing uncomfortable anxiety-related bodily sensations. Correspondingly, Honkalampi et al. (2000a) proposed that anxiety may

result in a reactive regression of emotional development. This is in concordance with the idea that alexithymic features represent an infantile psychic structure (McDougall 1989). However, one should bear in mind that alexithymic features have been found to be closely related with depressive symptoms possibly mediating the emergence of other mental disorders (Honkalampi et al. 2010).

6.3 Correlates of alexithymia and familial factors in adolescents

6.3.1 Alexithymia and perceived parental attitude

Alexithymia was found to be associated with higher parental overprotection both in males and females. However, in contrast to the hypothesis, parental care was not associated with alexithymia to the same extent as overprotection. The strongest association was observed between alexithymia and maternal overprotection, and it was attributed to the DIF and DDF subscales. When the socio-demographic factors were controlled for, the results remained significant. To my knowledge, this was the first time the associations of both parental bonding and social support with alexithymia were assessed in this particular age group. Consequently, the comparison of the results with previous research is not a straightforward issue. Furthermore, experienced parental care and overprotection during childhood and early adolescence are in several studies assessed with other methods than the PBI. However, the main findings of this study are in line with previous research.

It has been suggested that inadequate parenting may impair the development of emotion regulation and thereby have an impact on the development of alexithymia (Taylor et al. 1997a, Picardi et al. 2005a). Evren et al. (2009) found in a sample of male substance-dependent inpatients that a history of childhood emotional abuse was the only determinant for later alexithymia. Similarly, in a Finnish

study, alexithymia has been associated with childhood adversities, particularly with harsh discipline and unhappiness of the childhood home (Honkalampi et al. 2004a). However, Kooiman et al. (2004) have suggested that even if one parent's parenting style is neglecting the child, the other parent's optimal parenting style appears to protect the child from developing alexithymia.

Of the alexithymic features, difficulty describing feelings, in particular, has been associated with maternal overprotection. De Panfilis et al. (2008) suggested that maternal overprotection, such as behavioural restrictiveness and intrusiveness, may be associated with later difficulties in sharing and describing emotions. Additionally, in a study by Picardi et al. (2005a), DDF was related with certain personality traits, such as difficulties in being warm, sensitive, cooperative and sociable. Also in the present study, the strongest association was observed between alexithymia and maternal overprotection, and the association was attributed to the DDF and DIF subscales. Thus, it can be hypothesized that the presence of an overprotective, intrusive mother may promote denial of psychological autonomy and lead to difficulties in sharing emotions, which portrays the alexithymic feature of difficulty describing feelings. In a study concerning young adults and their mothers, Lumley et al. (1996) found an association between alexithymic features and general family pathology. Despite the fact that the measured dimensions of experienced parental attitude were different from those used in the present study, distinct family dysfunctions, such as emotional under or over involvement, were associated with the DIF subscale scores, further supporting the results of the present study.

On the basis of previous research, it was hypothesized that parental – particularly maternal – care would have a more significant association with alexithymic features. Indeed, alexithymic individuals reported having experienced significantly less maternal and paternal care when growing up, but these associations did not principally remain in the multivariate analyses. In males, paternal

care remained associated with DIF and EOT, but the associations of EOT were as a whole clearly divergent as compared with the other subscales. Fukunishi et al. (1997) suggested difficulty describing feelings to be associated with the lack of experienced parental care. Mason et al. (2005) found both DIF and DDF to be negatively associated with experienced parental care.

However, similar to the present study, the aforesaid studies are limited by their cross-sectional design wherefore it is difficult to establish causality. On one hand, it may be that the lack of parental care has had an impact on the development of alexithymia, but on the other hand, it may be that the primary alexithymic features in the child have affected the child-parent-relationship negatively. Kooiman et al. (1998) found only a weak association between perceived parental attitude and alexithymia in a sample of adult psychiatric outpatients, which supports the findings of the present study. The finding led the authors to question whether individuals who indeed are victims of parental neglect are suitable persons to be studied with self-report instruments since they may resort to primitive defence mechanisms. In the present study, however, the subjects were relatively young and hence probably able to recall their childhood experiences more accurately, and secondly, they were a non-clinical population sample.

6.3.2 Alexithymia and social support

To my best knowledge, this was the first time the associations of both parental bonding and social support with alexithymia were assessed in this age group. Although alexithymia has in previous studies been associated with low social support (Fukunishi & Rahe 1995, Posse et al. 2002), the studies are scarce and varying methods have been used to assess the relationship. Therefore, comparison of the results is a challenging task. Due to the lack of longitudinal studies, the causation between alexithymia and low social support remains unresolved. Since alexithymia constitutes

impaired emotional recognition and expression, it may reduce social support by hindering the building of relationships *ipso facto*, but at the same time it has been suggested that, alexithymic individuals may not be able to utilize social support adequately, because they neither recognize others' emotions nor respond to them appropriately (Kojima et al. 2003).

Alexithymia was found to be associated with experienced lack of social support, particularly from friends. When alexithymic adolescents were compared with their non-alexithymic peers, there was a significant difference in both the MSPSS total scores and all of the subscales, that is, Family, Friends, and Significant Other, in the univariate analyses. The experienced social support of alexithymic individuals was clearly lower in comparison with the non-alexithymic group. In the multivariate analyses, the Family and Friends scores remained associated with the TAS-20 total score and the lack of social support from friends was particularly prominent. The association between the lack of social support and alexithymia was attributed to the DIF and DDF subscales.

In the study by Posse et al. (2002), having a low level of social support was over three times more common in alexithymic than in non-alexithymic individuals. Additionally, alexithymic individuals with low social support and without any stressful life events were significantly worse off regarding their mental health. Also in the present study, alexithymia was associated with significantly poorer subjective overall health, as will be discussed in detail in the following chapter (6.5). In both studies, the association between alexithymia and social support was mostly attributed to the DIF and DDF subscales. The material in the study of Posse et al. (2002) comprised only females, but according to the results of the present study, the lack of social support appears to be a significant factor associated with alexithymia in both genders.

In the present study, the Significant Other subscale score was only associated with the EOT subscale score in females, not with the other alexithymia variables or in males. This may, at least partly, be explained by the subjects' age. After all, youth in this age group have often nnot formed deep relationships outside their family and friends. The emphasized role of peer relationships is an interesting finding, but due to the lack of comparable studies, it is not possible to evaluate whether it is typical for adolescents with alexithymia, although it is plausible.

6.4 Impaired speech development as a risk factor for development of alexithymia

In the present study, alexithymia in late adolescents was significantly associated with impaired speech development at the age of five years, particularly in males. When the comprehensively assessed developmental factors were analysed exploratorily in association with alexithymia, impaired speech development was virtually the only that predicted later alexithymia. According to my knowledge, no comparable studies have been published up to date.

The role of speech development in terms of later alexithymia has been assessed earlier in one study by Kokkonen et al. (2003). In a prospective setting, they studied the association of the ability to speak at the age of one year with adulthood alexithymia. The authors found that those children who spoke at least one word at the age of one had significantly less commonly alexithymia 30 years later in adulthood. Lagging speech development was mostly attributed to the EOT subscale, which was also the found in the present study. With reference to the results in Studies I–III presented above, the associations of the EOT subscale were divergent from the other subscales also in this regard. This topic is discussed in detail in the following chapter (6.5). Interestingly, in the present study, the association between alexithymia and speech development remained in the multivariate analyses

only in males, while in the study of Kokkonen et al. (2003) the gender difference was not so clear, although the association was slightly stronger in males.

Alexithymic individuals appear to possess adequate vocabulary to describe their feelings, but because the feelings are poorly differentiated, the individuals have difficulties identifying or describing them properly (Irwin & Melbin-Helberg 1997, Taylor et al. 1997b). It is worth pointing out that the difficulties commonly faced already in their childhood by individuals with impaired speech development are very similar to those experienced by alexithymic individuals (Way et al. 2007). Due to lacking communication and regulation skills on an emotional level, it is often hard for them to bond deep and gratifying peer relationships, leading to difficulties in various social situations (Craig & Washington 1993, Brinton & Fujiki 1999). Based on these similarities, it is not surprising that irregularities in interpreting emotional and facial cues have been found both in individuals with impaired speech development (Timler 2003, Spackman et al. 2005) and, in individuals with alexithymia (Kano et al. 2003).

The association between speech development at the age of five years and later alexithymia was most significantly attributed to the ability to comply with multi-part instructions, which measures receptive language skills. Although the above mentioned studies cover mostly impairment of speech production, also receptive language skills have been studied in this regard. Recently, Schoon et al. (2010) found that poor receptive language skills at the age of five years predicted significantly lower level of adult mental health and psychosocial adjustment. It allows to hypothesize that the relation of alexithymia and impaired speech development is not only confined to speech production, but there is a relation with receptive speech development as well. Thus, it is plausible that children with impaired language skills and the resulting struggle in social situations have a higher risk of developing alexithymia. However, bringing the findings on the association of alexithymia with

speech development and parental attitude together, leads also to interesting hypotheses. For example, it is possible that certain innate temperament characteristics of the child leads to passivity in social interaction and thus, promotes slower speech development and further to alexithymic features. This passivity and struggling in social interaction may also induce the noted parental overprotection. Depending on the temperament of the child and furthermore, the compatibility of the mother's characteristics with it, may also *per se* promote uncertainty in the relationship and overprotective behaviour in the mother. Thus, for its part, parental overprotetiveness may again lead to social restrictiveness and further to lagging speech development and alexithymia. These pieces of the puzzle may be intertwined in many ways and these associations appear to be as intricate as the whole developmental process of alexithymia.

6.5 Other issues

In several studies, the associations of the EOT subscale have been discordant when compared with the DIF and DDF subscales. The TAS-20 scale as a whole, as well as its DIF and DDF subscales have proven to have good validity, whereas the validity of the EOT subscale has been only moderate (Bagby et al. 1994a, 1994b, Parker et al. 2003; Taylor et al. 2003). Also in the present study, the associations of the EOT subscale were divergent compared with the other subscales. For example, while a significant relation was found between the DIF and DDF subscales and both eating disorder symptoms and anxiety, respectively, the EOT subscale appeared not to be associated with them. In contrast, the association of speech development with later alexithymia was clearly attributed to the EOT subscale. These central findings were in line with previous studies. On the basis of the present study, the associations of the EOT subscale are indeed different from the corresponding relations of the DIF and DDF subscales. The EOT has been suggested to be the most

constant subscale, reflecting its developmental nature, whereas DIF and DDF may fluctuate with mood (Saarijärvi et al. 2006). This further strengthens the contemporary understanding that alexithymia should be comprehended as a construct with a wide spectrum and degree of difficulty, and these relations portrait the different emphasis of alexithymic features.

Subjectively perceived health appeared to be notably associated with alexithymic features. Alexithymic individuals assessed their overall health as being significantly poorer, in comparison with their non-alexithymic peers, and this association remained in several analyses conducted in Studies I–IV. The same finding has been made previously in different Finnish population studies, both in adults (Honkalampi et al. 2000b, 2004b, Mattila et al. 2006) and in adolescents (Honkalampi et al. 2009). However, it must not be forgotten that alexithymic subjects showed significantly more frequently mental problems, such as anxiety, hazardous drinking, as well as, eating disorder and depressive symptoms. Thus, it can be hypothesized that, in spite of their deficiencies in insight on an emotional level, alexithymic individuals are able to assess their mental problems relatively well and thus, are likely to seek professional help for their symptoms.

6.6 Strengths and limitations of the study

There were some limitations in the present study to be considered. In Studies I–III, the cross-sectional design sets its limitations since it precludes the possibility of drawing any conclusions about causality. However, as presented previously in this dissertation (Chapter 2.3), reliable methods for measuring alexithymia have not been available even for more than two decades. Despite the relatively extensive research on alexithymia, longitudinal studies are scarce. Causation is difficult to establish also because there are several possibilities as to how familial factors are

affiliated to alexithymia and there is a clear risk of recall bias. In Study III, since the parental attitude was evaluated using only the subjects' assessments, a more reliable picture of the child-parent relationship would have been received, if also the parents' assessments would have been at disposal. This would also have enabled an evaluation of the temperament of the child, and an outright sturdier estimate on causality. As pointed out above, twin studies have suggested a genetic influence on alexithymic features (Heiberg & Heiberg 1977, Jørgensen et al. 2007). One may also argue that traumatized individuals are not able to correctly assess parental attitudes perceived in childhood, and that traumatic experiences may induce overprotective parental behaviour *per se* (Kooiman et al. 1998). Additionally, Lumley et al. (1996) have proposed that, alexithymia could be an adult defence mechanism to cope with unresolved family conflicts rather than a primary deficit due to early experiences.

The measures applied in the present study also set their limitations. First, the results obtained in Studies I–III are based on self-reported material alone. Second, the measures themselves have also been questioned (for their validity). Regarding the TAS-20 scale, the validity of the EOT subscale is only satisfactory compared with the DIF and DDF subscales, as pointed out in previous studies (Bagby et al. 1994a, 1994b, Parker et al. 2003, Taylor et al. 2003). It has even been questioned whether the most alexithymic individuals are able to assess their alexithymic traits accurately with a self-report measure (Lane et al. 1996). Recently, Parker et al. (2010) questioned the psychometric properties of the TAS-20 scale in adolescents. However, the age group in the present study is more parallel to the group of young adults (19 to 21-year-olds) used in the study as a reference group, which showed satisfactory psychometric properties. The cut-off score of 61 points or more has provoked speculation as well (Loas et al. 1996). The cut-off score was suggested by the developers of the scale in the basis of a relatively small sample of students (Bagby & Taylor 1997). Even though its validity may not have been studied thoroughly, the cut-off score has been used

extensively in studies using the TAS-20 scale in different languages. Therefore, to facilitate prevalence comparisons with previous research, the original cut-off score was applied in this study.

The evidence regarding the SCOFF questionnaire used in Study I is still rather scarce, and the lack of comparable studies inevitably impedes the evaluation of the significance of the results. In Study II, since the normative data for the STAI-State and STAI-Trait scales was not deemed as being applicable, the cut-off scores used here are not supported by any previous studies. Nevertheless, the mean values were compared with the normative values provided by Spielberger & Vagg (1984) and, in females, they were at the same level for both the STAI-State and STAI-Trait scales. In males, however, the mean scores were consistently lower than the normative values, and in certain comparisons the number of male subjects was rather low. In any case, the differences observed in the analyses were clearly statistically significant in both genders. In this study, the use of depression and alcohol consumption as covariates substantiates the results.

In Study IV, due to the lack of comparative studies, an exploratory approach to the subject matter was used. Thus, it is, likely that there were correlations between the variables that could not be controlled for. Due to the large number of variables and potential correlations, the significance level was set at $p<0.01$ in order to avoid overestimating significant associations. However, by setting the level higher, it is possible that some false negative associations were excluded from the multivariate analyses. Regardless of the significance level, the associations observed in males were strong and for their part, the generalisation of the results is good.

Given the study design, the strengths of the present study include the relatively high response rate. Although the participation rate was lower among males and older subjects, the overall participation rate was quite high (78%) and thus, presumably did not have a deteriorating impact on general

applicability of the results. Regarding Studies I–IV, to my best knowledge, no fully comparable studies have been published previously. An essential reason for this is that the alexithymia studies carried out up to date have mostly involved different adult populations and clinical patient groups. Despite the limitations resulting from the lack of comparable studies, the fact that the population in this study is comprised of healthy adolescents reflects one of its central strengths, namely, that it provides much needed new evidence regarding this age group.

7. CONCLUSIONS

In this study, the prevalence of alexithymia was 8.2% for females and 8.5% for males. This is parallel to the prevalence found in previous population studies among adolescents. No gender difference was observed in the mean TAS-20 total scores.

In alexithymic adolescents, eating disorder symptoms are more common in comparison with their non-alexithymic peers. This was the first time the SCOFF questionnaire was used to measure eating disorder symptoms in association with alexithymia. Two out of the three alexithymia subscales, namely difficulty identifying feelings (DIF) and difficulty describing feelings (DDF), were associated with the SCOFF score. Alexithymic subjects presented more eating disorder symptoms, and the share of SCOFF positive among them was threefold as compared with non-alexithymic group.

Alexithymia was also found to be strongly associated with anxiety in adolescents. The association was evaluated taking into account depressive symptoms and use of alcohol as well. The relation between alexithymia and anxiety remained strong in both genders in the multivariate analyses and the association was mostly attributed to difficulty identifying feelings. Difficulty describing feelings was associated with the STAI-Trait score and externally oriented thinking with the STAI-State score, but otherwise the associations of EOT were more obscure. It is also worth noticing that the highly anxious alexithymic subjects were more likely to suffer from depressive symptoms and their use of alcohol was more hazardous when compared with their equally anxious non-alexithymic peers.

Lack of social support, as well as parental overprotection appeared to predict alexithymia. After controlling for the socio-demographic factors, alexithymic features were associated with the lack of social support, particularly from friends. Maternal overprotection was more strongly associated with alexithymia than paternal overprotection, both in females and males. The relation between maternal overprotection and alexithymia was attributed, both to difficulty identifying and describing feelings. In this study, parental care was not significantly associated with alexithymic features.

Developmental factors comprehensively assessed at the age of five years were analysed in association with alexithymia in late adolescence. Surprisingly, speech development appeared to be the only significant factor in this regard and, moreover, in males alone. Due to the lack of comparable studies, it remains an open question whether this is a gender-specific finding. Interestingly, the association was attributed strongly to the EOT subscale, whereas in the other studies presented in this dissertation, the associations were mainly attributed to the DIF and DDF subscales.

It is also worth pointing out, that in studying the association between alexithymia and the different mental problems and factors associated with its development, perceived health was repeatedly found to be associated with alexithymia. This strengthens the previous findings in adolescents that, alexithymic individuals are prone to assess their subjective health poorer compared with their peers.

7.1 Implications for clinical practice

This study shows that alexithymic late adolescents present significantly more mental problems than their peers do. Additionally, the results in the present study support the earlier findings that

alexithymia is associated with the perception of poor subjective health. This indicates that these individuals are commonly encountered in psychiatric care settings and, by general practitioners. Alexithymic individuals often experience their emotions as diffuse, and since the expression of feelings is generally even harder for adolescents, these individuals require explicit assessments so as to ensure that, for example, their mood disorders are addressed adequately.

Since alexithymia is likely to predict a poorer outcome in several different mental disorders also in adolescents, the possibility of alexithymia should be explored efficiently, preferably before initiating any psychological treatments, but at the latest, if the outcome is not the predicted. The present results suggest that, for example, anxious patients with depression symptoms and/or hazardous alcohol consumption should be evaluated also in terms of alexithymia. Thus, the therapeutic methods used with these individuals could be more beneficial for the development of their emotion regulation skills and, moreover, the treatment of their mental disorder.

7.2 Implications for future research

The aetiology of alexithymia is still inadequately understood. This study adds to the findings of the previous research by showing that subjectively experienced social support, as well as overprotective and intrusive parental attitudes are associated with alexithymic characteristics. In this regard, the lack of social support from friends emerged as emphasized, and there is a need for further studies to evaluate the role of peer relationships in the development of alexithymia.

This was the first time comprehensively assessed developmental factors were evaluated in association with alexithymia without the degrading effect of recall bias. Interestingly, only impaired speech development in childhood was significantly associated with later alexithymia in males. This

supports the theory that alexithymia is a developmental process that may be influenced by, for example, impaired language skills, which for their part can lead to varied difficulties in social relationships. However, further studies are needed to clarify whether this is a gender-specific phenomenon.

Although the results speak for the association of alexithymia with several mental problems also in adolescents, causality is difficult to establish. Thus, prospective studies are required in order to shed more light on the mechanisms through which alexithymia possibly predisposes individuals to the development of different mental disorders. With reference to the findings regarding the factors possibly influencing the development of alexithymia, longitudinal studies are called for in order to elucidate how and when alexithymia is developed and in what ways these different factors impact on this process. In this regard, studies taking simultaneously into account both environmental and neurobiological factors could be fruitful.

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