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## Conference on 'Malnutrition matters'
## Symposium 1: Living with coeliac disease

# The safety of oats in the dietary treatment of coeliac disease

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Coeliac disease is a permanent inflammatory disorder of the small bowel affecting approximately 1% of the population. The only effective treatment that exists is exclusion of gluten from the diet. The present paper aims to review the literature as to whether oats are safe to eat for people with coeliac disease. Much data exist on the restrictive nature that adhering to a gluten-free diet imposes on an individual. If oats could be eaten, this would help reduce the restrictive nature of the diet. This in turn could lead to an increase in the quality of life. Oats are of high-nutritional value, providing a rich source of fibre, vitamins and minerals. The fibre source contains soluble fibre which is believed to help reduce LDL-cholesterol. A systematic review of the literature was conducted. Earlier studies conducted are difficult to compare as they used different methodologies and it is not known whether samples of oats in the studies were contaminated with gluten from other cereals. Many studies reviewed do not state the strain of oat used. Recent research has suggested that it may only be in certain strains of oats which could produce a toxic response to people with coeliac disease. In conclusion, research suggests that the risk from consuming oats may be less harmful than first thought; however, may vary according to the strain of oat. Handling that risk in clinical practice remains controversial.

**Coeliac disease: Oats: Gluten-free diet**

### Introduction to coeliac disease

Coeliac disease is a chronic alteration of the proximal small intestines associated with a permanent intolerance of gluten in genetically susceptible people[1]. The disorder is highly diverse, ranging from asymptomatic to severely symptomatic. It is associated with numerous autoimmune disorders[2]. Whether consuming oats causes harm in coeliac disease is controversial for numerous reasons. There is a lack of consensus on the use of terms related to coeliac disease and gluten[3]. This variability in the use of terminology has led to difficulty when comparing and evaluating clinical studies and research findings. In 2012, attempts were made to standardise terminology. This led us to a consensus statement from a working group in Oslo[4]. This lack of definition has only added to the controversy of whether oats are harmful to people with coeliac disease.

Coeliac disease may well have a history dating back to the first and second centuries AD[5]. The first clear account of what might have been coeliac disease was by the physician Aretaeus of the first and second centuries AD, with his reference to undigested food, loose stools and 'a coeliac disease of chronic nature'. The first clear description was given by Samuel Gee in 1888[6]. He suggested that dietary treatment might be of benefit. In the early twentieth century, various diets were tried, with some success, but without clear recognition of the toxic components. The doctoral thesis of Wim Dicke of 1950 established that exclusion of wheat, rye and oats from the diet led to dramatic improvement. The toxicity was shown to be a protein component, referred to as gluten[7]. Dicke's colleagues, Weijers and Van de Kamer, suggested that measurement of stool fat reflected the clinical condition.

Earlier studies were in children, but stool fat measurements documented that the condition could be recognised in adults. Histological abnormalities of the lining of the small intestine were demonstrated beyond doubt by Paulley in 1954[8]. In 1956, techniques of biopsy of the jejunum

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were described by Shiner[9]. Since 1954, serological and endoscopic techniques have improved the diagnosis of the condition.

Concurrence studies in monozygotic twins suggested a genetic component, confirmed by studies of human leucocyte antigens. The probability of developing coeliac disease if a first degree relative has coeliac disease is one in ten[10]. In addition, non-genetic factors (such as timing of gluten exposure) seem likely to contribute; however, the evidence is not conclusive[11]. Circulating antibodies suggest an immunological mechanism of damage and provide non-invasive screening tests. Osteoporosis is particularly associated with coeliac disease. Lymphoma, adenocarcinoma of the small intestine and a range of immunological disorders are also associated with coelaic disease. However, the risk of developing cancer from coelaic disease is low in absolute terms[12]. A relationship with dermatitis herpetiformis was suggested by Samman in 1955 and established by Shuster and Marks in 1965 and 1968[13].

The only known effective treatment of coeliac disease is total exclusion of gluten from the diet. This can be extremely challenging to the patient[14] and cause a considerable burden. Non-adherence to a gluten-free diet has been shown to be as high as 58 %[15]. Clearly, if oats were safe to eat, the diet would be less restrictive to many people and could well increase adherence. This has in turn been linked to a reduction in complications associated with coeliac disease[16]. Research is being conducted using more convenient methods of treatment that are less restrictive than removing gluten from the diet. However, at present the only effective treatment that exists is adherence to a gluten-free diet.

It is clearly recognised in coeliac disease that the damage in the small bowel is induced in genetically susceptible people when proline- and glutamine-rich proteins found in wheat, barley and rye are eaten. However, knowledge on many aspects of the disorder is inadequate[17]. Present areas where information is lacking include definition of the tolerated levels of gluten among different individuals and the implication of non-adherence in people without classical symptoms. The exact prevalence of the condition is still not known. Another major area of controversy is whether oats are toxic for some or all people with coeliac disease. Debate has raged for decades as to whether proteins in oats cause similar damage to those of wheat, rye and barley.

## Oats and coeliac disease

Oats, like all other grain varieties, belong to the Poaceae family. They are a staple in Germany, Ireland, Scotland and the Scandinavian countries. *Avena sativa* L (common oat) is the most important among the cultivated oats. Like wheat, it is an annual grass that is believed to be Asiatic in origin[18]. Modern oat, probably originated from the Asian wild red oat, which grew as a weed in other grain crops. Although the proteins in oats are similar to those in wheat, rye and barley, the oat prolamins (avenin) have significantly lower levels of proline[19].

It is an annual crop used both for human and animal nutrition. Before being used as a food, it was used for medicinal purposes. Although oats are not suitable for bread making, they are found in a wide variety of foods and forms as well as being served as porridge. Thus, inclusion into a gluten-free diet would greatly expand the repertoire of foods that a person with coeliac disease could safely consume. There are a wide variety of cultivars which are characterised by their relative protein concentration. There are some traits that cause it to be less favoured than other grains. Many people find their taste bland and they have a shorter shelf life than many other cereal grains[20].

Despite these issues, oats contain numerous nutrients that have been shown to confer health benefits. Oat grains are a rich source of B-complex vitamins, proteins and minerals. Much attention has recently centred on their fibre content, in particular the soluble fibre content. This has been seen to be beneficial in the glycaemic control of people with diabetes. The β-glucan found in oats has also received much attention in particular, as it has been associated with improving lipid profiles, which have been linked with the prevention of heart disease.

Thus, the incorporation of oats into the diet is not only important from a quality of life standpoint for people with coeliac disease. They also have the potential to play a therapeutic role. As such, there is considerable relevance in knowing whether people with coeliac disease can eat oats safely.

## Safety of oats

The first suggestion that oat consumption is deleterious in people with coelaic disease was made in 1953 when Van de Kamer measured fat absorption in a patient with coeliac diseases[21]. This sample size of one was clearly not statistically significant. It is unclear from early studies whether the samples of oats used were contaminated with gluten. At that time, technology did not exist to accurately assess traces of gluten.

Further studies were performed in other groups of children showing no harmful effects with oats[22]. However, these studies had less than six children and had numerous methodological flaws. There were no controls and indirect measurements were used for estimating damage to the gastrointestinal tract. No trial lasted more than 6 months from what is a life long condition. It is also difficult to compare accurately between these early studies as completely different methodologies were used[23].

With advances in histology more specific studies were performed. Haboubi *et al.*[24] in their systematic review report on six studies. Two of these six studies included in this review found changes in small bowel histology with increased intraepithelial levels in the group eating oats compared with the controlled group. However, in all six studies there was no significant difference in the serology between the control group and the oat group.

The largest study reported was by Janautuinen, who found no statistical difference in the grade of villous

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atrophy between the gluten-free diet with oats group and the standard gluten-free diet group in patients with coeliac disease in remission[25]. Janautuinen continued his earlier study[26] for 5 years in an attempt to examine the long-term effects of a gluten-free diet containing oats in patients with coeliac disease. The authors contacted their original study population and discovered that after 5 years 65·7% of patients in the original oats group still consumed oats. Some patients who had reverted to a traditional gluten-free diet had done so because of concerns about the safety of oats at that time. The study showed an improvement in the villous architecture of both groups after 5 years. However, neither of the groups showed a return to normal. Thus, this proved inconclusive as to the safety efficacy of taking oats in coeliac disease.

These results differ slightly from the findings of the systematic review by Garsed and Scott in 2007[23]. Using different inclusion and exclusion criteria they reviewed ten studies. From their review, they found only one out of 165 patients who showed mucosal damage from oat consumption. This one patient was added into a further uncontrolled study[27] which found two other patients who developed villous atrophy possibly caused by oats. As ever, it is difficult to be certain that gluten from wheat, rye and barley had not inadvertently entered into the diet of the subjects studied.

The methodology to assess potential pathology to oats is compounded by limited clinical tools of assessment. A reduction in symptoms does not guarantee absence of small bowel atrophy[28]. The most widely used serological clinical test for coeliac disease is the presence of IgA tissue transglutaminase antibodies. If tissue transglutaminase levels are normal, it is still possible that the small bowel villi are still damaged[29]. Subsequently, the testing of the reintroduction of oats using typical clinical assays becomes problematic.

However, a more recent study of the impact of oats using specific monoclonal antibodies showed more precise results[30]. This research group demonstrated variation in response to different cultivars of oats. In this study, it was found that three groups of oat cultivars reacted differently against the monoclonal antibody moAb G12. The study distinguishes three groups of oat cultivars, which gave different reactions against the antibody: a group with considerable affinity, a group showing slight reactivity and another with no detectable reactivity. This suggests that the reactivity of this antibody with cereal storage proteins of different varieties of oats was correlated with its immunotoxicity. This gives an explanation for why only some oats trigger an immunological response. This is a rational hypothesis given that oats are a cereal crop that exists with a wide variety of form within the species. This would also explain different results from different studies performed. Many of the studies previously conducted do not mention the cultivar of oat used.

## Current dietetic practice

There is clear discrepancy in the advice given regarding oats in clinical practice.

A recent survey of national societies for coeliac disease by Garsed in 2007[23] demonstrated clear variation in the advice given to their members. From the seven societies that replied to their survey, two recommended oats with caution (French speaking Switzerland and Slovenia). Five recommended against eating oats for people with coeliac disease (USA, Romania, South Africa, New Zealand and the society representing German and Italian speaking regions of Switzerland).

Further discrepancy also exists at a more local level. In three northwest England hospitals, three different policies on oat consumption exist. One hospital advises total avoidance of oats; one advises to try re-introduction after 6 months on a gluten-free diet. The third hospital advises re-introduction of oats after 12 months. The monitoring of patients after oat consumption also varied between the hospitals.

## Conclusions

In reviewing the literature comparisons between different studies is extremely difficult not only due to the different study designs but also due to different conditions used in testing. There is also the issue of how the oat material used in the clinical trial has been tested for contamination of gluten. In view of recent studies particularly on oat cultivar[30], the whole area of accurate comparison has further been compounded as the vast majority of studies do not mention the variety of oat used.

This lack of clear evidence and controversy seen is highlighted by the different recommendations from different patient support groups. The controversy is exacerbated by the lack of clarity around terms relating to coelaic disease. The recent research on differing cultivars appears to shed more light on the extent of the risk of oat consumption. However, more research particularly in relation to cultivar variation is required to further clarify the risk of eating oats in coeliac disease. It is clear that if eating oats safely in coelaic disease is possible this would be of benefit to many patients. Given no 100% clear guidelines exist, it seems prudent as a minimum to clinically monitor patients who are eating uncontaminated oats.

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