



**DET PSYKOLOGISKE FAKULTET**



***Giardia Patients in Bergen with Continued Complaints:  
Current Status on Gastrointestinal Complaints, anxiety, depression  
and neuroticism***

HOVEDOPPGAVE

*profesjonsstudiet i psykologi*

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## Abstract

The aim was to investigate 111 former Giardia patients in Bergen, in context of the subjective health complaints field. Gastrointestinal complaints and its relation to anxiety, depression and neuroticism were assessed with GSRS, ROME II, HADS, and EPQ-R(N). Gender differences on these variables were investigated.

We found that gender differences are related to complaints prior to Giardia infection. Anxiety and depression levels are high and only related to complaints prior to Giardia infection. The relationship between neuroticism and complaints are complex. We conclude that our sample is unique and not directly comparable with other IBS populations. The high levels of anxiety and depression could be used as a possible route to alleviate the patients in some aspects of their complaints.

## Introduction

### *The Epidemic in Bergen*

In the period October to December 2004, 1300 people were infected with the parasite *Giardiasis Lamblia* in Bergen (Steen & Damsgaard, 2004). Bergen is the second largest city in Norway, with a population of 240 000. In comparison, only 1-2 domestic cases of *Giardia* infection were reported annually in Bergen the previous years.

The first individuals were infected in the beginning of September, and the number of cases increased gradually after this, until it reached a peak in the midst of October (Nygård & Schimmer, 2004). The epidemic probably started six weeks before it was acknowledged (Steen & Damsgaard, 2004). It seemed to be very difficult to diagnose the infection on a clinical basis, since there was no awareness that the symptoms were caused by the parasite. The source of contamination was a water reservoir which supplies the city-centre of Bergen with water. The infected individuals were mainly in their twenties (20-29 years), with few children or elderly. They showed symptoms of diarrhoea, fever, vomiting and nausea, abdominal pain, flatulence, weight loss, blood and mucus in the defecation/stool (Steen & Damsgaard, 2004). The individuals were treated with antibiotics which cured most of them. None of them were hospitalised as emergency cases.

### *General Information about the Parasite Giardiasis Lamblia*

*Giardiasis Lamblia* is a parasite that is among the most common identified causes of outbreak of waterborne diseases in many countries worldwide (Nygård, Vold, Robertson & Lassen, 2003). Individuals infected by *Giardia* can get diarrhoea, pain in the upper stomach region, foul smelling gas and flatulence, and weight loss. The most typical course is 1-4 weeks, but some get a chronic course of symptoms (Nygård et al., 2003).

*Terms of contamination.*

The parasite, can in the form of cysts, infect through direct or indirect faecal-oral contact with humans or animals, or for example via water or food/nutrients. The dose of contamination is low (under 100 cysts is enough to infect) (Wahl & Evanger, 2007). The World Health Organisation (WHO) estimates that about 200 million humans in Asia, Africa and Latin America have symptomatic Giardia. About 500 000 get infected every year, the majority is children. In Norway there are between 200 and 400 reported cases of Giardia infection every year, based on estimates from the years 1994-2003. According to The Norwegian Surveillance System for Communicable Diseases (2005), the majority of the reported cases are infected abroad, often countries in Asia.

*The course of infection.*

In developmental countries the infection is mostly asymptomatic and individuals often become long-lasting carriers (Folkehelseinstituttet, 2005). In industrialised countries the course of the infection is different, as a common symptom after infection is diarrhoea. Treatment of both asymptomatic and acute ill patients consists of metronidazol in seven days, or either metronidazol or tinidazol as a single dosage (Folkehelseinstituttet, 2005).

*Complaints Among the Giardia Patients in Bergen After Medical Treatment*

Of the original 1300 Giardia patients, there were about 200 patients who did not have an effect from this medical treatment, and these individuals continued to have complaints. The medical experts at the Haukeland hospital in Bergen have tried to treat the patients with medicine (for Giardia, even though they showed no signs of the parasite), and with diets or anti-inflammation medicine, without any results (Hanger, 2007). Medical examinations as

gastroscopy and colonoscopy show no structural findings, and the patients were given the diagnosis post infectious irritable bowel disease. Kurt Hanevik, a medical doctor at Haukeland Hospital says that “It is unique that so many young people get these complaints”. Incidents of IBS have been reported post salmonella and campylobacter infections, but never before after Giardia infection (Hanger, 2007). Three years post the infection; some of the patients still have complaints (Hanevik et al., 2007). Some of them are seriously influenced by this incidence, as they had to quit their studies or jobs, and alter their life to adjust to the complaints (Hanger, 2007). The subjects in our sample are unique considering their young age and their high levels of subjective health complaints. It is interesting to look at what aspects that seems to characterize this group and what might be possible reasons for the continued complaints among these patients.

### *Subjective Health Complaints*

In trying to understand the patients infected by Giardia that report to have complaints after medical treatment, the term health, illness and disease are important terms to put under scrutiny, as a basis in trying to understand their condition. According to WHO, health includes physical, social and psychological well being, not just the absence of illness or weaknesses. Disease is understood as a pathological state with objective signs of changes specific to the disease. Illness is understood as a state in which the person is feeling sick, including both pain and suffering (Eriksen, 1999). Different kinds of subjective health complaints would fall into this last category. Based on the course of reported symptoms in our sample, the individuals would be categorized as having a disease as they were infected with the Giardiasis parasite. After medical treatment they no longer had any signs of infection, but still experienced health complaints. This state would be categorized as illness, and placed in

the field of subjective health complaints. In our study, research within this area thus seems relevant in trying to understand our sample.

A variety of subjective illnesses exists within the field of subjective health complaints. Based upon the type of complaints reported by the individuals in the time after Giardia infection and medical treatment, possible parallels to irritable bowel syndrome, functional dyspepsia and myalgic encephalitis can be found. These categories of subjective health complaints thus seem potentially relevant in trying to understand their condition. In this study though, we will focus on irritable bowel syndrome, since the patients in our sample consists of individuals that were seeking medical assistance related to gastrointestinal complaints. The type of complaints among the patients bears similarity to IBS.

A common factor for different categories within subjective health complaints are considerable ambiguity in the diagnosis and treatment (Eriksen & Ihlebæk, 2002). Another aspect of the ambiguity, is that some of the major symptoms related to the subjective health complaints, overlap with depressive disorders. Examples of such symptoms are insomnia, bodily aches and fatigue, which all are listed in the diagnostic system of mental disorders (DSM-IV) as possible criteria's for a major depressive episode (Eriksen & Ihlebæk, 2002).

### *Subjective Health Complaints and Gender*

Different factors have been hypothesized as having an impact on subjective health complaints. Starting out broadly, research has focused upon gender. A cross-national study of the dimensionality and prevalence of subjective health complaints of adolescents indicated a pattern of gender differences (Haugland, Wold, Stevenson, Aaroe & Woynarowska, 2001).

Based on a representative sample of 11, 13 and 15 year old students, the results indicated that symptoms reported in general increased with age of both genders, girls reported more complaints than boys and the gender difference increased with age. A Norwegian study



where the Subjective Health Complaints Inventory was used, results showed that women reports more complaints than men (Eriksen, Ihlebæk & Ursin, 1999). On the factor for Gastrointestinal problems, there was a higher prevalence of women (69 %, N=617) than men (46%, n=149). On the factor “severity” of subjective health complaints in general, women had significantly higher scores than men. Women also scored significantly higher on “severity” of gastrointestinal problems compared to men (Eriksen, Ihlebæk et al., 1999).

Based on existing findings in the field of subjective health complaints, it is hypothesized that in our sample, women will have a higher degree of complaints relative to men.

#### *Irritable Bowel Syndrome*

The type of complaints the patients in our sample describe, were by the medical profession at Haukeland placed in the category of irritable bowel syndrome (IBS). Camilleri and Choi report that IBS is a chronic gastrointestinal disorder with a worldwide prevalence of 10-20% (Lackner, Dowser, Mesmer & Hamilton, 2004). IBS is primarily characterized by abdominal pain or tenderness, and altered bowel habits such as diarrhoea and constipation (Wan & Blanchard, 1994). The physical causes of IBS are at this point not known, and are commonly considered a stress-related disorder (Wan & Blanchard, 1994).

Generally, for all types of subjective health complaints, the person’s perception of symptoms seems important. Eriksen (1999) has shown that perception of complaints seem to vary both within the same category of complaints, and between different types of complaints. Catastrophizing about the complaints are related to worse prognoses compared to perceiving the complaints as worrying, but manageable.

Irritable bowel syndrome (IBS) is focused upon in this study. Different psychosocial factors have been linked to the incidence and recurrence with the course of IBS (Levenstein, 2002).

Possible mechanisms include immune deregulation, gut permeability changes, and poor medication adherence. IBS is considered as belonging to the growing category of diseases thought to have an infectious component, in this case an exaggerated immune response to gut bacteria. The condition is seen as representing as unique interactions among psychosocial, immunologic, endocrine, infectious and behavioural factors (Levenstein, 2002).

#### *Irritable Bowel Syndrome and Co morbidity with Other Functional Disorders*

The absence of standardized diagnostic criteria for the combination of functional gastrointestinal and psychiatric disorders makes precise descriptions and classification of these syndromes difficult (Olden, Drossman, Douglas & Olden, 2005). However, the last 15 years significant advances have been made on this matter. Today the Rome and Rome II criteria are used to provide a common clinical basis description and research (Olden, Douglas & Drossman, 2000). It has been questioned though, if IBS can be categorized as a separate disorder because the disorder seems to be frequently occurring with other co morbid or extra intestinal symptoms. Whitehead, Palsson and Jones (2002) did a systematic review on the co morbidity between IBS and other disorders. The results show that the co morbidity with other functional disorders is high. Whitehead and others suggest that this may be caused by a shared pathophysiological mechanism, such as visceral hypersensitivity. The non gastrointestinal nonpsychiatric disorders with the best documented association to IBS found in this review were fibromyalgia, chronic fatigue syndrome, temporomandibular joint disorder and chronic pelvic pain. The study concludes that these disorders seem to be distinct from one another, but that the strong co morbidity suggests a common feature important for their expression, and that this feature most likely is psychological.

*Irritable Bowel Syndrome and Co morbidity with Anxiety and Depression*

The previously mentioned systematic review by Whitehead et al. (2002) also includes investigation of co morbidity between IBS and psychiatric disorders. The review shows co morbidity to major depression, anxiety and somatoform disorders occurring in up to 94%. The co morbidity is considered as manifestations of varying combinations of interacting physiological and psychological factors. Alternatively it is seen in relation with IBS as a heterogeneous group, with some patients having a predominantly psychological aetiology, while others have a predominantly biological aetiology. The presence of different co morbid disorders is here understood as a marker for psychological influences on aetiology (Whitehead et al., 2002). If this can be said to apply for all patient groups, we hypothesize that it can be assumed that higher levels of anxiety and depression can increase the level of complaints in our sample of subjects as well.

*Irritable Bowel Syndrome and Individual Characteristics*

Other psychological features identified to be greater in IBS are personality style, altered health beliefs, cognitions and coping style (Drossman et al., 2002). Focusing upon personality, Farnam, Somi, Sarami, Farhang and Yasrebinia (2007) found that compared to the general population, IBS patients scored higher on neuroticism (26.25, SD 7.80) on NEO-PI-R, compared to controls (22.92, SD .54). They suggest that emotional states and personality traits may affect the physiology of the gut and also play a role in how symptoms are experienced and interpreted. Neuroticism is a personality trait characterized by overstated reactivity to physiological changes (Farnam et al., 2007). Costa and McCrae suggest that people with elevated scores on the neuroticism dimension are emotionally unstable with overwhelmingly negative emotions. The dimension is also related to emotional intelligence, which involves emotional regulation, motivation and interpersonal skills (Farnam et al.,

2007). Hans Eysenck has further suggested that neuroticism is a function of activity in the limbic system, and research have shown that people who score high on neuroticism have a more reactive nervous system, and are more sensitive to environmental stimulation (Farnam et al., 2007).

A study focusing on the prevalence of IBS among university students and different psychological factors (e.g. worry, neuroticism, anxiety sensitivity and visceral anxiety), found results that seem to be in line with Farnam et al.'s (2007) result concerning neuroticism. The IBS patients in this study had higher scores on EPQ-R(N) than controls. There are several possibilities of how the relation between IBS and personality might be. Aronowitz and Spiro suggest that any personality traits characteristic of IBS are likely to be secondary to long standing illness, although Gazzard, Price, Libby and Dawson suggest that the individuals personality structure per se might influence the adjustment to the disease (Levenstein, 2002). Another link suggested is that IBS could influence personality especially if the onset of IBS happens during adolescence. Studies by Robertson et al. and Siegler et al. have reported that in IBS patients there is a slight excess of obsession symptoms or neuroticism (Levenstein, 2002). This relation suggests that personality changes are secondary rather than causative (Levenstein, 2002).

The specific role personality has on IBS is unclear; although it seems plausible that personality has an impact on the condition. We hypothesize that we would find higher levels of neuroticism on EPQ-R(N) among individuals with higher levels of reported complaints post Giardia infection, based on ROME II criteria's. For our sample we also expect that there would be higher levels of neuroticism reported among patients that reported higher levels of gastrointestinal complaints prior to the Giardia infection, based on GSRS.

*Models Integrating Psychosocial Factors*

Different models have been developed in trying to integrate psychosocial factors and the various forms of categories within the field of subjective health complaints. Wilhelmsen (2005) has suggested a dual- aetiology hypothesis of functional somatic syndromes. The hypothesis states that in some patients with these kinds of complaints, there is a predominant biological aetiology, whereas in others, there is a predominant psychological aetiology. Cognitive factors like catastrophizing, amplifies subjective physical symptoms, and emotions also affect the perception of symptoms.

Brosschot (2002) has focused on the relationship between somatic health complaints and the role of cognitive- emotional sensitization. Holger Ursin suggests that sensitization could be understood as an increased efficiency in the synapse due to repeated use (Broschot, 2002). Sensitization theory has been used to account for the development of subjective health complaints, and negative affect is suggested as a catalyst in this process (Brosschot, 2002). A prospective study by Spence and Moss-Morris found that individuals who developed IBS had significantly higher levels of anxiety, somatisation, and negative illness beliefs perceived at the time of infection, than individuals who did not develop IBS. They conclude that high levels of anxiety and stress, and the tendency to interpret illness in a pessimistic way, are risk factors for developing IBS (Spence & Moss-Morris, 2007). These findings implicate that psychological factors like negative affect, illness beliefs and stress have a major impact on subjective health complaints. According to the studies mentioned, it is likely to find a connection of neuroticism and increased level of complaints. In addition, it is likely to find a connection of anxiety and depression and increased complaints.

## Hypotheses

The aim of our study is to describe the group of patients on the selected tests, which also have been used on other subjective health population. We want to compare the sample on these variables with findings in the field of subjective health and further; explore if there are gender differences on reported gastrointestinal complaints. We also want to assess how the patients can be described on the following psychological factors: anxiety, depression and neuroticism, and if these factors are related to the levels of gastrointestinal complaints. Since findings within the field of subjective health complaints and IBS populations show gender differences, we want to explore if there are differences between men and women on the psychological variables and on gastrointestinal complaints. Our rationale is; that if we find gender differences on gastrointestinal complaints, maybe the psychological factors included in our study could be a source of information that could help explain these possible gender differences on gastrointestinal complaints.

We hypothesize the following:

- i. Women will have relatively higher scores in measures of complaints compared to men.
  - i. a) We expect that women will score higher on levels of complaints post Giardia infection compared to men.
  - i. b) We expect that women will score higher on levels of complaints prior Giardia infection compared to men.
- ii. Higher levels of anxiety and depression are correlated with higher levels of complaints.

- ii a) Is there a gender difference in reported levels of anxiety and depression?
- ii b) How is the level of complaints related to the level of anxiety and depression among men and women?
  - ii b 1) How is the level of complaints post Giardia infection related to the level of anxiety and depression among men and women?
  - ii b 2) How is the level of complaints prior Giardia infection related to the level of anxiety and depression among men and women?
- iii. Higher levels of neuroticism are correlated with higher levels of reported gastrointestinal complaints.
  - iii. a) Is there a gender difference in reported levels of neuroticism?
  - iii b) How is the level of complaints related to the level neuroticism among men and women?
    - iii b 1) How is the level of complaints post Giardia infection related to the level of neuroticism among men and women?
    - iii b 2) How is the level of complaints prior Giardia infection related to the level of neuroticism among men and women?

## Methods and Sample

### *Study Design*

The study was a cohort study with patients with persisting symptoms post Giardia infection. The data was collected as part of the clinical evaluation by medical doctors at Haukeland hospital. The regional Ethics Committee approved the data collection and analysis of the study.

Variables included, were measures on gastrointestinal symptoms post Giardia infection based on ROME II criteria's for irritable bowel syndrome (ROME II (Short version)), as a reflection of their current condition. The subjects were also measured on gastrointestinal complaints one year before Giardia infection using The Gastrointestinal Symptom Rating scale (GSRS). This measurement was based on the patients looking back on their gastrointestinal health condition in retrospect, and was reported at the same time as they reported their current condition. Levels of anxiety and depression were assessed with The Hospital Anxiety and Depression Scale (HADS). Levels of neuroticism were assessed using Eysenck Personality Questionnaire (EPQ-R(N)). Gender was also included as a variable in this study. The study focused on the current and previous levels of gastrointestinal complaints, and to what degree these levels correlate with gender, anxiety and depression levels, and levels of neuroticism.

### *Subjects*

The total number of subjects was 111. The number of subjects in each analysis varied as a consequence of exclusion criteria on each subsequent test and combination of tests.

### *Age*

In the group of 1300 patients there was a predominance of individuals in the age of 20-29, with few elderly or children (Nygård, Schimmer, Søbstad, Walde, Tveit, Langeland et al., 2006). The mean age of all subjects in our study is 30.8 (N=111, SD 10, 73, min 15.7, max 76.4, median 28.0). The mean age of women is 31.0 (N=67, SD 11.33, min 15.7, max 76.4, median 28.8). The mean age of men is 30.5 (N=44, SD 10.0, min 15.6, max 57.8, median 26.5). In this study the subjects are considered to be similar enough age-wise to be chunked together in one large group (21-30).



*Sex*

In the original sample of infected individuals (N=1300), there was 60% more women than men (Nygård et al., 2006). In our sample (N=111) it is 50% more women than men.

*Criteria for Inclusion and Exclusion*

Subjects included in our study had been diagnosed with Giardia infection. In addition, the subjects had persisting abdominal symptoms after one or more treatment courses of metronidazole.

Subjects that had atypical symptoms or co morbidity with other illnesses were excluded from this study. With more than two missing answers on any of the tests, the subject was excluded only on this test in the dataset. In cases where one or two answers to the questions were missing on HADS and EPQ-R(N), an approximate of the scores was calculated by this formula (score\*answered questions/sum of questions).

*General Assessment*

The subjects were given the following tests; ROME II, GSRS, HADS and EPQ-N(R). The tests were administrated during the patients' initial meeting at Haukeland Hospital in Bergen. The test given was a package which was put together by the medical doctors at the department of Gastroenterology at Haukeland hospital in Bergen. The package aimed at measuring symptoms pre- infection with the questionnaire GSRS, and post infection with ROME II. The psychological features anxiety, depression were assessed using HADS. Neuroticism was assessed with EPQ-R(N).

It should be mentioned that the measurements this study is based upon, were solely chosen by the medical doctors at the department of Gastroenterology at Haukeland Hospital. The authors of this article were not involved in planning of which type of measurement, and

which variables, that the sample was to be assessed on. We became part of the project after the data were collected. To the reader it should be noted, that as the Giardia epidemic came rather sudden, the choice of which tests and which factors that should be included in the study had to be taken rather quickly by the medical doctors, and in retrospect they say that the methodological basis could have been improved, if more time had been available in the preparation of the study.

### *ROME II*

The ROME II classification system is based on the work of Rome Committees that developed consensus criteria for over 20 functional gastrointestinal disorders. The ROME II is a symptom based diagnostic classification system, and is also based on a hypothesis that for each disorder there is a cluster of symptoms (Drossman, 1999).

#### *ROME II (Short Version).*

Questions were based on the Rome II criteria for IBS (modified Rome II modular questionnaire) originally by Thompson, Longstreth, Drossman, Heaton, Irvine and Muller-Lissner (1999). The subjects are asked to rate following items on a scale of 0-10; nausea, bloating, stomach-ache, constipation, diarrhoea and anorexia. The version used in this study is ROME II Short, which is a short version of ROME II assessing IBS. The short version is translated from English to Norwegian at the department of Gastroenterology at Haukeland University Hospital by Arnold Berstad, Johann Lunding and Ragna Lind. It has been used in several studies, e.g. by Vandvik, Wilhelmsen, Ihlebæk and Fahrup (2004), and also studies by Trygve Hausken, Arnold Berstad, Mette Morken, Kurt Hanevik, Vernesa Dizdar at Haukeland Hospital. All items and response alternatives on ROME II (short version) used in our study is enclosed in Appendix A.

### *The Gastrointestinal Symptom Rating scale*

The Gastrointestinal Symptom Rating scale (GSRS), developed by Svedlund, Sjödin and Dotevall (1988) were originally used in assessing gastrointestinal complaints among patients with IBS and peptic ulcer. The questionnaire was developed because of a need for rating scales designed to evaluate a wide range of gastrointestinal symptoms (Svedlund, Sjödin & Dotevall, 1988). The questionnaire consists of fifteen items with different gastrointestinal symptoms in which the subject rates the symptom severity on a likert scale ranging from 0- 6. The maximal score on GSRS is 96 points. GSRS in a Norwegian version has been used on Haukeland Hospital as a measurement of gastrointestinal complaints prior to Giardia infection. The medical doctors at Haukeland Hospital responsible for completion of collection of data in this study have added to the original version. The GSRS version used in our study thus include a total of 16 items. In our study the questionnaire was used as a measurement of symptoms the subjects experienced the previous year before they were infected with Giardiasis. All items and response alternatives on GSRS used in our study is enclosed in Appendix B.

### *The Hospital Anxiety and Depression Scale*

The patients' depression and anxiety levels were assessed with The Hospital Anxiety and Depression Scale (HADS). HADS was developed in 1983 by Zigmond and Snaith (Zigmond & Snaith, 1983). The scale is divided in two subscales, anxiety (HADS-A) and depression (HADS-D), both with seven intermingled items. The HAD Scale is likely to separate the concepts emotional and somatic illness, and the scores are not affected by the presence of bodily illness (Zigmond & Snaith, 1983).

A review of the validity of HADS found that HADS is suitable for assessing the symptom severity and caseness of anxiety disorders and depression. This applies for both somatic, psychiatric and primary care patients as well as the general population (Bjelland, Dahl, Haug & Neckelman, 2001). A Norwegian version of the HADS questionnaire was used in this study. According to a review of the validity of HADS, the Norwegian version is valid (Bjelland et al., 2001). The Norwegian version of HADS is also used e.g. in a study by Tone Tangen Haug, Arnstein Mykletun and Alv A. Dahl (2004).

Zigmond and Snaith separate cases in three groups according to subscale scores. For both HADS-A and HADS-D, scores of 7 or less are considered non-cases, scores of 8-10 are considered doubtful cases, and scores of 11 or more are definite cases (Zigmond & Snaith, 1983). If the scale is used in research; the cut off point can be in either the lower or upper end of the borderline range. If the research require inclusion of all possible cases; the lower end (8-9) should be used, and if it requires the inclusion of only the cases with a high probability of suffering from the mood disorder the upper end (10-11) should be used (Zigmond & Snaith, 1983).

In a review of the validity of HAD the suggested cut-off value for possible cases are 8+ (Bjelland et al., 2001). In this review it is also reported that the sensitivity of the subscales HADS-A and HADS-D with a threshold of 8+ were often found in the range of 0.70 to 0.90 (Bjelland et al., 2001). According to Zigmond and Snaith (1983), a cut-off point at 10 is considered as a cut-off point in the upper end. We chose to divide scores into two groups, where the cut off point is set at 10. Subjects with scores 0-9 is categorized in the low group, and subjects with scores 10+ is categorized in the high group. All items and response alternatives on HADS used in our study is enclosed in Appendix C.

*Eysenck Personality Questionnaire*

The personality dimension neuroticism in Eysenck's personality dimensions, was assessed in our sample using the questionnaire EPQ-R(N). This questionnaire is based on EPQ-R short version, where the 12 items concerning the neuroticism personality dimension (Eysenck et al., 1985) are selected. These items were answered with 'yes' or 'no'. The total score ranges from 0-12, and a higher score would indicate a higher degree of neuroticism. The items were translated to Norwegian by Helge Nordby.

Generally, the neuroticism scale of the Eysenck Personality questionnaire (EPQ-N) assesses general tendency to over-responsiveness or over- reactivity (Malt, Olavsson, Lund and Ursin, 2002) and is based upon the Eysenck Personality Questionnaire developed in 1975 by Hans J. Eysenck (Eysenck et al., 1985). The EPQ was revised in 1985, and the short version was later devised for use when time was limited in the test situation (Eysenck et al., 1985).

The mean for males is 5.17, with SD 3.35, and women 5.93, with SD 2.89 within the normal population of the age group 21-30 years (Eysenck et al., 1985). Based on these values, scores below 7 would be considered normal and scores over 7 as high. According to this, we chose to divide scores on EPQ-R(N) into two groups; low, with scores 0-6, and high, with scores 7+. All items and response alternatives on EPQ-R(N) used in our study is enclosed in Appendix D.

*Statistical Methods*

All analyses were conducted with Statistica 8.0 (Stat Soft Inc.). In all analyses we used nonparametric statistics because of lack of homogeneity in the sample scores. In the correlation analyzes concerning total scores on HADS, scores on the subscales anxiety and depression, total scores on EPQ-R (N) and total scores on ROME II and GSRS;

nonparametric statistics were used, and Spearman Rank Correlation coefficients were estimated. The nonparametric statistical test Man Whitney U was conducted in comparing groups.

## Results

### *Gender Differences on Measures of Complaints*

The main hypothesis here is i) Women will have relatively higher scores on measures of complaints compared to men. With this, we investigate reported complaints both post and prior to the Giardia infection.

### *Gender differences in the level of Complaints Post the Giardia Infection*

First, we investigate hypothesis i a) We expect that women will score higher on levels of complaints post Giardia compared to men.

Descriptive information of how the subjects score on ROME II is given in table 1.

Table 1

### *Means, Standard Deviations, Median and Range on ROME II*

ROME II	N	Mean	SD	Median	Range
All subjects	72	24.28	9.78	25	0-47
Men	27	21.48	9.87	21	4-47
Women	44	26.11	9.48	26	0-44

As table 1 show, the mean score of men is lower than the mean score of women on ROME II. This gender difference in total scores were significant ( $U=423$ ,  $N1=27$ ,  $N2=44$ ,  $p<$

.04). Men have a higher maximal score than women. There was also a significant difference in how men and women score on the item called "nausea" on ROME II ( $U=325.5$ ,  $N_1=44$ ,  $N_2=27$ ,  $p < .001$ ).

These results in general, show that women report higher levels of gastrointestinal complaints post Giardia infection compared to men.

#### *Gender differences in the level of Complaints Prior to the Giardia Infection*

Secondly, we investigate hypothesis i b) We expect that women will score higher on level of complaints prior to Giardia infection compared to men.

Descriptive information of how the subjects score on the Gastrointestinal symptom Rating Scale is given in table 2.

Table 2

*Means, Standard Deviations, Median and Range on Gastrointestinal symptom Rating Scale*

GSRS	N	Mean	SD	Median	Range
All subjects	102	17.68	19.28	14	0-71
Men	42	16.55	19.70	11,50	0-71
Women	59	18.78	19.11	14	0-69

As table 2 shows, the mean score of men is lower than the mean score of women on GSRS. This difference was not significant at  $p < .05$ . Men have higher maximal score than women. After further exploration, using nonparametric statistics (Mann-Whitney U test) of how men and women score on the different items in GSRS, we found a significant gender difference in the total score on item 13 which measures "hard stool" ( $U=1076.5$ ,  $N_1=44$ ,  $N_2=44$ ,  $p < .05$ ).

Summarized, these results show that the differences in gastrointestinal complaints comparing men and women were not very different prior to Giardia infection.

*The Relationship between Levels of Anxiety and Depression and Levels of Complaints*

When we investigate the main hypothesis ii) Higher levels of anxiety and depression are correlated with higher levels of complaints, we look into this according to both post and prior to the Giardia infection. We also investigate if there are gender differences overall, and if there are gender differences when individual levels of anxiety and depression are categorized in a low or a high group.

*Reported Levels of Anxiety and Depression*

First we investigate ii a) Is there a gender difference in reported levels of anxiety and depression? Descriptive information of how the subjects score on HADS in total and the subscales, anxiety and depression is given in table 3.



Table 3

*Means, Standard Deviations, Median and Range on HADS*

HADS	N	Mean	SD	Median	Range
All subjects	111	7.77	6.74	6	0-27
Men	44	8.44	7.83	7	0-27
Women	67	7.33	5.94	6	0-25
<b>Anxiety</b>					
All subjects	107	4.54	3.71	4	0-17
Men	43	4.84	4.36	4	0-17
women	64	4.34	3.23	4	0-13
<b>Depression</b>					
All subjects	107	3.04	3.49	2	0-15
Men	43	4.84	4.36	4	0-17
Women	64	4.34	3.23	4	0-13

There is relatively little variations in the mean scores for men and women, both on HADS overall, and also on the subscales anxiety and depression. Men score higher in general, but the difference is not significant on  $p < .05$ . Note that the mean scores are relatively high. These results show that men and women in general report rather similar levels both on the subscales and in general on HADS.

*Gender differences based on low and high scores on HADS*

The categories of men and women were separately divided in two groups based on scores on HADS. The sample distribution of men and women in each category is given in figure 1 and figure 2.

Figure 1

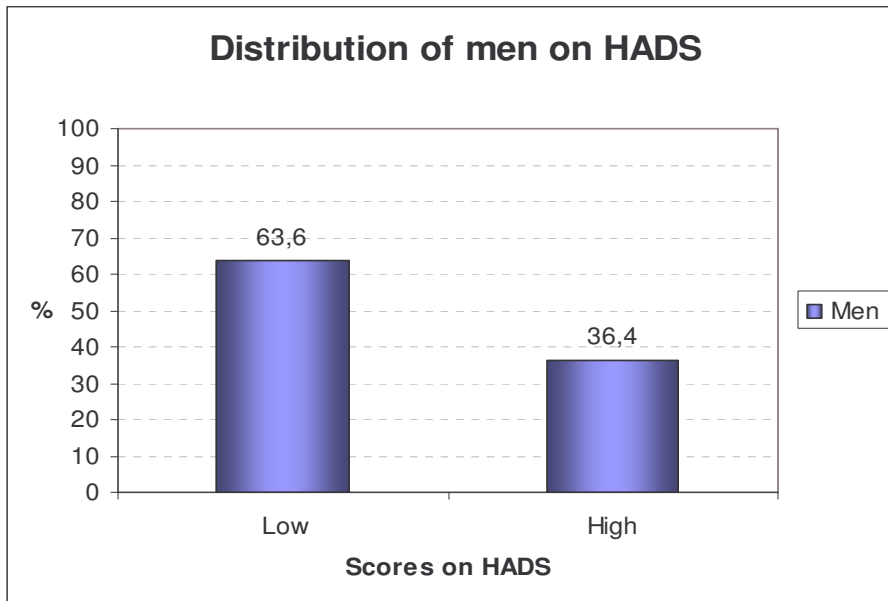
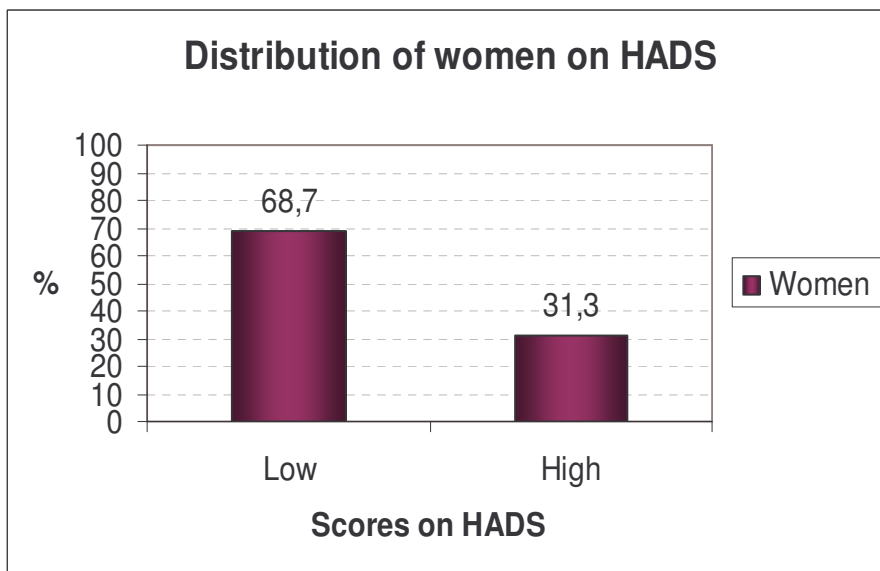
*Distribution of men on HADS*

Figure 2

*Distribution of women on HADS*

No significant gender difference was found. In general, this shows that even though subjects are divided in one low and one high group, compared with results without these categories, there are still no gender differences. The distribution though, shows that there are

relatively more men in the category with low levels on HADS, while there are relatively more women who fall into the category with high levels on HADS.

*The Relationship between Levels of Anxiety and Depression and Levels of Complaints*

When we investigate the hypothesis ii b) How is the level of complaints related to the level of anxiety and depression among men and women? we look into this according to both post and prior to the Giardia infection.

*The Relationship between Levels of Anxiety and Depression and Levels of Complaints post Giardia*

First we investigate ii b 1) How is the level of complaints post Giardia infection related to the level of anxiety and depression among men and women?

In the first part of the correlation analyses, we examined associations between total scores on HADS; scores on the subscales anxiety and depression, and scores on ROME II. Based on these analyses, we did not find significant correlations in the total sample between scores on HADS and ROME II.

When divided in two subgroups on HADS, there were no significant results in the group with low scores. In the group with high scores, results show a significant correlation of the total score on IBS item "nausea" and the total score on HADS ( $r_s = -.40$ ,  $N=25$ ,  $t(N-2)=-2.15$ ,  $p<.04$ ). In the high group there is also a significant correlation of the IBS item "constipation" and the total score on HADS(A) ( $r_s = -.42$ ,  $N=24$ ,  $t(N-2)=-2.20$ ,  $p<.04$ ).

*Correlations on HADS and ROME II for Men.*

When correlation analyses is computed separately for men and women, in the group of men, there is a significant correlation of the scores of IBS item "anorexia" and HADS(D) ( $r_s = .50$ ,  $N=26$ ,  $t(N-2)=-2.88$ ,  $p < .008$ ).

When men were divided in groups based on low and high scores, the results show that men in the group with low scores had a significant correlation between scores on the item "stomach-ache" and HADS total score ( $r_s = .57$ ,  $N=16$ ,  $t(N-2)=-2.57$ ,  $p < .02$ ). For men with low scores on HADS, "stomach-ache" is correlated with levels of depression ( $r_s = .55$ ,  $N=16$ ,  $t(N-2)=-2.45$ ,  $p < .03$ ). In the group of men with high scores, there was a significant correlation between IBS total and depression ( $r_s = .70$ ,  $N=9$ ,  $t(N-2)=-2.60$ ,  $p < .04$ ). These results show that men with low scores on depression report higher levels of stomach ache. Men with pathological scores on depression, also tend to have high scores on IBS complaints.

*Correlations on HADS and ROME II for women.*

No significant correlations between scores on HADS and scores on ROME II were found for women.

Summarized; the results show that levels of anxiety and depression and gastrointestinal complaints post Giardia infection does not correlate when we look at the total scores in the total sample. However; when divided in subgroups there are some significant results in the high group. Looking at men and women separately there are no significant results for women, and few for men.

*The Relationship between Levels of Anxiety and Depression and Levels of Complaints prior to Giardia infection*

Secondly we investigate ii b 2) How is the level of complaints prior Giardia infection related to the level of anxiety and depression among men and women?

In this part of the correlation analyses, we examined the associations between total scores on HADS; scores on the subscales anxiety and depression and scores on GSRS.

In the total sample we found a significant correlation between total scores on HADS and total scores on GSRS for the sample as a whole. The results show that there were significant correlations for the subscales anxiety ( $r_s = .60$ ,  $N=97$ ,  $t(N-2)=-7.82$ ,  $p < .05$ ) and depression ( $r_s = .56$ ,  $N=97$ ,  $t(N-2)=-6.65$ ,  $p < .05$ ), and also total scores on GSRS ( $r_s = .x$ ,  $N=101$ ,  $t(N-2)=-7.54$ ,  $p < .05$ ). All of the items on GSRS correlated with anxiety, depression and total scores on HADS.

When divided in two subgroups on HADS, we found in the group with low scores, significant correlations between HADS in general, and GSRS ( $r_s = .53$ ,  $N=67$ ,  $t(N-2)=-4.98$ ,  $p < .01$ ). On the subscales there was a significant correlation between anxiety and total scores on GSRS ( $r_s = .54$ ,  $N=65$ ,  $t(N-2)=-5.08$ ,  $p < .01$ ) with the exception of item 5 and 10 on GSRS. We also found significant correlations between depression and gastrointestinal symptoms ( $r_s = .035$ ,  $N=66$ ,  $t(N-2)=-3.03$ ,  $p < .01$ ) with the exception of item 3,10,11,12, and 15 on GSRS. In the high group there were no significant correlations between scores on HADS and GSRS.

*Correlations on HADS and GSRS for men.*

Among men, we found significant correlations between GSRS and HADS ( $r_s = .68$ ,  $N=42$ ,  $t(N-2)=-5.94$ ,  $p < .01$ ). On the subscales there were also significant correlations between GSRS and anxiety ( $r_s = .67$ ,  $N=41$ ,  $t(N-2)=-4.90$ ,  $p < .01$ ) except for item 10 on GSRS, and between the subscale depression and GSRS ( $r_s = .62$ ,  $N=41$ ,  $t(N-2)=-4.90$ ,  $p < .01$ )

Among men in the group of low scores, we found a significant correlation between total scores on HADS and total scores on GSRS ( $r_s = .51$ ,  $N=27$   $t(N-2)=-2.99.$ ,  $p < .01$ ), except for item 2, 5, 7, 10, 11, 12, 13 and 14 on GSRS. The results show that there were significant correlations for the subscale anxiety and GSRS ( $r_s = .57$ ,  $N=27$   $t(N-2)=-3.50.$ ,  $p < .01$ ) except for item 2, 5, 7, 10, 12, 13, and 14 on GSRS. There were not a significant correlation between GSRS and depression. For men with high scores on HADS, there was not found any significant correlation with total scores on GSRS.

*Correlations on HADS and GSRS for women.*

Among women, we found a significant correlation between total scores on HADS and total scores on GSRS ( $r_s = .53$ ,  $N=59$   $t(N-2)=-4.77.$ ,  $p < .01$ ), except for item 10 and 14. The results show that there were significant correlations for the subscales anxiety and GSRS ( $r_s = .59$ ,  $N=56$   $t(N-2)=-5.39.$ ,  $p < .01$ ), with the exception of item 10 and 14. For GSRS and depression there was also a significant correlation ( $r_s = .51$ ,  $N=57$ ,  $t(N-2)=-4.86.$ ,  $p < .01$ ) except for item 10, 11, 14 and 15.

The results show a significant correlation on total scores on HADS and total scores on GSRS in the group of women with low scores on HADS ( $r_s = .51$ ,  $N=40$   $t(N-2)=-3.67.$ ,  $p < .01$ ) except for item 2, 3, 8, 10, 14 and 15 on GSRS. There was also significant correlation between total scores on GSRS and anxiety ( $r_s = .51$ ,  $N=38$   $t(N-2)=-3.53$ ,  $p < .01$ ) except for item 1,2,5 and 13 on GSRS. We found significant correlation between the subscale depression and GSRS ( $r_s = .33$ ,  $N=39$   $t(N-2)=-2.09$ ,  $p < .01$ ). For women with high scores on HADS, there was not found any significant correlation with total scores on GSRS.

Summarized; the results show that levels of anxiety and depression, and gastrointestinal complaints one year prior to Giardia infection correlate, and also, that there is a correlation between these variables when men and women are seen separately, with

exception of some items on GSRS. This correlation seems to be related to the categories of men and women with low levels on HADS.

#### *The Relationship between Levels of Neuroticism and Levels of Complaints*

When we investigate hypothesis iii.) Higher levels of neuroticism are correlated with higher levels of reported gastrointestinal complaints; we look into this according to both post and prior to the Giardia infection. We also investigate if there are gender differences overall, and if there are gender differences when individual levels of neuroticism are categorized in a low or a high group.

#### *Reported Levels of Neuroticism*

First we investigate hypothesis iii. a) Is there a gender difference in reported levels of neuroticism?.

Descriptive information of how the subjects score on neuroticism (EPQ-N (R)) in total is given in table 4.

Table 4

#### *Means, Standard Deviations, Median and Range on EPQ-R(N)*

EPQ-R(N)	N	Mean	SD	Median	Range
All subjects	103	3.15	3.98	3	0-12
Men	40	2.93	3.38	2	0-12
Women	62	3.29	2.75	3	0-9

The mean scores of men are lower than for women. The range is different for men and women, where men have a higher maximal score. There are no significant gender differences in reported levels of neuroticism at  $p < .05$ .

*Gender Differences Based on Low and High Scores on Neuroticism*

Here we look at the scores on EPQ-N (R) when subjects were divided in two groups. The sample distribution of men and women in each category is given in figure 3. The scores on EPQ-N (R) were divided in two groups. The sample distribution of men and women in each category is given in figure 3 and figure 4.

Figure 3

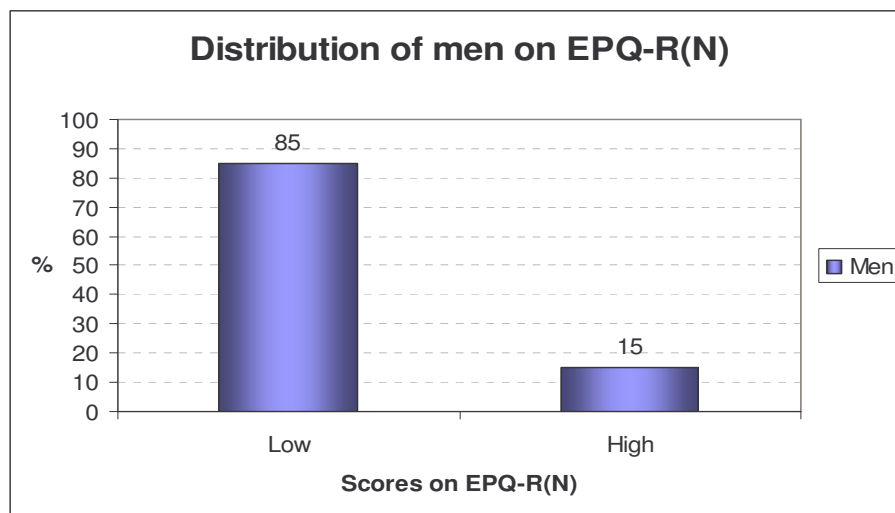
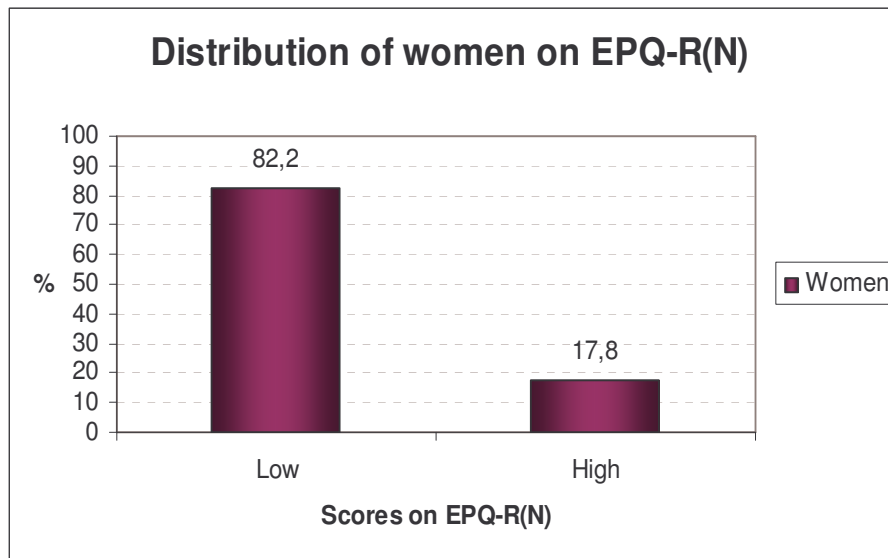
*Distribution of men on EPQ-R(N)*



Figure 4

*Distribution of women on EPQ-R(N)*



When the distribution of men and women is calculated separately, the distribution is relatively the same, as when calculated as a total sample. We found that there were no significant differences between men and women in reported level of neuroticism at  $p < .05$ .

#### *The Relationship between Levels of Neuroticism and Levels of Complaints*

When we investigate hypothesis iii b) How is the level of complaints related to the level neuroticism among men and women?; we look into this according to both post and prior to the Giardia infection.

#### *The Relationship between Levels of Neuroticism and Levels of Complaints post Giardia*

First we investigate ii b 1) How is the level of complaints post Giardia infection related to the level of neuroticism among men and women?

Looking at the total sample, there was a significant correlation between total scores on ROME II and neuroticism ( $r_s = .25$ ,  $N=67$ ,  $t(N-2)=2.07$ ,  $p < .004$ ).

When divided in two subgroups based on reported neuroticism levels; there were no significant results for neither low nor high levels of neuroticism.

*Correlations between Neuroticism and ROME II for Men.*

Among men, we found no significant correlation between total scores on EPQ-R(N) and total scores on ROME II. When men were divided in groups of low and high, based on neuroticism levels, we found no significant correlations with ROME II scores for none of the groups.

*Correlations between Neuroticism and ROME II for Women.*

Among women, we found no significant correlation between total scores on EPQ-R(N) and total scores on ROME II . When women in our sample were categorized after high and low levels of neuroticism, there were not found any significant correlations with ROME II scores.

Summarized; when men and women are seen separately, there was not found correlations between level of neuroticism and level of gastrointestinal complaints post Giardia. Without any categorizations, there was a significant correlation between level of neuroticism and level of complaints post Giardia infection. This last result indicates a relation between neuroticism level in general and complaints post infection.

*The Relationship between Levels of Neuroticism and Levels of Complaints prior Giardia*

Secondly we investigate hypothesis iii b 2) How is the level of complaints prior Giardia infection related to the level of neuroticism among men and women?

In the total sample we found a significant correlation between total scores on EPQ-R(N) and total scores on GSRS ( $r_s = .59$ ,  $N=96$ ,  $t(N-2)=-7.07$ ,  $p < .01$ ), in which all of the items on GSRS correlated with EPQ-R(N).

When divided in two subgroups based on reported neuroticism levels, in the group with low scores; there was significant correlation between neuroticism levels and total scores on GSRS ( $r_s = .x$ ,  $N=63$ ,  $t(N-2)=-x.$ ,  $p < .05$ ). In the high group there was no significant correlation between levels of neuroticism and GSRS at  $p < .05$ .

*Correlations between Neuroticism and GSRS for Men.*

Among men, we found a significant correlation between total scores on EPQ-R(N) and total scores on GSRS ( $r_s = .68$ ,  $N=42$ ,  $t(N-2)=-5.94.$ ,  $p < .01$ ). Item 2 and 10 on GSRS did not correlate significantly with GSRS scores.

When divided in two subgroups based on reported neuroticism levels; the results show a significant correlation on EPQ-R(N) and total scores on GSRS in the group of men with low scores on EPQ-R(N) ( $r_s = .65$ ,  $N=33$ ,  $t(N-2)=-4.75$ ,  $p < .01$ ) except for item 2, 10 and 16 on GSRS.

For men with high scores on EPQ-R(N), there was not found any significant correlation with total scores on GSRS at  $p < .05$ .

*Correlations between Neuroticism and GSRS for Women.*

Among women, we found a significant correlation between total scores on EPQ-R(N) and total scores on GSRS ( $r_s = .55$ ,  $N=56$ ,  $t(N-2)=-4.86.$ ,  $p < .01$ ).

When divided in two subgroups based on reported neuroticism levels; the results show a significant correlation between neuroticism and total scores on GSRS in the group of women with low scores on EPQ-R(N) ( $r_s = .51$ ,  $N=46$ ,  $t(N-2)=-3.95$ ,  $p < .01$ ) except for item 2

and 3. For women with high scores on EPQ-R(N), there was not found any significant correlation with total scores on GSRS  $p < .05$ .

Summarized; the results show that neuroticism and gastrointestinal complaints one year prior to Giardia infection correlate, and also, that there is a correlation between these variables when men and women are seen separately, with exception of some items on GSRS. This correlation though, is just significant for individuals scoring low on neuroticism, and holds for both men and women.

## Discussion

### *Brief overview*

There are gender differences in the reported level of complaints, where women report to have more complaints than men. The levels of anxiety and depression are high in the sample, in which almost half of the overall sample has scores that could indicate pathology. The level of neuroticism in this sample is lower compared to the level found in other IBS populations. The level of neuroticism found in our sample is considered as normal, compared with a normal population. The subjects' young age, low level of neuroticism and high levels of anxiety and depression, characterize them as a unique population.

### *Gender Differences on Measures of Complaints*

According to the first hypothesis, we expect to find that women will have relatively higher scores on measures of complaints compared to men. Looking at the mean score on ROME II, women have significantly higher score than men. This indicates that women in our sample experience a higher level of complaints post the Giardia infection, compared to men in our sample. We also found a significant gender difference on one symptom at the GSRS, but

there was not a significant gender difference on the total score. This indicates that the gender difference of most importance when we refer to complaints is the complaints that the subjects reported they had at the time of the investigation, and not the complaints one year before the infection.

#### *Studies on Gender Differences in Gastrointestinal Complaints*

In general there seem to be a female predominance in IBS (Chang & Heitkemper, 2002). In the US and other industrialized countries, more females than men seek healthcare services for complaints. Gender differences in symptoms on IBS have also been shown (e.g. anorexia, nausea, bloating, constipation and heartburn). Women with IBS seem to report more complaints associated with IBS, e.g. constipation (Chang & Heitkemper, 2002). Chang and Heitkemper (2002) refer to studies by Lee, Mayer, Schmulson, Chang and Naliboff, (2001) and one by Corney and Stanton which (1990), which have shown that women have more symptoms of nausea, constipation and bloating, whereas men with IBS report more diarrhoea. In our sample we found that women reported more symptoms on nausea than men. Studies based on Norwegian population have shown that the prevalence of subjective health complaints in general are higher for women than for men (Eriksen, Ihlebæk et al., 1999) and gender differences has been shown already at age 15 (Haugland et. al, 2001). Women also seem to report more severe gastrointestinal symptoms compared to men (Eriksen, Ihlebæk et al., 1999). In our sample there was a higher prevalence of women than men.

Summarized; the gender differences found in our sample are in line with studies within the field of subjective health complaints, and more specifically findings on IBS patients.

### *Hypotheses Regarding Gender Difference*

There are several hypotheses regarding gender difference. There are indications of a physiological basis for the gender differences in the pathophysiology, clinical expression and management of functional bowel disorders, but more studies need to be conducted on this matter (Chang & Heitkemper, 2002). It has been argued by Wool and Barsky that girls and women somatise more than men, as females are relatively more sensitive to their bodies, more accepting of disease status and more talkative in reporting the symptoms (Haugland et al., 2001). Hence, the gender differences may be related to behavioural differences. In addition, it is observed that the responding to treatment of IBS is different relative to gender (Chang & Heitkemper, 2002).

We hypothesise that another factor that can have an influence the gender differences regarding to levels of reported complaints, might be in connection with individual characteristics such as dispositional anxiety and depression.

### *The Relationship between Levels of Anxiety and Depression and Levels of Complaints*

According to the second hypothesis, we expected to find that higher levels of anxiety and depression are correlated with higher levels of complaints. The results show that in our sample, 46.86 % have pathological total scores on HADS based on cut-off point in the upper end. Interestingly; nearly half of our sample population can generally be considered as having met criteria for clinical anxiety and depression at the time of investigation.

A review of the co morbidity of IBS by Whitehead et al. (2002), show that more than 20 studies have assessed overlap between IBS and psychiatric disorders, and that 54-94 % of IBS patients can be diagnosed with at least one psychiatric disorders along axis I in the DSM-IV. The same review also found a prevalence of 90% or more between IBS and other psychiatric disorders. No single psychiatric disorder seem to be uniquely associated with IBS,

however the psychiatric diagnoses most commonly associated with IBS, are major depression, followed by generalized anxiety disorder (Whitehead et al., 2002). The distribution in our sample based on HADS scores as indicators of anxiety and depression seem to be in line with Whitehead's review of previous studies where IBS and psychiatric disorders are put under scrutiny.

A study with a Norwegian sample by Vandvik et al. (2004) shows that the prevalence of mood disorders among IBS patients is 38 % compared to 11 % in a Norwegian reference population. Note that the prevalence in our sample is higher than in this sample.

In the same study they found co morbidity to reported somatic symptoms, and also a correlation between these somatic symptoms and psychological distress. Patients with IBS and high somatic co morbidity also reported higher levels of mood disorders, health anxiety, neuroticism, adverse life events, and reduced quality of life (Vandvik et al., 2004).

Based on the distribution within the categories low (0-9) and high (10+) on HADS, we found men and women approximately evenly distributed. The results show that there were no significant gender differences on HADS.

As our results show, we did not find the expected correlations between higher levels of complaints based on ROME II and higher levels on HADS. Our results show that higher levels of complaints measured with the GSRS were correlated with higher levels on HADS in total, and also on the subscales measuring anxiety and depression. This correlation was found for the total sample, and also for men and women separately. This result indicate that higher level of anxiety and depression covariate with higher levels of gastrointestinal complaints the last year before the subjects were infected with Giardia, but not with the level of complaints at the time of the medical examination.

The explanation for the different patterns of complaints might be due to the different types of assessments. It is noteworthy that correlations are found mostly when looking at the GSRS and not ROME II.

Summarized; Anxiety and depression levels seem to be high in our sample and only related to complaints prior to Giardia infection, and not to level of complaints post the Giardia infection. Our second hypothesis was thus partly falsified. One possible explanation for this finding might be due to different types of assessments of the complaints. There were no clear differences between men and women. The overall picture concerning anxiety and depression in our sample, show similarity to studies on IBS and co morbidity with other psychiatric disorders.

#### *The Relationship between Levels of Neuroticism and Levels of Complaints*

According to the third hypothesis we would expect to find that higher levels on EPQ-R(N) would correlate with higher levels of complaints. Our results show that 16.2 % of the sample have scores on neuroticism that lie above mean scores found in the normal population for the same age group as our sample (Eysenck et al., 1985). The pattern of the distribution for men and women in categories of low and high is approximately the same (see figure 3 and 4). It was not found any gender differences on neuroticism scores and level of complaints reported. Comparing the mean scores on neuroticism in our sample (3.15, SD 3.98), with mean scores found in other studies on neuroticism among IBS patients, the results bear similarity. Vandvik et al.(2004) found in a Norwegian sample consisting of 208 IBS patients a mean score on 4.1 (SD 3). The neuroticism level was assessed using the same questionnaire as in our study. It should be commented that the sample in Vandvik et al. study consisted of only women. But as our results show, there were no gender difference on neuroticism in our sample and the study thus seem possible to compare with ours. Vandvik et



al. (2004) understand the level of neuroticism as likely to be higher in the IBS population, than in a population without IBS, but are not able to be more specific because they lack control group. When the mean score in our sample is compared to the mean score found in a normal population (Eysenck et al., 1985), the mean score is lower in our sample (3.15, SD 3.98) compared to healthy subjects in the normal population of the same age group (3.57, SD 2.29). This shows that the neuroticism level in the overall of our sample is not pathological, compared to a normal population.

In the category of subjects with low scores on EPQ-R(N), a pattern is found between levels of symptoms reported on ROME II and depression (HADS-D). The results show that for subjects low on neuroticism, higher levels of reported symptoms are associated with higher levels of depression. Of subjects in the category with high levels of neuroticism, we found correlations between HADS overall and depression. This association was in the opposite direction of what we found in the category of subjects scoring low on neuroticism. This means that subjects high on neuroticism, lower degree of reported complaints of IBS are associated with lower degree of depression.

We found correlations between the Gastrointestinal Rating Scale and EPQ-R(N) on all of the items, for the group as a whole, and also for men and women in different categories. The sample divided in categories based on high and low scores on EPQ-R(N) show that the correlations with number of items on the Previous Complaints questionnaire have a different distribution. Subjects with low scores on EPQ-R(N), have almost all of the items on GSRS correlated, while the results show that subjects with high scores have almost none items on GSRS that correlate. The same pattern is found when the categories of high and low also are divided in gender categories. Based on this result it seems as there is a covariate between reported symptoms on GSRS and subjects that have scores on EPQ-R(N) that fall under what normal population scores, while there the correlation with scores on symptoms reported on

GSRS subjects with high scores on neuroticism. Subjects reporting higher levels of physical complaints, report lower levels on the psychological dimensions in this study.

Summarized; the picture of associations between levels of complaints and levels of neuroticism, varies for subjects with low or high scores on neuroticism. Interestingly, subjects low on neuroticism generally report more complaints. Subjects high on neuroticism, report lower levels of complaints, and also lower levels of depression.

Based on these results, we did not find the expected outcome. The association between levels of complaints and levels of neuroticism is complex; a lower level of complaints is associated with a higher level on neuroticism.

This picture of the sample tells us that the group of patients can not be seen as a homogenous entity. As the review of Whitehead et al. (2002) suggests, patients labelled IBS is a heterogeneous group characterized by various ethnology. According to a dual-aetiology hypothesis, some patients can be labelled as having a biological basis other as having a psychological basis. It is suggested that patients with a biological basis of IBS are likely to have no co morbid conditions and few general physical complaints. Patients with a psychological basis are likely to have co morbidity with other disorders and excessive general somatic symptoms. Co morbidity with other disorders and high degree of complaints are seen as markers for somatisation.

The dual-aetiology hypothesis (Wilhelmsen, 2005) might shed light on why the group of patients show the before mentioned pattern of complaints, anxiety, depression and neuroticism. If it can be said that in the group of patients, some can be seen as having a biological basis of developing IBS while other can be seen as having a psychological basis for developing IBS, this insight could have implication for type of interventional treatment. According to Vandvik et al. (2004) it is suggested that for the group of patients hypothesised to have a psychological basis, it is more important to identify co morbid symptoms and to

solve their current problems than to establish "what came first". For this group of patients it is also postulated that intervention of mind-based therapies such as cognitive behaviour therapy, hypnotherapy or tricyclic antidepressants could be efficacious.

Even though some characteristics of our sample seem to fit with the dual-aetiology hypothesis, there is not enough information to conclude that some of the patients in our sample have a biological basis while other has a psychological basis. It is nevertheless an interesting hypothesis, which can be used in future studies.

### *Methodological Issues*

Concerning our results in general, we think it is important to take some methodological issues into consideration. Complaints in our sample were measured with ROME II and GSRS, and were supposedly meant to measure complaints on two different points in time. ROME II; at the time the subject came back for further medical examinations, when they no longer had Giardia infection, and GSRS one year before the infection. The individual patients might find it difficult to interpret which complaints they sense at the time, and to separate which complaints they had one year ago, due to cognitive bias. In addition, the test instruction concerning complaints and time location (e.g. the subject were instructed to think back in retrospect about gastrointestinal symptoms prior to Giardia infection) can be misunderstood, and is also difficult to read in the version the subjects were handed.

Generally, for all of the questionnaires used in this study, we have no control over the specific test instruction the subjects got and to what degree it was standardized, because they were administered by the medical doctors at Haukeland Hospital. The basis for measuring the psychological variables (HADS and EPQ-R(N)) in this study were also chosen by the medical doctors at Haukeland Hospital, and they have reported that these questionnaires were

chosen rather quickly as a consequence of the sudden outbreak of Giardiasis and little time for preparation before the data were collected. In addition, the time of measurement on the questionnaires among the subjects vary, because they were handed out as they came back for medical examinations over a 15 months period after the Giardia infection (Hanevik et al., 2007). In an ideal world we would choose to collect both pre- and post measures of all variables, but that was difficult since this was a sudden outbreak of Giardia. The study design could be improved, and we would also set criteria to standardize assessments and interventions to minimize bias in results. These limitations muddy the water in the interpretation of the results. Nevertheless, we chose to look into how subjects scored on both questionnaires since useful information about the sample characteristics might be found.

#### *Implications for Intervention*

There is considerable ambiguity in treatment of subjective health complaints conditions (Eriksen & Ihlebæk, 2002). When it comes to the search for appropriate intervention programs trying to help alleviate the individuals in our sample with their complaints, this is a challenge. The ambiguity is one aspect of this, but the argumentation for this challenge is also based on our results alone. Our results show that the patients seem to be somewhat different on the variables included, compared with other IBS populations, although some of the results also bear similarity to this population. Nevertheless, we take caution in drawing very definitive conclusions, because of the methodological weaknesses mentioned in our study. Having taken this into consideration though, one implication of our results could be that the existing interventions used on IBS patients in general, maybe would not be the most appropriate or effective type of interventions on our sample.

Earlier, we have pointed to the dual hypothesis and other integrating IBS models, where an important point is that the interaction between psychological and physiological factors has distinct importance (Wilhelmsen, 2005). And also, there might be different paths to the development of IBS, in which psychological and physiological factors play different roles (Brosschot, 2002). If we strip our results down to the psychological dimensions anxiety and depression, it is interesting, and probably also important, to note that in our sample almost half of the individuals have scores on HADS that are considered pathological. This means, that among our patients, many reports symptoms of anxiety and depression. We think, as a possible route to help alleviate the patients on some aspects of their condition and contribute to better health, thus could be psychotherapy. This would be in line with WHO's definition of health (Eriksen, 1999), where also the psychological dimension is taken into consideration. More specifically, with the understanding of how psychological factors are interacting with physiological factors (Whitehead et al., 2002). Psychiatric diagnoses like anxiety and depression are also states in which the symptoms might be difficult to separate from subjective health complaints diagnoses (Eriksen & Ihlebæk, 2002). Another important point to note, concerning the possibility for interventions related to anxiety and depression among the patients in our sample, is that they in general up to this point, still have complaints after medical treatment, and thus might find psychotherapy effective as an alternative route to alleviation. This would be in line with the notion that illness perception and emotions affect the way symptoms are experienced and interpreted (Farnam et al., 2007).

### *Conclusions*

The individuals in our sample are young, have high levels of anxiety and depression, low level of neuroticism and high level of complaints- where women have the highest level. A gender difference was found in levels of complaints, but not on the other variables. Our

hypothesis regarding gender differences were thus partly defied. Based on the description of the sample, it seems as our sample is a unique population. This implicate that they may not be directly comparable with other IBS populations. Since the patients still have complaints, our hope are that further studies could contribute to implicate an effective intervention and that our results could be helpful in this process.

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## Appendix A

Funksjonelle mageslager – diagnostikk og kvantitering (Rome II kriterier)

Dato:.....

Pasient (distriktp):

### Spørreskjema

#### 1. IBS-KRITERIER:

Spørsmål	Svar
1.1. Har du vært plaget av smerter eller ubehag i magen de siste 3 måneder?	Ja / Nei
1.2. Har du kjent disse plagene minst 1 dag/ uke i 3 uker eller mer (la. siste 3 mnd)?	Ja / Nei
1.3. Er avføringen uregelmessig?	Ja / Nei
1.4. Har du mye luft i magen?	Ja / Nei
1.5. Blir smertene/ubehaget i magen bedre etter at du har hatt avføring/ført tørt de?	Ja / Nei

#### 2. IBS KRITERIER SOM GIR STØTTE FOR DIAGNOSEN:

Spørsmål	Svar
2.1. Hvis du har diare, hender det at avføringen fast inn i mellom?	Ja / Nei
2.2. Hvis du har forstoppelse, hender det at avføringen er løs inn i mellom?	Ja / Nei
2.3. Har du avføring om natta?	Ja / Nei
2.4. Hva har du mest av?	Diare/ Forstoppelse

#### 3. KVANTITERING AV IBS SYMPTOMER. Angis på en skala fra 1 til 10 der 0 = ingen symptomer og 10 = alvorlige symptomer (Kane, Am J Gastroenterol 2003) – SISTE UKEN

Spørsmål	Svar
3.1. Kvalme	
3.2. Oppblåsthet	
3.3. Magesmerter	
3.4. Forstoppelse	
3.5. Diare	
3.6. Anoreksi (uvis på mat)	

#### 4. SYMPTOMER SOM KREVER NÆRMERE VURDERING:

Spørsmål	Svar
4.1. Har du gått ned i vekt det siste året?	Ja / Nei
4.2. Har du sett blod i avføringen?	Ja / Nei
4.3. Har du brukt antibiotika det siste året?	Ja / Nei
4.4. Er det noen i din nærmeste familie som har eller har hatt kreft i tykktarmen? (som nærmeste familie menes foreldre, søsken og barn)	Ja / Nei

Snu  
↓

**5. FUNKSJONELL DYSPEPSI**

Spørsmål	Svar
5.1 Har du hatt smerter eller ubehag ovenfor navlen?	Ja / Nei
5.2 Har du kjent disse plagene høyt oppe i magen minst 1 dag/ uke i 3 uker eller mer i løpet av de siste 3 måneder?	Ja / Nei
5.3 Blir smertene/ ubehaget i øvre del av magen bedre etter at du har hatt avføring?	Ja / Nei

**6. HALSBRANN**

Spørsmål	Svar
6.1. Har du hatt halsbrann eller en sviende/ brennende smerte bak brystbenet?	Ja / Nei
6.2. Har du kjent disse plagene minst 1 dag/ uke i 3 uker eller mer i løpet av de siste 3 måneder?	Ja / Nei

**7. TILLEGGSPØRSMÅL FOR Å KARAKTERISERE ALLE PASIENTENE:**

Spørsmål	Svar
7.1 Har du hatt mageplagene lenger enn ett år?	Ja/Nei
7.2 Har du oppsøkt lege for slike mageplager tidligere?	Ja/Nei
7.3 Mener du at stress eller psykiske faktorer betyr noe for plagene dine?	Ja/Nei
7.4 Er du engstelig for om plagene kan skyldes kreft eller annen alvorlig sykdom?	Ja/Nei

Appendix B

4  
Siste året Plager fra magen før Sicilia.

Har du den... symptomene nevnt nedenfor?

0 1 2 3 4 5 6  
□ □ □ □ □ □ □

1	Plager med magen (Med magesplager menes all slags smerte eller knip i magen)	□ □ □ □ □ □ □
2	Halsbrann/brystbrann (Med det menes en sviende eller brennende følelse av ubehag bak brystbeinet)	□ □ □ □ □ □ □
3	Oppstøt (Med oppstøt menes plutselige oppstøt av mageinnhold, evt. surt mageinnhold)	□ □ □ □ □ □ □
4	Sug i magen (Med sug i magen menes en følelse i magen av behov for å spise mellom måltidene)	□ □ □ □ □ □ □
5	Uvel (Med å føle seg uvel menes ubehagsfølelse som kan gå over i kvalme og brekninger/oppkast)	□ □ □ □ □ □ □
6	Rumling i magen (Med rumling menes vibrasjoner eller "buldring" i magen)	□ □ □ □ □ □ □
7	Oppblåsthet (Med oppblåsthet menes utspiling, ofte forbundet med en følelse av luft i magen)	□ □ □ □ □ □ □
8	Røping (Med røping menes behov for "uttøffing", ofte forbundet med lindring av følelse av oppblåsthet)	□ □ □ □ □ □ □
9	Luftavgang (Med luftavgang menes behov for å "slippe seg", ofte forbundet med lindring av følelse av oppblåsthet)	□ □ □ □ □ □ □
10	Førstoppelse (Med førstoppelse menes minsket avføringshyppighet)	□ □ □ □ □ □ □
11	Diaré (Med diaré menes økt avføringshyppighet)	□ □ □ □ □ □ □
12	Løs avføring (Hvis du har hatt vekslende hard og løs avføring, gjelder dette spørsmålet bare i hvilken utstrekning du har følt deg plaget av at avføringen har vært løs)	□ □ □ □ □ □ □
12	Hard avføring (Hvis du har hatt vekslende hard og løs avføring, gjelder dette spørsmålet bare i hvilken utstrekning du har følt deg plaget av at avføringen har vært hard)	□ □ □ □ □ □ □
14	Tvingende avføringsbehov (Med tvingende avføringsbehov menes raskt oppståtte behov for å gå på toalettet, ofte forbundet med en følelse av mangelfull kontroll)	□ □ □ □ □ □ □
15	Ufullstendig tømning av tarmen (Med ufullstendig tømning av tarmen menes at det trass i anstrengelser i forbindelse med avføring gjenstår en følelse av ufullstendig tømning)	□ □ □ □ □ □ □
16	Dårlig appetitt	□ □ □ □ □ □ □

## Appendix C

HAD

Løpenr.....

Dette spørreskjemaet handler om hvordan du føler deg for tiden. Kryss av det svaret som best beskriver dine følelser *siste uken*. Funder ikke for lenge på ditt svar, din umiddelbare reaksjon på hvert spørsmål er sannsynligvis riktigere enn et svar du har fundert lenge på.

Jeg er nervøs eller anspent		Jeg føler meg som om alt går langsommere	
For det meste	<input type="checkbox"/>	Nesten hele tiden	<input type="checkbox"/>
Ofte	<input type="checkbox"/>	Svært ofte	<input type="checkbox"/>
Noen ganger	<input type="checkbox"/>	Fra tid til annen	<input type="checkbox"/>
Ikke i det hele tatt	<input type="checkbox"/>	Ikke i det hele tatt	<input type="checkbox"/>
Jeg gleder meg fremdeles over ting jeg pleide å glede meg over		Jeg føler meg urolig liksom jeg har sommerfugler i magen	
Avgjort like mye	<input type="checkbox"/>	Ikke i det hele tatt	<input type="checkbox"/>
Ikke fullt så mye	<input type="checkbox"/>	Fra tid til annen	<input type="checkbox"/>
Bare lite grunn	<input type="checkbox"/>	Ganske ofte	<input type="checkbox"/>
Ikke i det hele tatt	<input type="checkbox"/>	Svært ofte	<input type="checkbox"/>
Jeg har en urolighet som om noe forferdelig kommer til å skje		Jeg har sluttet å bry meg om hvordan jeg ser ut	
Helt sikkert og svært ille	<input type="checkbox"/>	Ja, helt klart	<input type="checkbox"/>
Ja, men ikke så veldig ille	<input type="checkbox"/>	Jeg bryr meg ikke så mye som jeg burde	<input type="checkbox"/>
Litt ille, men det bekymrer meg ikke så mye	<input type="checkbox"/>	Det kan nok hende jeg ikke bryr meg nok	<input type="checkbox"/>
Ikke i det hele tatt	<input type="checkbox"/>	Jeg bryr meg om utseende like mye som jeg alltid har gjort	<input type="checkbox"/>
Jeg kan le og se det morsomme i situasjoner		Jeg føler meg rastløs som om jeg stadig må være i aktivitet	
Like mye som jeg alltid har gjort	<input type="checkbox"/>	Uten tvil svært mye	<input type="checkbox"/>
Ikke like mye nå som før	<input type="checkbox"/>	Ganske mye	<input type="checkbox"/>
Avgjort ikke så mye nå som før	<input type="checkbox"/>	Ikke så veldig mye	<input type="checkbox"/>
Ikke i det hele tatt	<input type="checkbox"/>	Ikke i det hele tatt	<input type="checkbox"/>

Jeg får hodet fullt av bekymringer		Jeg kan se framover med glede	
Veldig ofte	<input type="checkbox"/>	Like mye som jeg alltid har gjort	<input type="checkbox"/>
Ganske ofte	<input type="checkbox"/>	Heller mindre enn jeg pleier	<input type="checkbox"/>
Av og til	<input type="checkbox"/>	Avgjort mindre enn jeg pleier	<input type="checkbox"/>
En gang i blant	<input type="checkbox"/>	Nesten ikke i det hele tatt	<input type="checkbox"/>
Jeg er i godt humør		Jeg kan plutselig få en følelse av panikk	
-Aldri	<input type="checkbox"/>	Uten tvil svært ofte	<input type="checkbox"/>
Noen ganger	<input type="checkbox"/>	Svært ofte	<input type="checkbox"/>
Ganske ofte	<input type="checkbox"/>	Ikke så veldig ofte	<input type="checkbox"/>
For det meste	<input type="checkbox"/>	Ikke i det hele tatt	<input type="checkbox"/>
Jeg kan sitte i fred og ro og kjenne meg avslappet		Jeg kan glede meg over en god bok eller et radio eller TV-program	
Ja, helt klart	<input type="checkbox"/>	Ofte	<input type="checkbox"/>
Vanligvis	<input type="checkbox"/>	Fra tid til annen	<input type="checkbox"/>
Ikke så ofte	<input type="checkbox"/>	Ikke så ofte	<input type="checkbox"/>
Ikke i det hele tatt	<input type="checkbox"/>	Svært sjeldent	<input type="checkbox"/>

## Appendix D

### Spørsmål om uro og bekymring (EPQ-N)

#### Instruksjon:

Vær vennlig å besvare hvert spørsmål med å sette en ring rundt «ja» eller «nei». Det er ingen riktige eller gale svar, og det er ingen «dure-spørsmål». Arbeid raskt med spørsmålene, og bruk ikke for lang tid på å tenke på den eksakte meningen med spørsmålene. Vennligst besvar alle spørsmålene.

		Ja	Nei
1	Går humøret ditt ofte opp og ned?	Ja	Nei
2	Føler du deg «helt elendig» uten grunn?	Ja	Nei
3	Har du lett for å bli irritert?	Ja	Nei
4	Blir følelsene dine lett såret?	Ja	Nei
5	Har du ofte følelsen av å «ha fått nok»?	Ja	Nei
6	Vil du beskrive deg selv som en nervøs person?	Ja	Nei
7	Er du en bekymret person?	Ja	Nei
8	Ville du beskrive deg som uspent eller overnervøs?	Ja	Nei
9	Bekymrer du deg for lenge etter en pinlig opplevelse?	Ja	Nei
10	Plages du av «nervene»?	Ja	nei
11	Føler du deg ofte ensom?	Ja	Nei
12	Er du ofte bekymret over å ha skyldfølelse?	Ja	Nei





