North Asian International Research Journal of Pharmaceutical & Medical Sciences

ISSN: 2456-8287 Vol. 6, Issue-10 October-2022

Index Copernicus Value: 64.15

REVIEW OF THE EFFECTS OF OAT INTAKE ON GASTROINTESTINAL HEALTH

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ABSTRACT

Oat (Avena sativa L.) stands out from the other cereal crops because it contains a diverse range of nutrients that have applications in a variety of industries, including the human and animal nutrition industries, the medical industry, and the cosmetics industry. Oats also have a long history of use as a traditional ingredient in a wide range of foods and beverages. It is a type of plant that is grown on an annual basis and has been farmed in many different regions of the world for more than 2,000 years. It is one of the earliest known crops to have been cultivated by human civilisation. It wasn't until many thousands of years after other cereal grains like wheat and barley were originally cultivated that it was even attempted to be cultivated.Long-term celiac disease consumption is safe. Consumption of oats was associated with an increase in the number of beneficial bacterial groups in both individuals who did not have GI disease as well as those who did have CeD. In the vast majority of investigations, researchers came to the conclusion that eating oats had no influence whatsoever on gastrointestinal (GI) symptoms.There was a correlation between oat-induced changes in plasma lipids and Akkermansia muciniphila, Roseburia, Bifidobacterium, and Faecalibacterium prausnitzii, as well as plasma SCFA. This suggests that the prebiotic activity of oats to modulate the gut microbiome could contribute towards the cholesterol-lowering effect of oats.For the physiological benefits of eating oats to be maximized, one needs to have a deeper awareness and respect of farming techniques, as well as the problems that they present, and the processing technologies that are available.

Keywords:Celiac Disease, Gastrointestinal, Oat, Probiotic

INTRODUCTION

Chronic diseases that are associated with modern lifestyles, such as obesity, insulin resistance, and type 2 diabetes mellitus, are some of the most significant health issues of the 21st century. This unfavorable trend, which is already being seen in the younger population, is one of the key consequences of shifts in both dietary practices

and lifestyle choices, which are among the primary causes.In order to maintain weight loss, the promotion of dietary intervention, exercise, and lifestyle adjustment, including second-line obesity treatments, has been difficult to achieve.[1]

Oat (*Avena sativa L.*) stands out from the other cereal crops because it contains a diverse range of nutrients that have applications in a variety of industries, including human and animal nutrition, medicine, and the cosmetics industry. It is a crop that is grown on an annual basis and has been cultivated in various parts of the world for more than 2,000 years. It is one of the oldest crops that is known to human civilization. It was not cultivated until many thousands of years after other cereal grains such as wheat and barley were first cultivated. Carbohydrates, dietary soluble fiber, balanced protein, lipids, various phenolic compounds, vitamins, and minerals are all found in significant amounts in this cereal.[2,3]

Oat has garnered an increased amount of attention from both scientific researchers and industries in recent years as a result of an increased public consciousness regarding the importance of maintaining healthy eating habits. Food-based businesses are taking into account better nutritional composition in addition to the popularity of ancient grains, and they are developing novel food products by incorporating oats as an ancient grain in breakfast cereals, beverages, bread, and infant foods.[3,4]

In order to maintain weight loss, the promotion of dietary intervention, exercise, and lifestyle adjustment, including second-line obesity treatments, has been difficult to achieve.

METHODS

This article is a literature review conducted to discuss about effects of oat intake on gastrointestinal health. The studies included in this article are randomized controlled trials as well as clinical trials conducted in humans. The PICO analysis used was adult patients. The index that is seen is oat intake, while there is no comparison.The objective of the study is impact of gastrointestinal health. The analysis involved must up to date from 2012. Study is searched on databases of international journals, such as Pubmed or GoogleSchoolar. The search keywords in this article were “oat intake” and “gastrointestinal health”.This analysis follows the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) paradigm, in which researchers initially enter keywords into each database, then sort out the studies worthy of inclusion in this article.

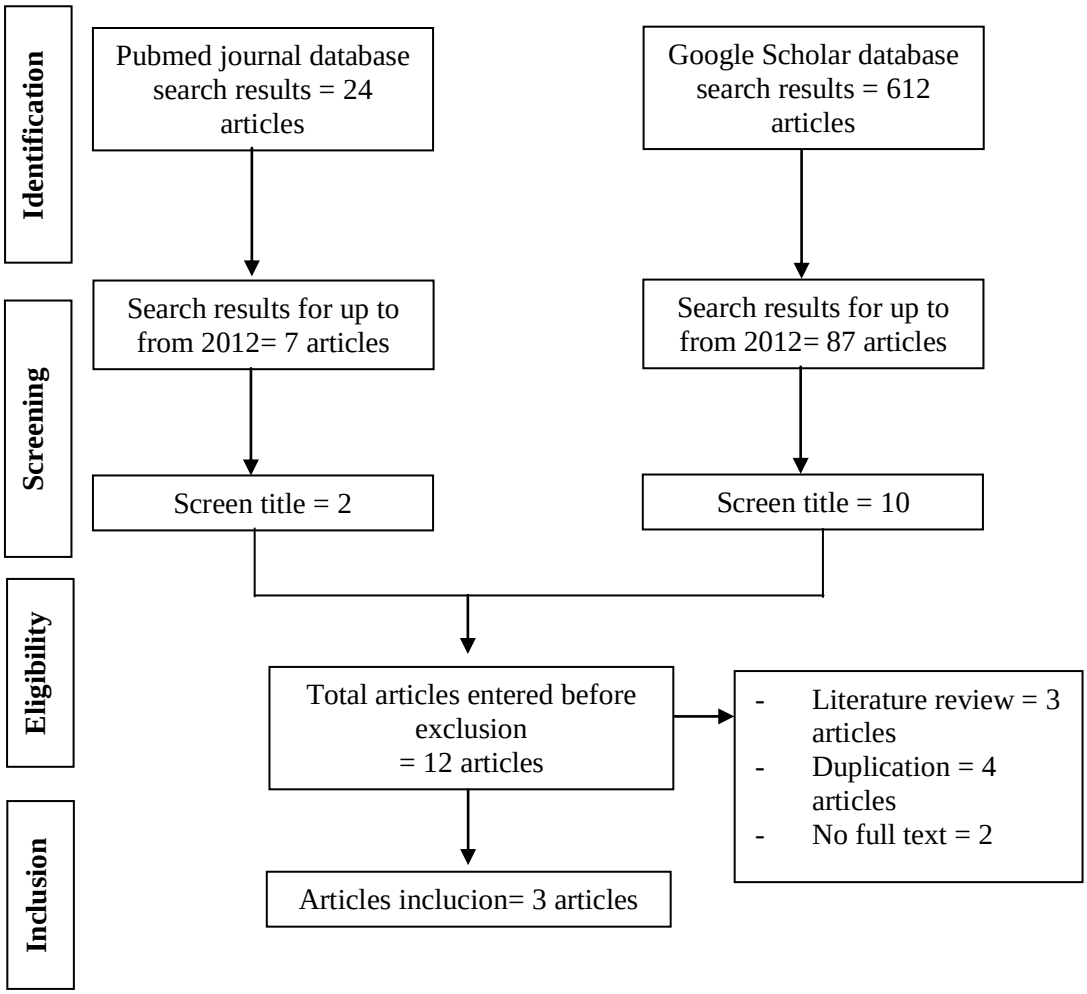

Figure 1. Flowchart of search results

The terminology used in the search is as follows: *"oat"[All Fields] AND ("intake"[All Fields] OR "intake s"[All Fields] OR "intakes"[All Fields]) AND ("digestive system"[MeSH Terms] OR ("digestive"[All Fields] AND "system"[All Fields]) OR "digestive system"[All Fields] OR "gastrointestinal"[All Fields] OR "gastrointestinally"[All Fields] OR "gastrointestine"[All Fields]) AND ("health"[MeSH Terms] OR "health"[All Fields] OR "health s"[All Fields] OR "healthful"[All Fields] OR "healthfulness"[All Fields] OR "healths"[All Fields])*. The search was carried out on September 25, 2022 at 20.30 WIB, where we found threejournals that met the criteria and could be included in the discussion.

RESULT

Study conducted by Xu, et al (2021) showed that consumption of oats and rice led to a significant reduction in total cholesterol (TC) and non-high-density lipoprotein cholesterol (non-HDL-C). At day 45, the reduction in

total cholesterol and non-HDL-C was greater in the participants who consumed oats as compared to those who consumed rice (p = 0.011 and 0.049, respectively). Consumption of oats was found to significantly lower total cholesterol and low-density lipoprotein cholesterol, and it also mediated a prebiotic effect on the gut microbiome. There was a correlation between oat-induced changes in plasma lipids and *Akkermansia muciniphila*, *Roseburia*, *Bifidobacterium*, and *Faecalibacterium prausnitzii*, as well as plasma SCFA. This suggests that the prebiotic activity of oats to modulate the gut microbiome could contribute towards the cholesterol-lowering effect of oats.[5]

Valeur study conducted with 7 healty person, they showed faecal levels of -galactosidase and urease were found to be lower (P = 0.049 and P = 0.031, respectively). The inflammatory state of the host, as determined by rectal levels of PGE2, also decreased, but this change was not statistically significant (P=0.168). The findings indicate that oatmeal porridge has an effect on the functions of the microorganisms in the gut and may possess potentially beneficial prebiotic properties that warrant further investigation.[6]

DISCUSSION

Oats are a type of cereal grain that are generally well received by customers all around the world. They can be found in a broad variety of food products, such as beverages with low energy content, foods intended for medical use, baked goods, and granolas. Oats have the potential to be included in low-cost, nutritional goods in the future, which would be beneficial at a time when there are growing concerns about food insecurity on a worldwide scale as well as the dual health consequences of being overweight and underweight.[7]

Consumption of oats was associated with an increase in the number of beneficial bacterial groups in both people who did not have GI disease and those who had CeD. The majority of studies found that consumption of oats had no effect on gastrointestinal (GI) symptoms. Although in vitro studies in CeD provide insight to oat-sensitive individuals and their GI mucosa, clinical studies are still limited, which prevents us from drawing definitive conclusions. It is important to conduct additional research on the prevalence of oat sensitivity in individuals who have CeD because this could improve clinical management and make it easier to include oat in the diet of individuals in this population.[9]

Table 1. Result of Searching Litelature

Author	Origin	Methods	Sample Size	Period	Outcame
Xu, 2021[5]	China	RCT	210 mildly hypercholesterolemic subjects	No date	After 30 and 45 days, total cholesterol (TC) and non-HDL-C decreased with oats and rice intake. The reduction in TC and non-HDL-C was greater in oats than rice at day 45 (p = 0.011 and 0.049, respectively). Oat consumption increased *Akkermansia muciniphila* and *Roseburia*, *Dialister*, *Butyrivibrio*, and *Paraprevotella*, and decreased *f-Sutterellaceae*. In the oat group, *Bifidobacterium abundance* was negatively correlated with LDL-C (p = 0.01, r = 0.31) and TC and LDL-C were negatively correlated to *Faecalibacterium prausnitzii* (p = 0.02, r = 0.29; p = 0.03, r = 0.27, respectively). *Enterobacteriaceae*, *Roseburia*, and *Faecalibacterium prausnitzii* correlated positively with butyric acid and valeric acid and negatively with isobutyric acid. HDL-C correlated negatively with valeric acid (p = 0.02, r = 0.25) and TG correlated positively with isovaleric acid (p = 0.03, r = 0.23). Consuming oats reduced TC and LDL-C and acted as a prebiotic on the gut microbiome. *Akkermansia muciniphila*, *Roseburia*, *Bifidobacterium*, *Faecalibacterium prausnitzii*, and plasma SCFA correlated with oat-induced changes in plasma lipids, suggesting prebiotic activity of oats to modulate gut microbiome could contribute to cholesterol-lowering effect.
Valeur, 2016[6]	Norway	Prospective study	7 healty subject	No date	After eating oatmeal porridge, -galactosidase and urease levels dropped (P=0,049 and 0,031, respectively). Rectal PGE2 levels decreased, but not significantly (P=0,168). The results suggest oatmeal porridge may have prebiotic properties that need further study.
Kaukinen, 2013[8]	Finland	Cross-sectional study	110 long-term treated celiac disease adults	No date	Oats did not cause any small-bowel mucosal villous damage, inflammation, or gastrointestinal symptoms when they were consumed on a daily basis or for an extended period of time. People who ate oats on a regular basis had a daily fiber consumption that was noticeably higher than that of people who did not eat oats. Patients diagnosed with celiac disease overwhelmingly favored including oats in their day-to-day diet. Even after being consumed for an extended period of time, there were no negative side effects.

The soluble and insoluble fractions of whole grain oat contain significant amounts of beneficial nutrients like proteins, carbohydrates, unsaturated fatty acids, and dietary fiber. Whole grain oat also contains a significant amount of protein.[10] Additionally, oats contain a variety of micronutrients, including vitamin E, folates, zinc, iron, selenium, copper, manganese, carotenoids, betaine, choline, sulphur-containing amino acids, phytic acid, lignins, lignane, and alkyl resorcinols. Despite the fact that wheat and rice are consumed in much greater numbers around the world than oat, oat has the benefit that it is more commonly consumed in its natural state as a whole grain cereal

than as its processed counterparts. Because of the preventative effects that they have, the consumption of cereals made with whole grains is gaining more and more attention in recent years.[2]

Oat grain is composed of around 60 percent starch. It is primarily found in the endosperm of the seed. When compared to those of other cereal starches, the physicochemical properties of oat starch have been found to exhibit a significant degree of variation. There are a variety of oat cultivars, each of which possesses its own unique set of physicochemical characteristics. These discrepancies are most likely caused by variations in the amount of the interaction between and among starch chains that exist inside the amorphous and crystalline portions of the native granules, as well as variations in the chain length of the amylose and amylopectin fractions of oat starch.[2,11]

Consumption of oats was found to significantly lower total cholesterol and low-density lipoprotein cholesterol, and it also mediated a prebiotic effect on the gut microbiome. There was a correlation between oat-induced changes in plasma lipids and *Akkermansia muciniphila, Roseburia, Bifidobacterium*, and *Faecalibacterium prausnitzii*, as well as plasma SCFA. This suggests that the prebiotic activity of oats to modulate the gut microbiome could contribute towards the cholesterol-lowering effect of oats.[5]

Other study was evaluated microbial fermentation by measuring intestinal gas production and faecal SCFA excretion. Lactulose is unabsorbable by the small intestine but fermentable by colonic microbiota. Gas excretion after lactulose ingestion measures colonic fermentation capacity. Similar gas excretion curves before and after the diet intervention suggest eating oatmeal porridge does not affect colonic carbohydrate fermentation.[12]Valeur results on oat consumption and SCFA excretion are similar to others'.[6]

Oats are a good source of soluble dietary fiber in the form of β-glucan, which is a crucial component responsible for the health advantages of oats, according to an examination of these and other grains. Other grains have also been examined. The distinct physicochemical properties of oats, in comparison to those of other grains, as well as the physiological responses to the consumption of oats, contribute to the breadth of health benefits that have been demonstrated for them, in addition to the potential for additional health benefits that are still being investigated.[7,13]

It is generally agreed that oats have the ability to serve as a source of protein that is both inexpensive and high in nutritional content. Oats have their own distinct protein composition in addition to having a high protein level ranging from 11–15%. Albumins, which are soluble in water, globulins, which are soluble in salt water,

prolamins, which are soluble in a solution of diluted alcohol, and glutelins make up the four different types of cereal proteins that have been classified according to their solubility (soluble in acids or bases).[7,13]

In comparison to the proteins found in other cereal grains, oat protein not only varies in terms of its structural features, but also in terms of the distribution of its protein portion. Oats do not have the distinctive protein matrix that other cereals like wheat and barley do. Other grains like oats include: While the store protein in wheat and a few other cereals is insoluble in salt solutions, the storage proteins of the endosperm in oats include a significant proportion of salt-water soluble globulins.[7,13]

In healthy subjects, eating oatmeal porridge daily for one week reduced faecal levels of β-galactosidase and urease, but not colonic fermentation capacity, SCFA excretion, or rectal inflammation (PGE2 levels). Oatmeal porridge may modulate gut microbial functions, the study suggests. These findings should encourage more research on oatmeal's prebiotic properties.[6] Kaukinen *et al* (2013) showed that consuming oats daily or for a long time did not cause small-bowel mucosal villous damage, inflammation, or gastrointestinal symptoms. Regular oat eaters consumed more fiber than non-oat eaters. Celiac patients favored eating oats daily. No side effects even after long-term use.[8]

Flatulence and abdominal distension are common symptoms that can be experienced shortly after beginning a diet that contains oats; however, in the majority of cases, these symptoms improve gradually as oat consumption is maintained. An increased consumption of fiber in oat products has been hypothesized to account for this finding. In point of fact, many people who do not have celiac disease experience similar symptoms when they unexpectedly begin eating oats. Patients with celiac disease who participated in the current study and consumed oats, even up to 100 g per day, did not experience any more gastrointestinal symptoms than those who consumed fewer oats or did not consume oats.[14–16]

It's interesting to note that patients who ate a lot of oats for a longer period of time and in greater quantities experienced less indigestion. There were no patients with celiac disease in they series who were intolerant of oats and who had previously consumed oats but had stopped doing so because of symptoms. According to the published research, patients with this condition may exist; however, in most cases, the manifestation of symptoms has not been found to be associated with mucosal damage or inflammation of the small intestine.[14–16]

In people who are gluten intolerant, the development of celiac disease can be precipitated by eating foods containing gluten. Gluten is a complex protein that is soluble in alcohol and is found mostly in wheat as well as

other cereals that are related to wheat, such as barley and rye. Consumption of gluten in individuals who are genetically predisposed to developing celiac disease results in an incorrect immune response in the small intestine, which is characterized by villous atrophy and crypt hyperplasia.[17]

For the physiological benefits of eating oats to be maximized, one needs to have a deeper awareness and respect of farming techniques, as well as the problems that they present, and the processing technologies that are available. Understanding the phenotypic and genetic variations associated with the climate and climate changes, environmental or abiotic stresses, plant pathogens and diseases, and agricultural production issues is necessary for the cultivation and production of oats. This is true regardless of where the oat crop is grown.[18]

CONCLUSION

Oats are safe for long-term celiac disease consumption. Oats diversify a gluten-free diet and increase fiber intake. Most celiac disease patients prefer oats when allowed. Pure oat products with strict production systems are available today, promoting their use. Celiac disease patients should be followed up regularly; those who eat oats can be followed up similarly to non-users.

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