

A critique of the literature on etiology of eating disorders

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ABSTRACT

The development of eating disorders including anorexia nervosa, bulimia nervosa, binge eating disorder, and atypical eating disorders that affect many young women and even men in the productive period of their lives is complex and varied. While numbers of presumed risk factors contributing to the development of eating disorders are increasing, previous evidence for biological, psychological, developmental, and sociocultural effects on the development of eating disorders have not been conclusive. Despite the fact that a huge body of research has carefully examined the possible risk factors associated with the eating disorders, they have failed not only to uncover the exact etiology of eating disorders, but also to understand the interaction between different causes of eating disorders. This failure may be due to complexities of eating disorders, limitations of the studies or combination of two factors. In this review, some risk factors including biological, psychological, developmental, and sociocultural are discussed.

KEYWORDS: Etiology, anorexia nervosa, Bulimia nervosa, Co-morbidity, Binge eating disorder

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Introduction

Eating disorders, particularly, anorexia nervosa and bulimia nervosa have been center of attention for clinicians and researchers. Eating disorders are one of the significant problems in the care of adolescents and even children. These complex disorders are believed to arise from interaction of multiple risk factors. Eating disorders are defined by disturbance in eating habits that may be either excessive or insufficient food intake. Bulimia nervosa, anorexia nervosa, and binge eating are the most common forms of eating disorder based on diagnostic and statistical manual of mental disorders (DSM-IV). As defined in DSM-IV, anorexia nervosa is a constant attempt to maintain body weight below minimally normal weight (85%) or body mass index <17.5 for age and height, with an intense fear of weight gain even though under weight, and inaccurate perception of own body size, shape, or weight. It may accompany with amenorrhea in girls and women after menarche. DSM-IV also defines bulimia nervosa as recurrent binge eating episodes followed by recurrent purging, excessive exercise, or prolonged fasting at least two times per week for three months. Excessive concern about weight or shape is also very common in bulimia nervosa. Another type of eating disorders is binge-eating disorder that is characterized with recurrent binge eating without purging, excessive exer-

cise, or fasting. Atypical eating disorder is referred to clinically significant eating disorders associated with unexplained weight loss, rumination, unexplained food intolerances or an extremely picky eating habit that does not meet the criteria of anorexia nervosa, bulimia, or binge disorder.¹

Prevalence of Eating Disorders

The average prevalence rates for anorexia nervosa and bulimia nervosa are 0.3% and 1% among adolescence and young people in western countries respectively. Prevalence rates of anorexia nervosa and bulimia nervosa increase during transition period from adolescence to adulthood.² Lifetime prevalence rates for eating disorder are higher among women than men (Table 1).³ A Canadian study reported that 4% of Canadian boys in grade nine and ten used anabolic steroids. Use of anabolic steroid in males may be an indicator of body preoccupation. The estimated rate of anorexia nervosa and bulimia nervosa in males is between 5% and 15%.⁴ Men's reluctance to be diagnosed with eating disorders or to participate in the study of eating disorders have been a big chal-

lenge; consequently, rate of eating disorders in males may be higher than it is reported. According to a 2002 survey, prevalence of eating disorders is 1.5% among Canadian women aged 15–24 years.⁵ Another Canadian survey in 2002 indicated that 28% of girls in grade nine and 29% of girls in grade ten showed weight loss behaviors.⁴

Impact of Eating Disorders on the Canadian Economy

Although eating disorders mostly receive community treatment, hospitalization may be needed for severe cases. In-patient crude hospital separations for any diagnosed eating disorders have increased by 4.7% between 1994 and 1999 in Canada (Canadian Institute for Health Information, 1999). Despite decrease in hospitalization duration for eating disorders between 1987 and 1999 reported by the Center for Chronic Disease Prevention and Control, Public Health Agency for Canada reported increased rates of hospitalization for eating disorders among women in general hospitals. In 2005/2006, hospitalization rate for adolescence girl with eating disorders were 2.5 times the rate of young women and 6 times the rate of any other groups (Canadian Institute for Health Information, 2008). The increase in the rate of hospitalization could be due to either increased cases of inpatient treatment or

Table 1: Prevalence rates of eating disorders.

Eating Disorders	Women	Men
Anorexia nervosa (AN)	0.9%	0.3%
Bulimia nervosa (BN)	1.5%	0.5%

higher rate of eating disorders, or combination of two factors. Further studies are required to clarify exact cause(s) of increased rate of hospitalization for eating disorders in Canada. In 1993 physician billing data, hospitalization data, and self-reported productivity losses were used to estimate mental illness cost to Canadian economy. It was estimated that the cost of mental illnesses was \$7.331 billion in 1997.⁶

Although eating disorders are among the mental illnesses that occasionally require hospitalization since hospitalization rate is increasing, even if costs of outpatient services are not taken into account, eating disorders can have a considerable impact on the Canadian economy. The exact estimation of economic burden of mental illness including eating disorders would be a big challenge, because of a lack of accurate data both on cost of services and productivity losses.

Mortality Rate in Eating Disorders

Anorexia nervosa has the highest mortality rate of any other mental illnesses. It is estimated that 10% of people with anorexia nervosa die within 10 years of the onset of disorder (Sullivan, 2002). One study showed the mean crude mortality rate of 5.0% for anorexia nervosa. In the surviving patients, on an average, only 46.9% of patients had full recovery, while 33.5% improved, and 20.8% had a chronic course of disease.^{7,8} Based on total sample of 196 female with bulimia nervosa, the mean crude mortality

rate was 2.0% for bulimia nervosa.¹⁰ A lower standardized mortality rate (the ratio of the observed number of deaths to the expected number of deaths in a matched population) for anorexia nervosa compared to normal populations is reported by some studies. However, a recent Canadian study that assessed 326 patients diagnosed with anorexia nervosa for 20 years showed a higher mortality rate for anorexia nervosa patients than normal populations in Canada.^{11,12} The challenges that this study faced over 20 years of follow up are: disconnection of cases with research group because of moving outside the British Columbia province; reassessment of previously diagnosed cases of eating disorders three times over 20 years based on three different revisions of DSM-IV that could have led to removal of few cases from study after a long term follow up.

Psychiatric Co-morbidity in Eating Disorders

Various psychiatric co-morbidities such as depression, anxiety disorder, obsessive-compulsive disorder, substance abuse, attention-deficit hyperactivity disorders, and personality disorders are prominent in patients with eating disorders. Suicide and suicide attempts are dangerous co-morbidities in eating disorders. Although primary cause of pre-mature death in eating disorders are medical co-morbidities, a meta-analysis that combined the results of 42 published studies of mortality of eating disorders determined that the second

most common cause of death in eating disorders is suicide.⁷ About 10% to 20% of patients with anorexia nervosa and 25% to 35% of patients with bulimia nervosa have a history of at least one suicide attempt. Standardized mortality rate for suicide in anorexia nervosa is estimated to be up to 5 or even more.¹¹ According to the statistics from public health agency of Canada, suicide is the eleventh cause of death in Canada, and more than 3,500 suicides, at a rate of about 11 per 100,000 are recorded per year. Eating disorders clearly contribute to suicide rates in Canada. An accurate suicide rate of eating disorders is very difficult because of unreliability of suicide statistics in general, difficulties in uncovering the exact cause of death, and undiagnosed cases of eating disorders who commit suicide.

Medical Co-morbidity in Eating Disorders

Wide range of medical complications such as anemia, endocrine system dysfunction, electrolytes disturbances, and cardiovascular diseases accompany eating disorders. Severity of medical complications depend on speed of weight loss, severity of underweight, duration of eating disorders, age of patients, and the intensity of purging (Table 2).¹¹

Etiology of Eating Disorders

Biological Factors

Genetic effects: A growing body of twin studies confirmed that there is an undeniable link between genetic factors and eating disorders. One of the twin study,

Table 2: Medical alterations in adolescent eating disorders.

	AN	BN
Physical examination findings	Dry skin, lanugo hair formation (only with severe weight loss), acrocyanosis, alopecia, low body temperature, dehydration, retardation of growth and pubertal development	Erosion of dental enamel, parotid/salivary gland enlargement, scars on the skin of the back of the hand resulting from inducing the gag reflex, dehydration
Cardiovascular system	Bradycardia, ECG abnormalities (mostly prolonged QT-interval), pericardial effusion, edema (before or during refeeding)	ECG-abnormalities (cardiac arrhythmia, prolonged QT- interval)
Gastrointestinal system	Impaired gastric emptying, pancreatitis, constipation Leukocytopenia, thrombocytopenia,	Esophagitis, pancreatitis, delayed gastric emptying
Blood	thrombocytopenia, anemia Hypokalemia, hyponatremia, hypomagnesiemia, hypocalcemia, hypophosphatemia (during refeeding), low glucose levels, AST↑, ALT↑ (with severe fasting or beginning of refeeding), cholesterol ↑	Hypokalemia, hyponatremia, hypomagnesiemia (caused by diarrhea), hypocalcemia, metabolic alkalosis (in case of severe purging), metabolic acidosis (in case of severe laxative abuse)

in which twenty- six twins with anorexia nervosa including 13 twins (7MZ, 6DZ) with threshold and 13 twins (7MZ, 6DZ) with sub-threshold anorexia nervosa were studied,¹³ neither of DZ twins met the criteria for diagnosis of anorexia nervosa, while 29%–50% of MZ twins were concordant for anorexia nervosa. Although some of the twin studies believe that contributions of shared environmental effects (the same family environment in which twins grow up), and non-shared environmental effects (negative life events) are often small but these effects were also included in the reported twin studies.

One of the limitations of twin study could be due to the short follow up period. Some cases that are not concordant may turn to be concordant later, and unaccounted cases can affect heritability estimate for eating disorders. Small sample size is another limitation in twin studies that prohibits researchers to study wide range of non-shared and shared environmental effects, and probably overestimates rate of heritability. Study of larger sample size that preferentially includes different racial groups would be more useful.

Neurobiology

Serotonin (5-hydroxytryptamin, 5HT) is believed to participate not only in appetite regulation but also in mood regulation. Altered tone or transmission of serotonin mediates anxiety reaction, problem with response inhibition, aggression, suicidality, heightened vigilance, and self-injury.¹⁴ Although exact cause of 5-HT dysfunction in eating disorders is unknown, but several studies presumed that alteration of 5-HT_{1A} and 5-HT_{2A} receptor activities, the 5-HTT (5-HT transporter), and CSF 5-HIAA levels can be involved in patients with eating disorders.¹⁵ Several studies confirmed persistence of alterations in serotonin activity,^{16,17} and also persistence of anxiety, perfectionism, and obsessive behavior¹⁸ after recovery from anorexia nervosa and bulimia nervosa.

Regarding these findings, serotonin may indirectly mediate its effects on development of eating disorders through some personality traits that are prominent in patients with eating disorders. Study of subtle differences in patterns of functional alteration of serotonin in subjects with pre-morbid personality traits without eating disorders, and in subjects with eating disorders without these personality traits may be helpful though sample size

would be small in this group. Data collection related to pre-morbid personality traits would be highly desirable. Interestingly, one experimental study showed alteration of mesolimbic dopamine and serotonin as a result of restricted eating coupled with excessive exercise in activity-based anorexia model.¹⁹ Based on this observation, it can be concluded that aberrant eating behaviors can potentially alter serotonin function and therefore result in persistence of functional alterations of serotonin after recovery of eating disorders. Neither of the studies interrogated persistence of functional alterations of serotonin as a “scar of prolonged aberrant eating behavior”. Although, study of possible functional alterations of serotonin due to aberrant eating behaviors is costly and invasive, but it would contribute to understanding complex relationship between functional alterations of serotonin and eating disorder.

Though one previous study suggested heritability of functional alterations of serotonin by showing anomalous peripheral uptake of serotonin in unaffected first-degree relatives of bulimia nervosa patients²⁰ but functional alterations of serotonin can be still considered as an outcome of aberrant eating behavior in patients. Further studies are required to confirm heritability of abnormalities of serotonin functions in eating disorders. To differentiate abnormalities of serotonin due to heritability from those due to aberrant eating behaviors, study of serotonin function in suspected subjects before the onset of eating disorders may be useful.

Psychology Factors

Body image disturbance

Body cachexia, the degree of body satisfaction and dissatisfaction is believed to be an integral part of self-esteem. Individuals assess their bodies by measuring them against ideal body type of culture. The result of this self-assessment determines body satisfaction or dissatisfaction.²¹ A prospective study on college freshman women showed that figure dissatisfaction, ineffectiveness and, public self-consciousness were associated with symptoms of eating disorders.²² Since the body dissatisfaction data collection was done after development of eating disorders in this study, body dissatisfaction could be a predictor for worsening of eating symptoms rather than a predictor for development of eating disorders. Striegelmoore et al. also showed that severity of

body dissatisfaction are correlated with worsening of disordered eating in sample of first year college women.²⁰ Another Study disproved body image disturbance as a predictive of later eating disorders after 2 years follow up of college students.²¹ Considering to changes in patterns of thinking due to developmental process, studies that begin to collect data in very early adolescence, and follow up patients into adulthood may be more informative.

Another useful approach is the study of body dissatisfaction in subjects who already recovered from eating disorders (recovered study design). Regardless of the fact that eating disorders are known as psychiatric disturbances with persistent residual symptoms, this type of study could define the role of body dissatisfaction either as an etiology or as a clinical feature of eating disorders. Examination of other variables that decrease or increase the risk of eating disorders may overcome lack of unanimous agreement about role of body dissatisfaction in development of eating disorders. Stice et al. opposed the role of body image disturbances in development of eating disorder because they believe that body dissatisfaction is a risk factor for depression.²³ Regarding this notion, concurrent depression should be carefully assessed in patients with eating disorders when studying body dissatisfaction as a risk factor for eating disorders.

A Canadian survey showed that 34% of adolescent girls and 24% of adolescent boys in Grades 6 to 10 thought that they were too obese. This notion increased among adolescent girls from 25% in grade 6 to 40% in grade 10, while only 15% were actually obese (Public Health Agency of Canada, 2008). Regarding significant number of students with body dissatisfaction, prospective studies are required to find out what percentage of these Canadian adolescent girls and boys will develop full picture of eating disorders later. In addition to huge amount of budget required, this study may face another big challenge that is convincing adolescent girls and especially boys to participate in this study. This study helps health care system in Canada to plan prevention, early diagnosis, and treatment of potential future patients with eating disorders in advance.

Personality traits

Role of personality disorders in the development of eating disorders has been the center of attention for many researchers. Several studies have found

that personality traits such as impulsivity, novelty seeking, stress reactivity, harm avoidance, perfectionism, and other personality traits are common in patients with eating disorders. Most of these studies assessed personality traits in their subjects during illness. Therefore, their personality traits could be a reflection of adverse effects of starvation.²⁴ A study shows the effect of starvation and recurrent binge and purging on development of anxiety, social withdrawal, and irritability in previously normal people only a few weeks after restricted food intake (Keys et al., 1950). Numerous studies used personality inventories such as Eating Disorder Inventory (EDI) to assess specific cognitive and behavioral dimensions of eating disorders such as drive for thinness, bulimia, body dissatisfaction ineffectiveness, perfectionism, interpersonal distrust, interceptive awareness, and maturity fear. Personality inventories are designed for the assessment of adult populations. Consequently use of these inventories for assessment of personality traits in majority of subjects with eating disorders who are typically in early adolescent may not be appropriate.²⁴ One important factor that could have possible effect on the accuracy of results in the study of personality traits in adolescences is the constantly changing patterns of perception about the environment and oneself due to ongoing developmental changes in personality. Medical and non-medical therapy in patients with chronic eating disorders could also affect post-morbid functions and personality traits of these patients. Interestingly some studies show the changes in behavior patterns such as harm avoidance, persistence, self-directedness, and self-transcendence after in-patient Cognitive Behavioral Therapy (CBT) for eating disorders.¹¹ Future researches should be aware of the effects of therapy on the result of study of personality traits in eating disorder cases.

Developmental factors

Childhood sexual abuse

Despite the fact that childhood sexual (CSA) abuse as a risk factor for eating

disorders has been a source of debate among clinicians and researchers. While some studies showed strong relationship between CSA and eating disorders, some other studies strongly refuse to accept this relationship. Discrepancy between the results of various studies could be due to the non-uniformity in definition of CSA. Although association between different psychiatric disorders with severity of trauma due to CSA is not well understood yet, but different severity of CSA ranging from non-touching, single episode to long-term sexual abuse combined with physical abuse reported by victims may affect the result of studies. The entry time of sexually abused subjects with eating disorders into the study should also be considered. If the gap between the development of eating disorders and occurrence of sexual abuse is very short, subjects may not be recovered from memories of such a horrible experience. Severity of eating disorders might also affect their sexual abuse reports. In severe forms of eating disorders, CSA experience may be inaccessible to victims.²⁶ Increase in the rate of CSA reported between 1998 and 2003 in Quebec²⁷ (Table 3) could be a warning sign for increased rate of psychiatric problems including eating disorder in Canada. A well-designed research project with consideration on the subject's ethnic origins, age at the time of sexual abuse, socioeconomic class, and family dynamics could contribute to the understanding of possible relationship between CSA eating disorder with CSA. The challenges this research may face are accuracy of data, careful examination of other variables, lack of victims' confidence to report the abuse to police or to child protection system, and clear definition of CSA. This study could also suffer from the problem of cost effectiveness.

Socio-Cultural Factor

Western cultural influence

Exposure to western culture that values slim body for women is presumed to play an important role in the increased eating disorders worldwide. Rate of eating disorders in countries such as Japan, Iran, and

Singapore continues to increase among women who have been exposed to western culture through temporary living in western countries for education, or even short-time vacation, or through mass media.^{28,29} Increase in the rate of eating disorders in populations exposed to western culture in those countries could strongly support the role of western culture in the development of eating disorders. Study of effects of western culture in relation to incidence of eating disorders in non-western immigrant women and girls has been recently given special attention. Swanson et al. studied binge eating (BED) disorder in Mexican immigrants to U.S.³⁰ Although anxiety and depression may not be etiology of BED, they adjusted prior anxiety and depression that could act as non-specific markers of high risk for psychopathology. This study showed significantly increased rate of BED in U.S born Mexican with two U.S born parents. This study also concluded that cultural influence underlying in the increased rate of BED occurs slowly. Most of the studies failed to control at least one variable such as socioeconomic status especially family income, which may have a positive correlation with body dissatisfaction, age differences, despite strong link between age and eating disorders.³¹ Usage of English language at home and religion could also be a potential cause of higher tendency for thinking about dieting and body shape, and as an indicator of acculturation.^{32,33}

Another study demonstrated that as generations further removed from immigration experiences, influence of western culture on body ideals and standards becomes prominent. In this study native Canadian born woman with one or no immigrant parent already completed acculturation had higher tendency to think about dieting than immigrant women or native-born women with two immigrant parents. Acculturation in this paper was defined as the adoption of Canadian values, lifestyle habits, particularly, eating habits, and dietary preferences. As far as development of eating disorders is concerned, the

Table 3: Changes in incidence rates of substantiated child sexual abuse, physical abuse, and neglect cases between 1998 and 2003 in the child protection services of the United States, Canada, and two Canadian provinces.²⁷

	United States	Canada	Ontario	Quebec
Sexual abuse	↘ 20%	↘ 30%	↘ 18%	↗ 24%
Physical abuse	↘ 22%	↗ 107%	↗ 84%	↘ 70%
Neglect	↗ 17%	↗ 78%	↗ 103%	↗ 38%

term "acculturation" is referred to adoption of negative aspects of Canadian eating and lifestyle habits similar to the symptoms of eating disorders, especially BED.³² Although this research group carefully considered effects of family income, age differences, and English-speaking at home, but neither of the subjects in this study fulfilled diagnostic criteria for eating disorders based on DSM-IV criteria. This study also failed to control psychobiological factors that might possibly make the subjects vulnerable to sociocultural pressures.

A large population of immigrants in Canada coming from non-western countries provides an excellent opportunity to study influences of western culture on different ethnic origins with different religious affiliations, socioeconomic status, and eating habits.

This study could contribute to better understanding of connection between western culture and eating disorders. Careful examination of a broad range of non-specific factors that result in psychiatric disorders associated with immigration in immigrant patients with eating disorder and their family may be a challenge for this study. Study of gene influence, particularly, in generations of families of mixed heritage with eating disorders is highly recommended.

Conclusion

It has been hypothesized that eating disorders have multiple and often shared etiologies including biological, psychological, developmental, and sociocultural. A tightly woven network of causes, symptoms, and outcomes of eating disorders makes the study of etiology of these disorders very challenging. Some suggested risk factors for eating disorders require to be defined as either integral parts of eating disorders syndrome such as body dissatisfaction, and perfectionism or outcome of prolonged disordered eating such as functional alterations in serotonin, and some mood disturbances. Researchers should structure their thought processes around this concept that some of currently well-known risk factors for eating disorders are concurrent symptoms of eating disorders. Hence paying special attention to the new and evolved concepts is highly recommended while studying the etiology of eating disorders.

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