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# Patients with Coeliac Disease Are Increasingly Overweight or Obese on Presentation

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## Abstract

**Background**: Historically weight loss is a classic symptom of Coeliac Disease (CD). Recent studies suggest CD sufferers are significantly more likely to be obese or underweight at the time of presentation. This study aimed to establish the frequency of obesity in newly diagnosed Coeliac Disease (CD). **Methods**: Dietetic records of CD patients were reviewed and patient demographics, initial assessment date, and Body Mass Index (BMI) recorded and statistically analysed. **Results**: out of 187 CD patients diagnosed between 1999 and 2009, 127 patients were female (68%) and 60 male (32%) (ratio 2:1). Overall median age was 54 years (range 18 to 87). Median BMI was 23.6, inter-quartile range (IQR) 21.5 - 28.1. Male median BMI was 23.9, IQR 21.8 - 27.3. Female median BMI was 23.2, IQR 21.4 – 28.6. Overall 83 patients (44%) had a BMI of 25 or above. No significant difference was found in the proportion of patients with a BMI of 25 or above when compared according to gender, age or year of referral. Twenty-five patients (13 %) had a BMI of 30 or above. Twenty were female with a median age of 56 years (range 18 – 71). The proportion of females with a BMI of 30 or more was 11% compared with only 3% males (ratio 5:1). Only 5 patients (3%) had a BMI less than 18.5. **Conclusion**: A significant proportion of CD patients (close to half of patients) were diagnosed with a BMI of 25 or over. Compared to males, females have a wider range of BMI and more likely to be obese (BMI of 30 or more).

## Key words

Celiac disease – obesity – overweight – gluten free diet – BMI.

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## Introduction

As celiac disease (CD) is classically associated with malabsorption and weight loss, clinicians may be unlikely to consider a diagnosis of CD among obese patients but some studies suggest the majority of CD sufferers do not display classic symptoms [1] and are more likely to be overweight or obese than underweight [2] at the time of presentation.

It is uncertain if there is a causal link between obesity and CD or just an association but there are certain health issues relevant to both conditions.

Hormonal, liver, cardiovascular, skeletal, psychological, digestive and inflammatory disorders have an increased risk of incidence in both conditions [3]. Both CD and obesity are associated with an increased incidence of type I diabetes, Hyppönen et al [4] suggesting a link with impaired insulin function. Obesity is known to influence insulin capability and the malabsorptive state of CD can increase the risk of hypoglycemia. Diabetic patients with antigen HLA DQ2 have a higher prevalence of transglutaminase autoantibodies, suggesting transglutaminase autoimmunity is more likely to occur in type 1 diabetics expressing class II HLA alleles seen in CD [5]. The predominant treatment and management for both conditions is dietary (NICE guidelines 2006/2009). The negative health impact of both is dramatically reduced by the implementation of a recommended dietary regime [6, 7]. From a health perspective there are concerns that a gluten free diet (GFD) can be nutritionally poor and increase weight further. If the incidence of CD associated obesity rises, appropriate assessment and monitoring of an overall healthcare plan is vital for those with both conditions [8].

This study will establish the BMI of patients with newly diagnosed CD to determine the frequency of obesity among patients diagnosed with CD. Analysing the temporal trend of increasing BMI among patients with newly diagnosed CD will help to widen the understanding of both diagnosis and treatment of CD sufferers in the future.

## Method

Records of all existing CD patients were manually

reviewed from the Dietetics department of the Alexandra Hospital, Redditch and the Worcestershire Royal Hospital, Worcester. From these records, demographics (BMI, age and sex) were recorded. All patients had a CD diagnosis. A data base was constructed containing details on sex, age, year and BMI when individual records began (assumed as the date of first referral). Coeliac disease was diagnosed in all these cases according to the standard classification proposed by Marsh [9] and subsequently modified by Rostami et al [10].

Patient records began in 1999 and continued to April 2009, a period spanning 10 years and 4 months. The analysis date was the date individual records began, assumed as the date of referral or first diagnosis.

To establish distribution normality, total BMI mean, medium, standard deviation and interquartile range were calculated. The absolute proportions of patients with low, normal, overweight and obese BMI were determined. The same statistical analysis was applied to data within groups of males and females to establish gender comparisons and BMI trends.

Similarly, age data was assessed for distribution normality, firstly to establish the mean, median and age range and secondly to divide age groups within genders. Data was also used between groups to compare age distribution and establish age related BMI trends. Data relating to the year when records began was similarly calculated to assess temporal trends and historical comparisons. The proportions were then correlated to establish BMI trends.

The study population was then split into two groups. Firstly equal numbers of years in each group by splitting the sample into two equal time periods and secondly, equal numbers of patients in each group. Each group was analysed within, compared between and combined with the proportion of overweight or obese. Finally, the temporal group was analysed comparing gender and age with BMI.

## Results

From the 240 adult patients registered with CD at Redditch and Worcester hospitals (96 and 123 respectively), 187 had the participation data required of sex, first recorded age, date and BMI (64 from Redditch, 154 from Worcester).

Across the overall population spread, the BMI mean was 25.07, median 23.6, standard deviation 4.98 with an interquartile range of 6.6.

Forty-four percent of patients analysed had a BMI in the overweight or obese range (31% and 13%). Only 3% were in the underweight category (BMI 18.5 and under), classically associated with CD. Although the majority fitted within the normal BMI range of 18.6 – 24.9 (53%), a large percentage (44%) had a BMI of 25 or above.

Each BMI group was tested for normality and indicated no specific trend with BMI values widely distributed across each population spread. BMI values were widely distributed across both genders indicating no specific trend. Female BMI mean was 25.55, median 23.3 and SD 5.4. Male BMI mean was 24.51, median 23.9 and SD 3.91. Gender distribution across the overall population was 2:1 (female/male respectively). Individual BMI groups maintained the 2:1 ratio apart from the obese category where the ratio rose to 5:1 (female/male).

The results showed age was widely distributed with no specific gender trend but a slight trend towards an aging diagnosis with three quarters of the population over 41. The male mean age was 52.5, median 54 and SD 16.5. Male age mean was 53, median 54.4 and SD 15.7, female mean age was 52, median 54 and SD 19.97.

When age and BMI were compared, in the overweight and obese groups combined the mean was 53.5, median 52 and SD 14.96. For just the obese group the mean was 54.5, median 54 and SD 15.22.

The age ranges across gender were widely distributed and not specifically related to an increased BMI. The overall population age range started at 18, in the overweight group it rose to 23 and in the obese group 28, suggesting a trend towards a higher weight/age of diagnosis.

Analysis shows temporal data was not evenly distributed, new records dramatically increasing in the second half of the period of analysis (Fig. 1). Both the temporal mean and median was 2006, SD 2.06. The drop in numbers in 2009 is explained by the fact this is only a part year (4 months).

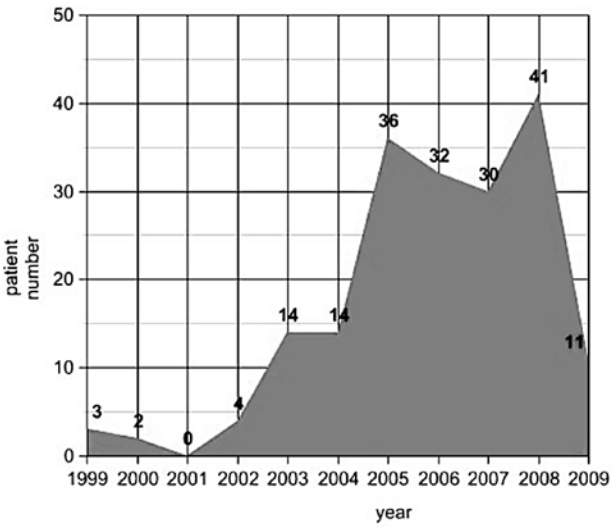


**Fig 1.** Number of newly recorded patients per year.

For sub-analysis, patients were split into two groups either side of the median year (2006). In the early group (those diagnosed up to and including 2006) the BMI mean was 25, median 23.4 and SD 4.78. In the late group (diagnosed after 2006 to present day) the mean was 25.4, median 24.9 and SD 5.24. Comparing the number of patients in the year they were first referred with the number of patients who also had a BMI of 25 or over (overweight or obese), the analysis shows that along with a rise in patient numbers, there was also a rise in patients overweight or obese. Patient numbers were relatively low in the early years, 3 in 1999, 2 in 2000, 0 in 2001, 4 in 2002. This rose to 41 in 2008 (2003/4

14, 2005 36, 2006 32, 2007 30). When the study was carried out in March 2009, 11 had already been recorded. In 2002 the number of obese patients diagnosed with CD accounted for 25%. By 2008 it was 52% and yearly projection on 2009 figures indicates a rise to 73%

By converting this data into percentages, allowing for the variations arising from very small samples numbers in the earlier years, there is a marked increase in recent years in the percentages of patients who are overweight or obese at first referral (Fig. 2).

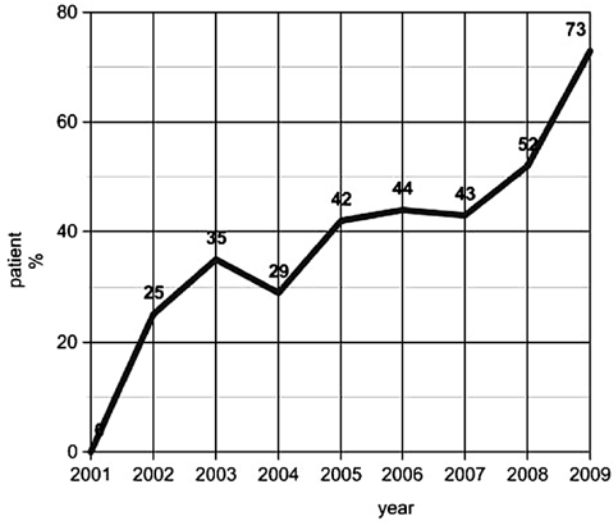


**Fig 2.** Increased percentage of overweight and obese CD patients from 2001 to 2009.

To summarise, this study found that 44% of CD patients at first referral were either overweight or obese. In the total population, 13% were obese and less than 3% were underweight. This ratio is widely distributed over age and gender although women have a wider distribution spread than men and were more likely to be clinically obese (5:1). The overall patient ratio between women and men was 2:1 but 5:1 in the obese category. The average age of newly referred patients was 54, with three quarters of the CD patient population over the age of 41. Age of diagnosis rose with BMI, diagnosis age for those in the obese group a decade later than overall. Temporally, there is a continuing increase in both the numbers of patients diagnosed and the percentage that are either overweight or obese .

## Discussion

Traditionally, CD has been perceived as a malabsorption disease, historically making weight loss the key focus in research and clinical assessment [11]. Although weight loss is a common symptom for children (43-59%), for adults it is considerably lower (6-16%) (NICE 2009) highlighting a higher proportion with no symptomatic weight loss. This study found 97% of patients did not display the classic symptom of weight loss (BMI below 18.5). Less than 3% of the study population were underweight at first referral. A large percentage (44%) were overweight or obese with a BMI of 25 or over. Specifically 13% of the overall study population were obese (BMI 30 or over).

Patients in this and previous similar studies [2] had already been referred to a gastrointestinal (GI) specialist and diagnosed with CD. To initially be referred, the assumption is other GI symptoms must have been evident. CD patients with mild or atypical symptoms would be unlikely to be investigated or referred in this situation [12].

According to National Health Service current data 24% of the adult population in England are classified as obese with a BMI of 30 or over and 38% are overweight (NHS 2009). The obesity levels in this study (13%) are considerably lower. However, in the overweight category generally more men (43%) than women (32%) are overweight. In this and other CD studies the ratio of women to men is 2:1. If the general findings are recalculated to match this ratio the percentage is a more comparable 35% (31% with CD). Obesity may still appear less common amongst patients with CD than in the average population but as demonstrated in this study, people with increasing weight are taking longer to get a CD diagnosis. Therefore, there may be a percentage of the obese population who have yet to be diagnosed with CD. Around 5% of the general population has a low BMI in the underweight category compared to only 3% in this study. As weight loss is traditionally symptomatic of CD, diagnostically a higher percentage would have been expected indicating a need to evaluate the relationship between weight and CD. There appears to be an increasing prevalence and incidence of both obesity and CD but an association between weight and presentation of CD is only just being recognised [8].

In the last decade, many lifestyle related conditions such as heart disease and diabetes have also increased alongside advancements in the diagnosis, healthcare and awareness of many classic conditions (DOH 1994). From a diagnostic point of view, obesity is easily assessed but CD has historically been considerably more difficult to detect. Unlike obesity, studies indicate that CD has been previously significantly undiagnosed [13].

The rise in obesity is mainly linked to relatively new negative diet and lifestyle practices (NHS 2009). Historically, the majority of CD sufferers have remained undetected with only a minority diagnosed. The estimated number of coeliacs has remained consistent suggesting that unlike the rise in obesity, the increase in CD is more to do with greater numbers being diagnosed than an actual increase in incidence.

Using BMI as a method of weight measurement needs to be considered in any health organizations. Although widely accepted to define overweight and obesity (NICE 2006), BMI does not measure body fat percentages and using it in isolation as a weight assessment tool has its limitations [14].

This study showed age and gender were widely distributed over the population demonstrating no specific age or gender trend. The female to male ratio of 2:1 was consistent with both historic and current data with the

exception of the obese category (ratio 5:1). A difference in the clinical presentation of CD in men and women is a possible reason for higher incidences in women [15] as well as environmental and social factors.

Regarding age, this study focused on an adult population, 18 and over. This was mainly because there were very few children registered, BMI calculations are not comparable and there are differences in CD manifestation. However, some studies suggest the age of childhood CD onset is rising with fewer new cases presenting typical GI symptoms and generally in a milder form [16]. In this study, the average age at first referral was 54 with three quarters of the population over the age of 41 suggesting a trend towards an aging diagnosis. Coeliac disease diagnosis in adults occurs more frequently in the 40-60 age group [17, 18] (Table I).

**Table I.** Comparison of this study with current data on coeliac disease and obesity

| Authors | Dickey | Reilly | Tucker |
|---|---|---|---|
| Year | 2006 | 2011 | 2012 |
| Underweight | 5% | 0% | 3% |
| Normal weight | 56% | 74% | 53% |
| Overweight | 26% | 12% | 31% |
| Obese | 13% | 6% | 13% |
| Location | Londonderry | USA | Worcestershire |
| Study number | 371 | 142 | 187 |
| Temporal data range | 10 years | 8 year | 10 years |

This study highlighted a relationship between age of diagnosis and weight, with age of referral rising with increased BMI. The overall age at first referral was 18 but in the obese category it was 28, a difference of 10 years. Atypical symptoms such as obesity could be less likely to initiate a CD diagnosis, generating an average delay in diagnosis ranging from 4.5 to 9 years [19-21].

Over the time period of this study (10 years and 4 months, 1999-2009) there was a continuing increase in both the number of patients referred and the number that were overweight or obese. In the first few years numbers were too small to obtain reasonable analysis but from 2003 a significant increase in patient numbers and those overweight or obese was evident (Figs. 1, 2). Little comparable research was available on the relationship of obesity and CD. Of those available, overweight and obese percentages ranged from 34% to 39% [2, 22]. No other similar study has been carried out in England so far.

Although this study has shown that obesity is increasingly common in patients with CD, it was not designed to ascertain an association between these two conditions. Obesity related social and environmental influences, comparable mechanical, physical and biochemical factors such as inflammatory and immune responses and the combination of both conditions on the health status of the individual could all be implicated and involve further study. There is also no direct evidence to suggest that either condition has a precursory effect. Both conditions have associated conditions and biochemical pathways.

Coeliac disease is a multi-system autoimmune disorder with a strong association to other autoimmune conditions [17]. Obesity also elevates levels of inflammatory markers, producing pro-inflammatory cytokines. Increased levels of C-reactive proteins, interleukin-6 and tumor necrosis factor-alpha create an immune sensitivity and increased risk of inflammation [23].

Increased insulin resistance in obesity is associated with increased levels of inflammatory inducing IL-6 and TNF-α [6, 7]. Diabetes and CD are both linked to impaired insulin function through the antigen HLA DQ2 suggesting a transglutaminase autoimmunity through the expression of specific class II HLA alleles [5].

Further investigation is required to determine if a similar inflammatory pathway or impaired hormonal or insulin function occurs in both obesity and CD or if the combined but dissimilar effect of both conditions creates a greater risk to health [24].

In this study, 44% of participants were overweight or obese when they were first referred to a dietitian for treatment, indicating many of these patients were overweight or obese before CD was diagnosed. It does not show the individual range of symptoms and how the symptomatic combination of CD and obesity has impacted on health status. Further research would help determine the impact on undiagnosed CD of social and environmental issues normally associated with obesity such as low activity levels and higher intakes of readily available, cheaper high energy foods [25].

This study analysed patient data at first referral to determine levels of obesity before they started on a GFD. Therefore there is no indication of what influence a GFD then had on levels of obesity in the sample population analysed. A GFD is specifically designed to relieve the symptoms of CD and not to address other diet related health issues such as obesity. It could potentially decrease [26] or increase obesity levels, one study finding 82% of initially overweight or obese patients increasing their weight on a GFD and the percentage of the whole group also increasing to more than half the sample number (51%) [2]. There are additional concerns regarding overall health as gluten free foods are often a nutritionally poor replacement [8]. There are also compliance and financial issues with those on a GFD [27]. If incidences of obesity continue to rise in newly diagnosed CD cases a combined dietary treatment programme is required that incorporates a GFD as part of an overall healthy eating regime with regular monitoring by a registered dietitian [8].

## Conclusion

Coeliac disease is frequently diagnosed among patients that are also obese. Amongst newly referred patients with CD there is an association with an increasing prevalence of obesity. This suggests that CD is more widespread than

previously suspected, generating a need for further research into the extent, causes of and implications to patients with both conditions. This study has also highlighted a need to reassess diagnostic criteria, review diagnostic procedures and initial patient assessment. Further research into the influence of a GFD on CD associated obesity would also help determine dietary and nutritional influences. Assessment of existing dietary guidelines and the formulation of a combined dietary approach aimed at treating both conditions is a strong consideration with increasing numbers of patients with both CD and obesity.

## Conflicts of interest

None to declare.

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