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14. ABSTRACT Research suggests that wheat has adverse effects on health-raising blood sugar, stimulating appetite, and causing obesity and mental disease-and it has the potential to reduce military effectiveness and diminish national security, so the military should take steps to secure the health of its service members by reducing or eliminating wheat consumption. Obesity and disease within the American population and military presents a threat to national security. Obesity and disease results in a number of discharged service members each year. Both obesity and disease result in significant U.S. health care cost, which detract from national security. Research demonstrating wheat's negative effects on the body and brain is beginning to accumulate. Research suggests that wheat ingestion results in fat storage on the body and causes chronic inflammation resulting in disease. Research demonstrates that wheat ingestion also has significant negative impacts on the brain. In order to insure national security the military should investigate eliminating wheat from the diet of service members. Recent research provides significant and compelling evidence that wheat has negative impacts on the body and brain resulting in obesity and other diseases prompting a need to change the diet of military service members in order safeguard national security.					
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Executive Summary

Title: Wheat's Unnoticed Impact on Military Health

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Thesis: Recent research suggests that wheat has adverse effects on health-raising blood sugar, stimulating appetite, and causing obesity and mental disease-and it has the potential to reduce military effectiveness and diminish national security, so the military should take steps to secure the health of its service members by reducing or eliminating wheat consumption.

Discussion: Obesity and disease within the American population and military presents a threat to national security. Obesity and disease results in a number of discharged service members each year. Both obesity and disease result in significant U.S. health care cost, which detract from national security. Research demonstrating wheat's negative effects on the body and brain is beginning to accumulate. Research suggests that wheat ingestion results in fat storage on the body and causes chronic inflammation resulting in disease. Resent research demonstrates that wheat ingestion also has significant negative impacts on the brain. In order to insure national security the military should investigate eliminating wheat from the diet of service members.

Conclusion: Recent research provides significant and compelling evidence that wheat has negative impacts on the body and brain resulting in obesity and other diseases prompting a need to change the diet of military service members in order safeguard national security.

Preface

I dealt with extreme allergies for the first 34 years of my life; and I constantly tried various cocktails of pharmaceuticals to ease the symptoms. In early 2011 a friend of mine explained to me that I might be able to reduce my allergic symptoms and related chronic nasal congestion via diet by eliminating inflammatory foods. At the time my cocktail of choice was Claritin, Flonase, and Patanol, which I had been taking for roughly 3 years. It never occurred to me that food might be causing my symptoms and I was skeptical because I have battled allergies for over 30 years with the most experienced medical warriors available who were experts at dealing allergies. I had nothing to lose in trying so I started the n=1 experiment on myself. Two months after eliminating inflammatory foods I lost 25 pounds of fat; an unexpected side effect of eliminating inflammatory foods. Five months into the diet I felt that I did not need Flonase and Patanol any longer and I stopped using both. I likely could have stopped much sooner, but I was so accustomed to taking the medication I was reluctant to stop. I finally stopped taking Claritin about 8 months after starting the diet. I felt healthier than I ever did previously.

After going through this experience I became obsessed with gaining additional knowledge about the power of nutrition on health. Over the years I learned that several others had similar experiences and eliminating inflammatory foods was helping individuals control a very broad spectrum of autoimmune diseases. Through the course of my research driven by curiosity it appears that wheat is the worst of the inflammatory foods. This information significantly changed my body type and health and has also helped many others. It is likely that simply removing wheat from the standard American diet could help safeguard national security in multiple ways.

A special thanks goes to friends who provided me their personal experiences after eliminating inflammatory foods from their diets. Your individual self-experiments helped demonstrate the power of nutrition. I must thank Dr. Jonathan F. Phillips for taking on the challenge of providing me mentorship along my research journey. He provided the right direction needed to incorporate military relevancy into this paper about the negative effects of wheat. I cannot thank Dr. Linda Di Desidero enough for helping me through the writing process. She provided much needed feedback on ways to improve my writing throughout the year.

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INTRODUCTION

Retired senior military leaders explain in “To Fat to Fight” that 27% of 17 to 24-year-olds in America are unable to serve in the military because they are overweight.¹ The report also explains that the number of states with greater than 40% of obese young adults has increased from one state in 1998 to 39 states in 2008.² It is reported that the military discharges roughly 1,200 first-term enlistees annually because of obesity at a cost of \$50,000 per service member, resulting in \$60 million per year.³ America’s obesity epidemic hinders military recruitment potential and it impacts existing service members. Service members who become obese while serving are discharged after the Department of Defense (DoD) has spent significant time and money on training. The obesity problem impacts training because additional time is required by military trainers in order to get service members within height and weight standards, limiting the amount of time available for learning military skill-sets.⁴

The Centers for Disease Control and Prevention reports that the annual number of new cases of diagnosed diabetes more than tripled since 1980, with 493,000 new cases reported in 1980 and 1.5 million cases in 2011.⁵ Robert Paris et al. report in “Weighing in on Type 2 Diabetes in the Military” that the prevalence of diabetes in the military is similar to the general population.⁶ Their concern is that the military population is younger and more fit than the general population, yet this preventable disease, diabetes, poses a significant problem.⁷ Hieronymus and Rickerson report that hundreds of service members are diagnosed each year with diabetes and 80% is type II diabetes, which is preventable and reversible.⁸ It is likely that diabetes currently has more to do with diet, specifically carbohydrate consumption, than with age, physical fitness, or obesity. Carbohydrate consumption leads to both diabetes and obesity, and they are usually observed together. Diabetes is a result of prolonged exposure to an insulin

response from carbohydrate consumption. By consuming increasingly more highly concentrated carbohydrates young Americans are developing diabetes at a much younger age. This may be why type II diabetes is currently equally likely in the civilian population as it is in the military population. It is possible to develop the onset of diabetes before signs of fat accumulation. In cases of extreme carbohydrate consumption it appears that military fitness requirements cannot outpace the development of diabetes. Edward Boyko et al., found that military members who suffer from PTSD are significantly more likely to develop diabetes.⁹

Senior leaders view obesity as a threat to national security.¹⁰ It is reported that the Department of Defense (DoD) spends \$1 billion each year on weight related issues.¹¹ It is easy to see how cost can quickly accumulate when additional training is needed for overweight service members, overweight members suffer more sprains and fractures resulting in limited duty, and overweight members suffer from other healthcare complications such as heart disease.

This is not the first time in history nutrition in young adults has been studied for potential impacts on national security. During WWII 40% of recruits were unable to serve due to poor nutrition; and this resulted in the development of the National School Lunch Program in 1946.¹² Mission: Readiness, a group of retired senior military members, recommends removing high-calorie, low-nutrition foods from schools, improving the quality of food in schools, and supporting life-term healthy eating habits in order to prevent obesity from impacting the future military.¹³ While Mission: Readiness focuses on improving school lunch programs the same ideas and focus on better nutrition are transferable to military galleys, grocery stores, and field rations. Changes in the existing military diet could have immediate cost savings within the DoD. The question is what foods provide the best nutrition and which foods have adverse effects.

“Eat food.”¹⁴ The first sentence in Michael Pollan’s *In Defense of Food* is an elegant two-word sentence that summarizes his entire book. Pollan suggest that the best way to optimize health is by simply eating food.¹⁵ The problem is that Americans don’t know what food is anymore. It appears that Americans have become so removed from their food sources that they cannot recognize real food. Food-like products have replaced real food. For example, if it comes in a package or it cannot be killed or picked, it is likely not real food; and if your great grandmother would not recognize it as food, it probably is not food.¹⁶ The lack of nutrient dense real food is likely a contributing factor to obesity and disease in America. The Centers for Disease Control and Prevention (CDC) report that 34.9% of adult Americans are obese and that obesity is strongly correlated with heart disease and cancer.¹⁷ The CDC also found that the annual medical cost of obesity in 2008 was \$147 billion.¹⁸ In comparison, the DoD spends \$1 billion each year on weight related issues.¹⁹ This is an important issue to solve in order to improve the health of America and its service members and to reduce health care cost. The irony is that Americans’ knowledge in science and medicine seems to be inversely proportional to their health. Americans in the past 20 years have gotten fatter and sicker.²⁰

The United States Department of Agriculture’s (USDA) Food Pyramid, introduced in 1992, recommends grains for the bulk of the American diet. The USDA switched to the My Plate model in 2011, but grains are still recommended for over 25% of the plate.²¹ The Food Pyramid and My Plate seem logical under the “you are what you eat” understanding; that eating fat would be unhealthy for you, so eat more wheat because it has little fat. Industry has also supported this health quest by developing zero fat and low calorie foods ranging from milk and cereal to ice cream and cookies. In spite of these efforts, Americans have only gotten fatter and sicker in the last 20 years.²² Many researchers are now beginning to question the validity of

grains in the American diet. It appears that the way the body processes and responds to the food eaten determines overall health. Wheat and other grains, which are a large staple in the American diet, appear to be causing obesity and other diseases.

Many argue that wheat is not a problem in the American diet and wheat only impacts the 1% of the population with celiac disease.²³ However, research suggests that a much larger portion of the population is impacted by wheat ingestion because they are intolerant to wheat.²⁴ Regardless, even if nobody was impacted by wheat's negative effect on the gut, everyone is still impacted by the glycemic load of wheat, which leads to fat accumulation, diabetes, and heart disease. As explained above, wheat is problematic but it should not simply be replaced by a wheat substitute such as rice or potato flour because they also have a high glycemic load that results in obesity and diabetes. This report argues that wheat has significant negative impacts on the body and should be eliminated from the military diet, but processed food in general should also be eliminated.

Currently, obesity and diabetes are both impacting individual service members resulting in adverse effects on national security.²⁵ The diet of American service members is representative of the USDA's recommendations; service members are becoming sicker and fatter along with the broader American population. On February 24, 2015 the *Navy Times* reported that because of the changing body type, one third of Navy service members had failed to meet height and weight standards, which had not changed in the past 30 years.²⁶ Recent research suggests that wheat has adverse effects on health-raising blood sugar, stimulating appetite, and causing obesity and mental disease-and it has the potential to reduce military effectiveness and diminish national security, so the military should take steps to secure the health of its service members by reducing or eliminating wheat consumption.

ROADMAP

Wheat consumption negatively impacts the general American population and military service members. Wheat, being the root cause of these negative impacts is going unnoticed. The evidence proving that wheat consumption results in obesity and disease is the most critical element needed in order to drive change within the military. Without convincing evidence there is no obvious reason for change. A complete and thorough understanding of wheat's impacts on service members is the first step in creating awareness and ultimately driving change. The DoD certainly requires convincing evidence if it goes against the USDA's recommended guideline with respect to wheat consumption and this is the driving reason why the evidence is provided in this report.

This report explains wheat's negative impact on the body and the brain. Wheat's carbohydrate content and how it ranks on the glycemic index and how wheat stimulates appetite will be examined. This report will explore the evidence explaining how carbohydrates in wheat are easily converted and stored as fat on the body and around organs, which causes chronic inflammation and leads to disease. Appendix A investigates how wheat is the source of many ailments of the brain and demonstrates that wheat consumption results in Alzheimer's, which a few researchers are now calling type III diabetes. This report will also examine possible drivers of change within the military in order to reduce the amount of wheat available and consumed by service members. Finally, this report will explore how policy, service members, and logistics can drive change in order to reduce or eliminate wheat in the diet of service members.

Unfortunately, the research currently available explaining wheat's negative impact on the body is extremely new and not fully developed at this time. In the same way that initial studies about tobacco's impact on the body were limited, initial studies about wheat are also

experiencing the same initial struggles. The research currently available with respect to wheat is based on small sample size experiments, anecdotal evidence, epidemiologic studies, in vitro studies, and in vivo studies on small rodents. Obviously, the best research data will come from double-blind, randomized control, placebo-controlled experiments from a large sample size of humans, but those experiments require significant funding. The smaller experiments, referenced in this paper, provide the initial research in order to develop hypotheses for larger experiments. Correlation is not causation; however, the research evidence presented in this paper builds an extremely strong case about wheat's negative impact on the body, arguing that it should be removed from the military diet. But eliminating wheat from the service member's diet is likely to encounter resistance to change.

WHEAT: THE ANTI-NUTRIENT

Wheat in America is available in abundance. The USDA recommends wheat consumption; and wheat is considered a staple in Western diets. Wheat in the form of bread is nearly always on the US dinner table, and wheat is often incorporated into our main dishes and desserts. The American food industry promotes wheat as heart healthy because it is low in fat and contains healthy fiber. The American Heart Association recommends whole grains and even gives advice on how to consume at least three servings or more of whole grains per day.²⁷ However, although most people believe that wheat is healthy, wheat is a highly digestible sugar with a high glycemic index, it is an appetite stimulant, it causes permeability in the gut and acts as an anti-nutrient.

Wheat is mostly a carbohydrate, which is just a scientific word for sugar. Sugars that most people are familiar with are glucose, fructose, and sucrose; sucrose is simply a joined glucose and fructose molecule. A complex carbohydrate is a repeating sugar molecule. William

Davis, M.D., in *Wheat Belly*, explains that whether a sugar is labeled as a complex carbohydrate or not, as sugar breaks down and is absorbed after digestion, even the complex carbohydrates that are often presented as healthy cause fat accumulation faster than simple sugars.²⁸ This is because not all sugars are structured exactly the same and, as a result, break down differently during digestions. The gut also absorbs various sugars differently, and the carbohydrates in wheat break down more rapidly and cause the greatest fat accumulation. Davis explains that amylopectin is a glucose in a linear chain; amylopectin B is found in bananas and potatoes, amylopectin C is found in legumes, and amylopectin A is found in wheat and is extremely digestible resulting in a higher increase in blood sugar when ingested than simple sugars.²⁹ This high increase in blood sugar triggers a greater insulin response, and insulin's job is to convert ingested sugar into fat storage. Davis explains, when glucose is ingested, the hormone insulin transports glucose into the cells, where it is converted into fat.³⁰ Fortunately, food's ability to spike insulin and store fat can be measured, and service members can avoid foods that result in high insulin spikes. Unfortunately, wheat is extremely effective at spiking insulin, resulting in stored fat.

One measure of a carbohydrate's ability to increase insulin is called the glycemic index (GI). All foods have a measurable glycemic index (GI) and foods with a higher glycemic index increase insulin more than foods with a lower GI. Kaye Foster-Powell reports in the "International Table of Glycemic Index and Glycemic Load Values: 2012," that the glycemic index of Coca Cola is 63, Sucrose is 68, Snickers and Mars candy bars are 68, and White Wonder Bread is 73.³¹ From a GI, insulin, and fat accumulation perspective, a Snickers bar is healthier than white bread. The GI table, however, can be a little misleading. Davis points out that the GI of pastas are roughly 50, but the tables are based on two-hour observations, and

pastas, due to the extruding process when making them, take longer to digest.³² So, although pastas have lower GI than breads, the longer digestion period of pastas at moderately elevated insulin levels results in similar fat accumulation. While the GI is great for predicting the effects of equal amounts of carbohydrates in specific foods, as compared to pure glucose, researchers determined that a more realistic approach would need to factor in the typical serving size. With this in mind, researchers developed the glycemic load (GL). There are a few outlier foods that have a numerically high GI, but don't spike insulin because of the amount typically eaten, and this is corrected with the GL measurement. For example watermelon has a GI of 72, but its GL is 4.³³ The greater the glycemic load, the higher insulin level rises in the body, resulting in increased fat storage in the cells. Unfortunately, wheat in any form results in higher fat accumulation than eating table sugar. The GL of Wonder bread is 10, an English muffin is 11, and table sugar is 7. So, bread and English muffins, from a GL perspective, are worse than table sugar, but are better than Snickers and Mars candy bars, which have a GL of 23 and 27, respectively. While the GI and GL table provides insight into insulin response from various foods, researchers have determined that the GI and GL table does not completely explain a food's impact on the body. They have determined that the carbohydrates in whole foods don't appear to create as many health risks as the carbohydrates in processed foods such as wheat.

Not all sugars are created equal. Fructose, for example, is converted and stored as fat easily, but glucose is utilized to support the brain. Chris Kresser, a leader in the field of integrative medicine, points out that refined carbohydrates such as flour and sugar lead to disease, but the carbohydrates in whole foods might be outweighed by some of the beneficial components of the whole food source.³⁴ Kresser also points out that there are many hunter-gather societies with high carbohydrate consumption who don't show any signs of disease and that recent

research shows that whole-food carbohydrates may decrease health issues.³⁵ Andrew Cooper et al. reported in “A Prospective Study of the Association Between Quantity and Variety of Fruit and Vegetable Intake and Incident Type 2 Diabetes” that ingesting more vegetables and/or a greater variety of fruits and vegetables reduced the risk of Type II diabetes.³⁶ And Allan Christensen reports in “Effect of Fruit Restriction on Glycemic Control in Patients with Type 2 Diabetes – A Randomized Trial” that his study investigated the possibility of removing fruit from the diet because of the possible glycemic load of fruit, but no change in body weight or waist circumference was detected when tested on overweight patients diagnosed with Type II diabetes.³⁷ So the carbohydrates in fruits and vegetables don’t appear to cause any adverse health effects and the Cooper report suggests that eating a variety of fruits and vegetables may help reduce the chance of Type II diabetes.³⁸ In contrast, the carbohydrates in wheat have a high glycemic load and result in fat accumulation. Wheat is also an addictive stimulant signaling the body to eat more.

Wheat is a powerful appetite stimulant. Davis points out that wheat stimulates the appetite for more wheat and non-wheat containing foods and, like a drug, wheat’s appetite stimulant effects can be reversed with a drug called naloxone, a narcotic counter drug.³⁹ He further explains that wheat also causes an insulin spike, which is followed by a blood glucose drop, also known as hypoglycemia.⁴⁰ When blood sugar levels drop the body’s natural response is to create food cravings to bring blood sugar levels back to a normal state, but eating wheat again only spikes blood glucose level to an abnormally high level, starting the cycle over again.⁴¹ Davis reports that wheat, like many other drugs, appears to have addictive properties. People experience withdrawal symptoms such as headaches and mental fog when wheat is removed from their diets, and they bounce right back when wheat is reintroduced into their diets.⁴² Wheat

consumption has several compounding effects: first, wheat causes abnormally high insulin spikes, resulting in fat accumulation; second, after the high insulin spike the blood insulin levels dip lower than normal, resulting in food craving to bring the levels back up; third, wheat is an appetite stimulant and, just like any drug, the only way to eliminate the cravings and appetite stimulation is to stop eating wheat. And Davis reports that people who eliminate wheat from their diets consume fewer calories due to the reduced appetite stimulant and morphine effect of wheat.⁴³ Yet, wheat causes another appetite stimulating effect in the form of mixed signals to the brain: one signal to the brain is that the belly is full after consumption, and another signal is that the body did not get the nutrients it needed, so eat more. In fact, wheat is also known to have anti-nutrient properties, meaning that it blocks or disrupts absorption of nutrients in the intestines, and this reinforces the nutrient deficiency signal to the brain. Perlmutter points out that gluten and its sticky characteristics disrupt nutrient absorption.⁴⁴ Kresser, in *The Paleo Cure*, explains that the phytates found in wheat bind to its nutrients and, when bound, the intestines do not recognize them as nutrients in the digestive track and the phytates render the nutrients insoluble.⁴⁵ Kresser also points out that fiber is important for health and the insoluble and soluble fibers in fruits and vegetables are beneficial; however, wheat, which is mostly insoluble fiber, binds to nutrients and does not allow them to be absorbed into the body.⁴⁶ Not only does wheat act as an appetite stimulant, it is also considered an anti-nutrient as it also causes gut permeability.

Wheat has compounding effects on the body; not only is sugar in wheat efficiently converted and stored on the organs as visceral fat, it also creates gut permeability, which results in chronic inflammation that is known to cause disease. This anti-nutrient effect, a mechanism disrupting the body's absorption of nutrients, is caused by wheat's ability to disrupt the gut. To

summarize the work by Karin de Punder and Leo Pruimboom, in “The Dietary Intake of Wheat and other Cereal Grains and Their Role in Inflammation,” the anti-nutrients in cereal grains, gluten and lectin, which is carbohydrate-binding protein, cause intestinal permeability resulting in a chronic inflammatory immune response because the body seeks to handle foreign substances leaking from the gut.⁴⁷ Constant gut inflammation triggers a chronic immune response in the body and the body never shuts down the immune response signaling, which results in disease. The immune system becomes constantly active trying to solve inflammation in the gut, but healthy cells in the body also become affected by the constant assaults, and this results in autoimmune disease. Perlmutter explains that the immune system responds inappropriately when it is inflamed and labels food particles as an enemy.⁴⁸

Wheat is a carbohydrate with a unique ability to spike insulin to abnormally high levels. Wheat is also an appetite stimulant, an anti-nutrient, and causes gut permeability--which all increase health risks. Considering wheat as a healthy choice does not appear to be the best option anymore. Indeed, it should not be. For these reasons alone, wheat should be removed from the diet of American service members. The simple fact that wheat has a high glycemic index, causing abnormally high insulin, should be a significant warning indicator that wheat will have health consequences. The disturbing part is that wheat has many other negative effects to service members. Wheat puts service members at increased risks of type II diabetes, visceral fat accumulation, and heart disease.

DIABETES, VISCERAL FAT, AND HEART DISEASE

It is hard for consumers to get away from wheat because wheat is available in nearly every processed food product. However, eliminating wheat from the diet of service members can have significant effects on body weight. J. Cheng and et al., in “Body Mass Index in Celiac

Disease: Beneficial Effect of a Gluten-Free Diet,” explains that body mass index (BMI) in both underweight and overweight patients with celiac disease trended towards normal BMI after starting a gluten-free diet.⁴⁹ Although Cheng’s study was done specifically on patients with celiac, this reports explains later that wheat affects nearly everyone. Knowing that wheat causes cyclically high insulin when ingested and that wheat causes gut permeability, it is important to understand how these responses result in obesity and disease. Researchers, however, clearly understand the correlations between repeated exposure to insulin spikes and type II diabetes, visceral fat accumulation, and heart disease. Wheat’s unique ability to spike insulin extremely high and cause gut inflammation increases visceral fat accumulation placing service members at greater risk of developing type II diabetes, cancer, and heart disease.

Repeated and prolonged ingestion of carbohydrates, particularly high GI foods such as wheat, causes not only fat storage, but fat storage in the worst places, around the organs, which can result in Type II diabetes. Davis states, that when fat accumulates due to insulin, fat is stored on the liver, kidneys, pancreas, intestines, and the heart.⁵⁰ Yuji Matsuzawa in “Establishment of a Concept of Visceral Fat Syndrome and Discovery of Adiponectin” demonstrates that excess fat around the organs releases abnormal inflammatory signals into the bloodstream, resulting in abnormal hormone responses. Visceral fat reduces the body’s ability to fight against inflammation, and this results in diabetes, heart disease, and other inflammatory diseases such as dementia, rheumatoid arthritis, and colon cancer.^{51,52} Type II diabetes is made worse by visceral fat accumulation. Visceral fat accumulation requires insulin to work harder when transporting glucose into the cells. Davis explains that as fat accumulates around the organs, insulin’s effectiveness in transporting glucose into the cells becomes diminished and requires increasingly more insulin, which results in the onset of type II diabetes.⁵³ Just to be clear, type II diabetes is

a result of increasingly more and more insulin being released from the pancreas in order to transport sugar into the blood cells to be stored as fat. Visceral fat accumulation not only supports the formation of type II diabetes, it can also increase a service member's risk of cancer.

Visceral fat accumulation causes increased estrogen levels in men and women and has negative effects on both. Davis explains that men are particularly sensitive to increased levels of estrogen as a result of visceral fat accumulation and often grow breasts. Men can even suffer from increased levels of the hormone prolactin, which is a hormone that causes lactation.⁵⁴ Although estrogen is commonly known as a sex hormone present in women and is responsible for regulating reproductive cycles, too much estrogen can create hormone imbalances in women and increase risk of cancer. T. Key's research, although epidemiological, shows a correlation between elevated estrogen and risk of breast cancer in postmenopausal women.⁵⁵ Research suggests that excess carbohydrates cause hormone imbalances and the formation of cancer cells. It appears that cancer can be put into remission by a ketogenic diet, a diet primarily consisting of fat and very few carbohydrates. Mengmeng et al. investigated several animal studies showing that a ketogenic diet is effective against cancer.⁵⁶ Not only does wheat consumption cause visceral fat accumulation, type II diabetes, and cancer, wheat is also linked to heart disease.

Heart disease is another major concern from excess carbohydrate consumption and, as previously discussed, wheat's extremely high glycemic index and additive properties can make heart disease a real threat. The threat comes from triglycerides and how the triglycerides increase the number of small low-density lipoprotein (LDL) cholesterol particles as compared to large LDL cholesterol particle size. Hudgins, in "Effects of High Carbohydrate Feeding on Triglyceride and Saturated Fat," explains that high-carbohydrate diets increase triglycerides in the blood system.⁵⁷ When wheat is eaten, the body signals the production of an excessive

amount of triglycerides, which results in increased amounts of small LDL cholesterol. Davis explains that small LDL particles are less than 25.5 nanometers (nm) and large LDL particles are greater than 25.5 nm, but the small LDL particles accumulate on the artery walls. Davis also explains that the small LDL particles are not as easily processed by the liver as large LDL particles so the small LDL particles remain in the bloodstream longer, increasing the likelihood of attaching to artery walls.⁵⁸ Another major concern is oxidation and glycation of LDL. Glycation is when sugars bind to lipid molecules. Davis explains that small LDL particles are more susceptible to oxidation and glycation, and once they have undergone oxidation or glycation, they are more likely to accumulate on artery walls.⁵⁹ M.P. Cohen reports in “Increased Plasma Glycated Low-Density Lipoprotein Concentrations in Diabetes” and N. Rabbani, et al., report in “Glycation of LDL by methylglyoxal increases arterial atherogenicity” that glycated LDL is another risk factor for cardiovascular disease.^{60,61}

Wheat is predominantly carbohydrates and, therefore, has a high glycemic index resulting in an insulin spike when ingested and fat accumulation when processed by the insulin. Gluten, a protein in wheat, acts as an anti-nutrient and cannot be broken down into amino acids as normal proteins are, so it contributes to an inflamed gut. Wheat also releases appetite stimulant signals, causing additional food cravings. Knowing that wheat has these adverse effects on the body, there may be temptation to simply replace wheat with other substitutes, such as corn flour. However, wheat substitutes and other grains do not provide significant improvements. Simply substituting gluten products with gluten free or wheat free products is not the best solution because wheat substitutions contain highly processed ingredients such as rice flour, tapioca flour, or corn starches, which still create high blood sugar levels and an insulin spike resulting in fat accumulation. It is easy to understand the role of grains in fat accumulation by looking at the

cattle industry. Ranchers are extremely familiar with how grain consumption increases fat on their livestock. Ranchers feed grains to their livestock to fatten the livestock before processing. Grains appear to assist fat accumulation in every animal, including humans. But fat accumulation is just the initial trigger for additional problems. Davis points out that as more fat accumulates, estrogen and inflammation levels become elevated and result in increased risk for heart disease and cancer.⁶² Wheat has several adverse effects on the body but it is also linked to disease within the brain, which is described in Appendix A. Obesity and diabetes is just as prevalent in the military as it is in the general population and both are preventable and reversible with diet alone.⁶³ Therefore, it is important to investigate ways to reduce, or better yet, eliminate, wheat in the military diet.

ELIMINATING WHEAT FROM THE MILITARY

Research is accumulating with respect to the negative effects of wheat on the body and brain. Wheat consumption, which results in obesity, diabetes, and other disease, not only negatively impacts service members, it impacts budgets. Obesity is a threat to national security and the DoD spends \$1 billion each year on weight related issues.⁶⁴ It is important to understand and develop a solution to this problem to increase military readiness and reduce costs and simply reducing or eliminating wheat can result in major improvements in both. Due to the known adverse impacts of wheat in the diet, the next rational step is to implement change within the military to reduce the amount of wheat containing products that surround service members. In the same way that tobacco and alcohol are not completely eliminated from the military, it is not likely that wheat will be completely eliminated either. Wheat, however, should not be a large staple in military grocery stores, mess halls and galleys, and in packaged meals intended for the field. But how will change happen in the military? What will reduce the amount of wheat

products available to service members? In order to reduce wheat and drive change in the amount of wheat supplied to the military, the government must provide new dietary recommendations or guidelines, military members must drive change with their purchases and decisions, and the military supply chain must support the needs of the service members.

The most direct driver of change, and in this case, for wheat reduction in the military, would come from US policy or a new US dietary recommendation or guideline. Specifically, a new USDA recommendation will drive menu changes within DoD school lunch programs and in military galleys. Such a policy or recommendation would also drive an entire industry to support this new direction. However, a policy or guideline change from the government to eliminate or reduce wheat consumption is also the least likely to happen because the government is likely to receive resistance from the robust US industry around wheat production. Eliminating wheat from the diet of service members is likely to follow a similar path as tobacco reduction in the military, which is certainly not an example of positive change. Even understanding the undisputed adverse health consequences of tobacco, it is still prevalent in the military. The “DoD Survey of Health Related Behaviors Among Active Duty Military Personnel” reports that 31% of service members smoke tobacco and roughly 15% use smokeless tobacco.⁶⁵ In June 2014 Senator Dick Durbin expressed concerns about tobacco use in the military and questioned the discount prices of tobacco products offered within the DoD when \$1.6 billion is spent each year on tobacco related medical care and lost work time.⁶⁶ General Dempsey pushed back explaining that he had concerns about increasing tobacco cost on installations because tobacco is legal and making tobacco more expensive may negatively effect the force.⁶⁷ It seems absolutely absurd that top military officials would not be fully onboard with eliminating tobacco from the military.

Just like tobacco, there is not an immediate cause and effect relationship between wheat consumption and its adverse impacts on service members so there is not a perceived urgency for change and there will be general resistance to change. Both alcohol and tobacco, which are now known to have adverse effects and provide no known benefits, are still slow to receive government recommendations on restrictions because immediate adverse impacts are not present. The long-term effects of alcohol and tobacco use took years to research, and industry fought back with its own research claims. Wheat is not likely to disappear from the diet anytime soon because it is a major food item in the Western diet and it is considered healthy according to the USDA. It is likely that reducing wheat from the diet of Americans and service members will require a significantly longer process than that of tobacco. Tobacco and alcohol are luxury items and expensive and some people decide to quit smoking for cost savings alone. Wheat on the other hand is a food staple and extremely inexpensive for consumers. People also generally understand that inhaling smoke of any kind is likely to result in adverse health effects, but they weigh the health risk with the feeling they enjoy from smoking. The idea of wheat having negative effects on the body is going to require much more convincing evidence than smoking in order to gain popular support. Right now, the scientific evidence with respect to wheat is generally anecdotal or based on experiments using small sample sizes. Anecdotal experiments provide a starting point for follow on experiments, but without understanding the scientific mechanism behind wheat's impact on the body it is difficult to confirm that wheat consumption is a cause for obesity and disease. Although the most direct driver of change can come in the form of new government guidelines, this is not likely to happen. Fortunately, government recommendations are not the only method of change. The population and military members can create change themselves with the items they purchase.

A slower and arguably less effective way to implement change within the military food system is for service members to drive change by the products they purchase. However, a change in this way requires services members to be informed about the importance of eliminating wheat from their diet. Service members must be educated so they understand wheat's impact on the body and brain. This report provides the evidence needed in order to initiate the first steps in the education of service members. Unfortunately, education and a thorough understanding of wheat's negative effects on the body and brain might not be enough to eliminate wheat from the military diet. Service members as well as the general population are addicted to wheat. People experience withdrawal symptoms such as headaches and mental fog when wheat is removed from their diets, and they bounce right back when wheat is reintroduced into their diets.⁶⁸ In some cases, wheat addiction will have to be treated in a similar way as other addictions.

Once service members are informed and removed from their addiction they must have the ambition to physically stop purchasing wheat products. If military members simply stop purchasing wheat-containing products, then they can take control of their own health, and the commissaries will be forced to switch from wheat products to other more profitable products. Military members can also drive change by leaving the wheat products sit in the galleys and mess halls. They can also request that the galley staff provide some sort of labels for wheat containing food products. Or they can simply ask that the galley staff be knowledge about which items served contain wheat so service members can avoid those products. A simple label or the staff's ability to inform military members will create awareness and help drive change. A change like this will slowly and naturally drive changes in the logistic chain, which will also impact food supply chains at deployment locations and in the field.

A mobile and quickly advancing military is critical for its success, and transportable meals help support mobility. However, it is also important to maintain the health of the service members, and the current Meals Ready to Eat (MRE) contain a lot of wheat, which is an anti-nutrient. Of the available MREs, 42% of the entrees contain wheat, 67% of the side contain wheat and are often crackers or bread, and 46% of the desserts contain wheat.⁶⁹ Research shows that wheat has significant negative effects on the body that can result in obesity, type II diabetes, heart disease, and Alzheimer's. To support the health of the service members, logistics chains should provide wheat-free options. This is especially important during deployment when mental acuity, sharpness, and speed in decision-making is critical. Meals Ready-to-Eat or MREs currently come in several variations such as MREs that don't require utensils and those without heaters, which are used in confined spaces. The military also offers religious MREs such as Kosher and Halal meals. Understanding that wheat consumption results in adverse health consequences, it should not be difficult to change the meal options in existing MREs in order to provide more wheat free options. Another great option is to produce or order wheat-free MREs. Wheat-free MREs already exist outside of the military and are being produced by a few manufacturers who noticed a demand for them. Many military members who eat a wheat-free diet order their own wheat-free meals before deployment and try to maintain a steady supply of these MREs via the mail system. Other wheat-free service members purchase items like canned tuna and salmon, beef jerky, and nuts and seeds in order to sustain themselves during deployment. However, the option that best serves all service members is a supply chain that is capable of providing wheat-free meals at the galleys and mess halls in homeport and during deployment and in the form of MREs during homeport training evolutions and during operational deployment.

There are a number of service members who choose to be wheat-free because they do experience immediate negative reactions to wheat and other service members who chose to be wheat-free because they understand the long-term health risks of eating wheat. However, eating wheat-free in the field and on deployment is a daunting and difficult task, which often results in accidental and unnecessary wheat ingestion. Raising awareness about wheat and labeling wheat-containing food products is necessary to allow service members to avoid wheat in the galley. Wheat is in nearly everything, and even galley meat that has a sauce or has been marinated often contains wheat. CPT B. Donald Andrasik explains, in *Gluten Free in Afghanistan*, that he did the best he could to avoid gluten containing food items while on deployment, but also found that several other service members were trying to do the same thing so he started a gluten free support meeting.⁷⁰ A lot of informed service members are concerned about their wheat consumption because they understand how wheat adversely affects their bodies. The ultimate driver of change is a complete understanding at all levels, from the individual service members to the USDA, that wheat is making military service members fat and prone to disease. The scientific evidence and a general understanding of wheat is required to make this change.

CONCLUSION:

Wheat has a high glycemic index due to the nature of its carbohydrates and because it is processed, which causes unusually high insulin levels when ingested. Insulin converts the carbohydrates into visceral fat storage around the intestines and other organs of the body. Fat accumulation results in chronic inflammation, which causes antibodies to respond to this chronic inflammation, and the constant attack from antibodies leads to an attack on healthy cells, resulting in disease. The proteins in wheat also create additional inflammation in the gut because they make the gut permeable. Although many within the population will not experience any gut

pain or any immediate adverse reactions from wheat ingestion, a large portion of the population will be affected by wheat in the form of disease induced by chronic inflammation. Inflammation is important to manage because it starts to negatively impact the brain. The link between wheat, insulin, and inflammation is so strong that leading scientists within this field are starting to refer to Alzheimer's as Type III diabetes. Researchers have also determined that wheat causes imbalanced hormone levels causing incorrect signaling in the gut resulting in brain dysfunction. There is also a strong link between wheat ingestion and depression. Although the mechanisms are not fully understood, there is a very strong correlation between wheat ingesting and schizophrenia, and several studies have confirmed that once patients implement a wheat-free diet, their episodes of hallucination either cease or are significantly reduced. Wheat is also linked to many other brain dysfunctions ranging from autism to dementia. The need to eliminate wheat from the diet of service members is important in order to reduce health care cost within the Department of Defense and ensure service members are healthy, fit, and mentally able to provide the best security for the country. The easiest way this change could happen is through policy, followed by service members requesting wheat and gluten free options. In both cases the logistics chain will need to adapt in order to support the changing demand.

Convincing service members to eat non-processed foods, which includes wheat, is another challenge because they are all motivated differently. The younger service members are likely to be motivated by their peers and they will want to fit into the social norms established by their circle of friends. The younger generation is likely to be informed by outlets such as social media. The older service members are more inclined to require an understanding of the facts in order to conduct a risk analysis and make an informed decision about their diet. The older generation is likely to get information from more established and likely more creditable sources

and the older generation is more likely to understand the biases involved within each of the information sources. Other service members, regardless of age, could be motivated to eat healthier based on their current state of health, such as obesity or diabetes. Members already in good health are likely to be motivated to eat healthier non-processed foods if they understand that eating better could improve their physical performance. Each service branch also has a unique culture and each branch is likely to find motivation differently. Marines and soldiers are more likely to be motivated to eat healthier in order to perform better. As a group, sailors and airmen are more likely to be inspired by the ability of a healthy diet to reduce body fat. Individuals and groups are all motivated differently and the challenging part is initiating the spark in the appropriate place in order to start change.

Just like service members, a large majority of the American population seeks to improve their health and industry will support the population with products that are demanded by the population. In order to do this, industry and the population must be informed as to which foods support good health and which do not. Within the DoD, the first step in creating change is getting the correct information out to the service members and industry can also play a role by supporting this change. Informed service members will demand healthier whole food choices and industry will likely be there to supply the healthy options. Industry also has the opportunity to preemptively get ahead and start offering healthier choices before service members are informed. This approach is risky for industry, but it also has the possibility of providing a significant financial reward.

The end state is that the DoD needs healthier service members in order to maintain security and reduce the financial burden associated with poor diets. The way to get there is by informing service members about healthy food choices and by making healthy options available.

There are short-term and long-term options available for improving the health of service members.

The short-term goal is to inform the service members about healthy food choices. A few service members are likely to experience significant benefits from eating a wheat-free and non-processed food diet and will share their positive experiences with others. This will have cascading effects on the service members' knowledge and awareness of healthy food choices. Information transfer in this way is nothing unusual and in the past, weight loss experienced by many on the Atkins diet helped inform the population about how carbohydrates can result in obesity. It is argued that Dr. Atkins did not develop a perfect diet plan, but his diet recommendations challenged the mainstream concepts about diet and created the initial first steps needed for more refined knowledge to be built upon. Additional short-term goals include increasing the offerings of non-processed food options in the dining facilities in homeport and in contingency environments. This should also include eliminating fast food options in contingency environments. It is also important for the DoD to develop wheat and grain free options for MREs. This is not too difficult because many options already exist in the currently military inventory and simple changes like removing the bread and cracker snacks with other products like nuts and seeds and tuna are quick and inexpensive fixes. Several wheat free items exist within the current MREs; unfortunately no single MRE is wheat free. Regrouping existing wheat free MRE items into a single MRE provides an easy way to create an inexpensive and wheat free MRE. Currently MREs are arranged with an entrée, two sides, and a snack, which are all individually packaged and at least one of the items contains wheat. For example, the beef brisket MRE is accompanied with garlic mashed potatoes, snack bread, and cookies. To make a wheat-free MRE, the snack bread and cookies can be swapped with the First Strike bar and nuts

from other MREs. While an MRE is highly processed and not the best choice in optimizing health; creating a wheat free MRE is an easy step in the right direction.

The long-term goal is to increase the service members' understanding about diet to the point where they have enough knowledge and information needed in order to adjust their own diets independently to maximize their health and potential with respect to their goals. Some Marines or soldiers might seek to gain mass in order to pack and haul more equipment on marches. Other Marines might seek to slim down in order to be lighter and faster on specialized missions. The long-term goal with respect to healthy food options within the DoD is the elimination of processed foods within the galleys. While changing the food offered in the galleys is relatively easy, the most challenging thing will be developing the science necessary in order to create a healthier MREs. While there are some relatively inexpensive improvements that can be made to MREs, such as eliminating wheat; developing new methods to store and preserve food, like an MRE, while maintaining the food's nutritional value will require a serious scientific and engineering effort. Because of this, it might be more realistic to improve the supply chains in order to deliver fresher foods to service members in the field. It is likely that as the use of drones become more prevalent, drones will also play a role in delivering fresh foods to service members in contingency environments where it was previously too risky to send an expensive manned helicopter.

One of the arguments for not going wheat free is because wheat is an inexpensive item. Relative to other items available on the grocery store shelves, wheat is comparably cheap. Wheat consumption, however, results in obesity, heart disease, diabetes, and host of other diseases and the true cost of wheat is much more than the sticker price on that loaf of bread. Diabetics must constantly purchase medication in order to maintain appropriate blood sugar

levels while they continue to eat carbohydrates and slowly make their disease worse and more costly. Consumption of wheat and other processed carbohydrates results in a host of other diseases that are also costly. The upfront sticker cost of wheat consumption is low, but the total cost is significant. Dietary food choices might simply boil down to whether we pay more for better food options now or pay higher medical bills later. But the future might not be so grim. Wheat is currently inexpensive because we have developed an industry around streamlining the processing of wheat. The same can be done with livestock and the latest research suggests that eliminating large monocrops and replacing them large grazing herds are better for the environment.

There will certainly be an upfront economic cost when eliminating wheat from the diet of service members, but it might not be that drastic and it might actually prove to be more sustainable and better for the environment than consuming wheat. As mentioned earlier, wheat should be replaced with animal protein and fat, and the upfront cost will initially be a result of the demand being greater than the available supply. As the demand is prolonged the supply will catch up to meet the demand, but this will require the conversion of land that was previous used for mono-crop production to be converted and used for ranching. Once the conversion takes place the effort becomes extremely sustainable and better for the environment. The Savory Institute's goal is to restore grasslands around the world and they have been extremely successful at reversing desertification using the natural behavior of large herds.⁷¹ Not only do the large herds result in a significant source of meat, thereby reducing the cost of meat, the large herds are also useful in restoring the environment by reversing desertification.

Wheat is unhealthy and it is large staple in the American diet. Wheat in the American diet is usually in a highly processed form such as bread and cookies, and its negative impacts are

numerous. There is also an extremely large food industry based on wheat products. However, if wheat is eliminated, it must be replaced with something better. Indeed, better options are available in the form of protein and fat from natural whole sources. Contrary to popular belief, eating fat does not get stored as fat on the body easily, the way sugar does. In fact, ingesting fat can help burn fat. Mark Sisson states that fat does not increase insulin and ingesting fats help promote burning of the body's fat stores.⁷² F.L. Santos et al. report, in "Systematic Review and Meta-Analysis of Clinical Trials of the Effects of Low Carbohydrate diets on Cardiovascular Risk Factors," that low carbohydrate diets significantly reduce body fat and blood sugar levels, and increase high-density lipoproteins, the good cholesterol.⁷³ And wheat is not the only food item making the population sick; sugar, salt, and most processed food, which contain both, are also to blame. Sugar and salt are hidden in the nearly every form of processed food and cause inflammation in the same way as the carbohydrates in wheat. The overall recommendation is to replace wheat with protein and fat from whole food sources. The safest, most nutritious, and healthy items for American service members is food.

Appendix A

WHEAT'S EFFECT ON THE BRAIN:

Introduction:

Wheat's negative impact on the body is far worse than most people suspect, but it also has significant negative impacts on the brain. Wheat has effects on the brain like mental fog that occur within a few hours and effects like Alzheimer's disease which happens several years or decades later. The near-term and long-term effects impact the military. The immediate or near-term effects occur a couple of hours after wheat consumption, when the blood glucose levels drop to hypoglycemic level. Perlmutter, Kresser, and Davis all report about mental fog after wheat consumption in their clinical practices. Because wheat results in mental fog, it is important to remove it from the military diet. Removing wheat from Meals Ready-to-Eat (MREs) and in the galleys will help keep service members sharp in battle, on patrol, and during training on the range. The long-term effects of wheat on the brain result in things like Alzheimer's disease and dementia. While it can be argued that both don't have much of an impact on the military because they occur later in life, it will effect military veterans and the general U.S. population resulting in significant healthcare cost which will compete with defense funds. The CDC reports that in 2010 between \$159 and \$215 billion was spent on Alzheimer's disease and the cost is expected to increase because the number of Alzheimer's disease patients is projected to triple by 2050.⁷⁴ Most of the research analyzing wheat's impact on the body and brain come from studies on patients with some diagnosis of a wheat problem such as celiac disease, gluten intolerance, gluten sensitivity, or wheat/gluten allergy. The main issue is that most of the population has a problem with gluten, but the problems do not present themselves as a diagnosable disease such as celiac disease. The National Foundation for Celiac Awareness

reports that 1% of the population has celiac disease.⁷⁵ Although one percent of the population has celiac, the important thing to understand is that everyone seems to be affected by the destruction of the gut lining due to gluten, and everyone seems to be affected, as a result, by the chronic inflammation that follows. Just because immediate and noticeable signs for gluten intolerance are not present, it does not mean that the detrimental effects of inflammation are not taking place within. Celiac disease and gluten sensitivity expert Jane Anderson in “How Many People Have Gluten Sensitivity” reports that three leading researchers, Dr. Alessio Fasano, Dr. Kenneth Fine, and Dr. Rodney Ford, are unable to definitely report population percentages suffering from gluten sensitivity because there are no solid tests for it, but they suspect gluten sensitivity may affect between 6% to 50%.⁷⁶ Perlmutter, in *Grain Brain*, suggests that most people with celiac disease go undiagnosed, and it is more likely that 1 in 30 have celiac disease, 40% of the population cannot process gluten, and it is questionable whether the remaining 60% can. Perlmutter strengthens his case by stating that studies have shown that gluten can cause neurological abnormalities even in people who show no signs of gluten digestion.⁷⁷ Dr. Rodney Ford reported that in his clinical work, he discovered that 80% of his patients reacted negatively to gluten and that gluten was harmful to everyone.⁷⁸ The real danger is that it appears that everyone gets inflammation from the gluten protein in wheat, whether they know it or not, and it is often too late for patients when their wheat intolerance manifest as brain disease. M. Hadjivassiliou et al., in “Gluten Sensitivity: From Gut to Brain,” explains that gluten from wheat is the root cause of most neurological dysfunction.⁷⁹ Jessica Jackson et al., in “Neurologic and Psychiatric Manifestations of Celiac Disease and Gluten Sensitivity,” explains that gluten sensitivity is typically not diagnosed in patients, but is a contributing cause of psychiatric

problems.⁸⁰ Although people do not connect wheat ingestion with adverse brain function, wheat ingestion has been linked to Alzheimer's, depression, schizophrenia, and other brain diseases.

Inflammation, A Cause of Brain Disease

Perlmutter, in *Grain Brain*, reports that most diseases, including diseases that afflict the brain, are the result of untreated inflammatory issues, predominantly dietary, caused from too many carbohydrates. The link between Alzheimer's and carbohydrates is so strong that many researchers refer to Alzheimer's as type III diabetes.⁸¹ Perlmutter explains that sugar flows through the blood stream like a shard of glass causing inflammation and high insulin levels that inhibit normal metabolism.⁸² Perlmutter also explains that insulin resistance results in the formation of plaques of protein in the brain, and that those with diabetes are twice as likely to develop Alzheimer's.⁸³ Dr. Alessio Fasano, in "Zonulin and its Regulation of Intestinal Barrier Function: The Biological Door to Inflammation, Autoimmunity, and Cancer," explains that wheat disrupts the gut barrier and results in increased inflammation.⁸⁴ Inflammation, however, is not completely bad as it is the body's natural response to healing, but as the inflammation becomes chronic, the inflammation begins to break down healthy cells. The link between inflammation and Alzheimer's is so well understood that scientists are now tracking inflammatory proteins in relation to the degradation of Alzheimer's, as Rufina Leung et al. did in their article, "Inflammatory Proteins in Plasma Are Associated with Severity of Alzheimer's Disease."⁸⁵ Perlmutter explains that inflammation becomes increasingly more dangerous when it starts to impact the brain because the brain does not have pain receptors to warn us of the inflammation so the inflammation results in free radical production and oxidative stress.⁸⁶ The inflammatory response also releases cytokines, proteins that affect the behavior of cells. Cytokines attack healthy brain cells resulting in brain damage and disease, and cytokines can be

tracked in patients with Alzheimer's.⁸⁷ Just as there are very strong connections between wheat and Alzheimer's, wheat is also linked to depression.

Wheat and Depression

Depression as a result of wheat ingestion is a likely possibility, and depression affects a number of military members as well as their families. In 1956 Guy Daynes, in "Bread and Tears – Naughtiness, Depression and Fits Due to Wheat Sensitivity," reports on several clinical cases of depression and fits due to wheat and explains that symptoms, in some cases, went into complete remission when wheat was removed.⁸⁸ Most of the research available compares the link between those experiencing depression and markers for celiac disease; however, as research shows that gluten sensitivities are difficult to determine and can manifest in many forms, it is becoming clear that wheat is a common cause of depression.⁸⁹ Some people experience gut stress or pain when eating gluten, so it is not a far stretch to assume those people would experience sleep loss and constant pain resulting in feelings of depression. This does not explain if gluten specifically causes depression. The major problem with the current research available is that a direct cause and effect link between gluten and depression is not possible; however, sufferers of depression report feeling better after going wheat free. S.L. Peters et al. report, in "Randomized Clinical Trial: Gluten May Cause Depression in Subjects with Non-Coeliac Gluten Sensitivity – an Exploratory Clinical Study," that people report depression when ingesting gluten even while no obvious gastrointestinal symptoms are present.⁹⁰ While research has not definitively determined how wheat could cause depression, Perlmutter suggests that serotonin production, which is important for mood regulation, is blocked by cytokines and symptoms of depression are reversed when gluten is removed.⁹¹ Perlmutter also explains that wheat damages the gut, limiting the gut's ability to absorb nutrients such as zinc, tryptophan, and

B vitamins, which are needed for the production of serotonin.⁹² He also states that between 80 and 90 percent of the body's serotonin is produced by the gut.⁹³ In a similar way in which gut health and inflammation impact the body, gut inflammation also impacts the brain.

Blood Brain Barrier and Permeability:

It is easy to understand that nightly gut pains can cause disruptions in sleep and result in fatigue and reduce the brain's ability to function correctly, but a more challenging concept is trying to understand how gut health can cause diseases afflicting the brain. Researchers have, however, found a strong correlation between schizophrenia and gut health and suggest that gut health is directly linked to brain health due to the role of hormone signaling. K. Nemani et al. report in "Schizophrenia and the Gut-Brain Axis" that schizophrenia is linked to intestine health due to the communication between the brain and gut via neural and hormonal routes; they suggest a gluten-free protocol as remedy.⁹⁴ Research suggests that once penetrations in the gut occur due to gluten, chronic inflammation starts, resulting in the onset of autoimmune disease, which can attack the brain. Schizophrenia is an example of this, and experiments have proven that eliminating patients' ingestion of wheat can control their hallucinations.

Schizophrenia:

It is important to discuss the topic of how wheat and schizophrenia are linked because it provides the most compelling evidence demonstrating how wheat ingestion can result in schizophrenic behavior and how it can impact the brain. Once this is understood, the connections between wheat and other disease of the brain, which do not present themselves as immediately and as obviously as schizophrenia, are more readily understood.

Although it is difficult to understand how eating something that is perceived as benign, such as wheat, can cause immediate hallucinogenic behavior in schizophrenia patients and that,

once wheat is removed from the diet, behavior returns to normal, but this is exactly what happens. Davis reports that Curtis Dohan made a connection between wheat consumption and schizophrenia during WWII and noticed a reduction in schizophrenia during food shortages and noticed schizophrenia increased when the war was over and when grain returned as a normal part of the diet.⁹⁵ Curtis Dohan, in “Is Schizophrenia Rare if Grain is Rare?,” also noticed in the New Guinea population, schizophrenia was almost unheard of, but after introduced to a Western diet, New Guineans experienced a 65 fold increase in schizophrenia cases.⁹⁶ Davis reports that Curtis Dohan went on to study the connections between wheat products and schizophrenia patients in the mid-sixties at the Veterans Administration Hospital in Philadelphia, where Dohan removed wheat products from all meals for four weeks and noticed a remarkable improvement in his patients.⁹⁷ When wheat was put back into their diet, the patients’ hallucinations and delusions returned.⁹⁸ Others researchers have also experienced similar results. A. E. Kalaydjian et al., in “The Gluten Connection: The Association Between Schizophrenia and Celiac Disease,” showed full remission or drastic reduction of schizophrenic symptoms after gluten elimination in a subset of patients.⁹⁹ S. J. Genuis and R. A. Lobo present a case study of one patient in “Gluten Sensitivity Presenting as a Neuropsychiatric Disorder,” who demonstrated elimination of hallucinations after a gluten-free protocol and the return of hallucinations after accidental gluten exposures.¹⁰⁰ Inaki Irastorza presented a case study, in “A Trichobezoar in a Child with Undiagnosed Celiac Disease: A Case Report,” of a young girl experiencing trichotillomania, pulling hair from the scalp, whose episodes stopped after introduced to a wheat free protocol.¹⁰¹ In an attempt to understand the mechanisms behind wheat’s effect on behavior, researchers have started feeding wheat to rats; and researchers have observed that wheat ingestion can access

opioid receptors in the brain.¹⁰² Wheat also causes several other impacts on the brain and is linked to a range of disorders from autism to seizures.

Autism, Brain Atrophy, Cerebellar Ataxia, and Dementia

A significant amount of research suggests that gut health is directly correlated to brain health, and there is no evidence of the reverse; that diminishing brain health results in problems within the gut. Most of the research suggests that poor gut health is the result of gut inflammation due to gluten, even when no other signs of a gluten sensitivity are present. M.A. Daulatzki reports, in “Non-Celiac Gluten Sensitivity Triggers Gut Dysbiosis, Neuroinflammation, Gut-Brain Axis Dysfunction, and Vulnerability for Dementia,” that gut inflammation needs to be controlled because it disrupts the gut-brain axis, increasing the chances for dementia.¹⁰³ Like dementia, autism is also a problem linked to wheat ingestion. Paul Whiteley et al, in “Gluten- and Casein-Free Dietary Intervention for Autism Spectrum Conditions,” reports that although the mechanisms linking gluten and casein with Autism are not fully understood, there is improvement in autistic patients when gluten is removed from their diets.¹⁰⁴ N. Cherbuin et al. report, in “Higher Normal Fasting Plasma Glucose is Associated with Hippocampal Atrophy: The PATH Study,” that clear evidence exists showing that diabetes and brain atrophy are related, and suggest that the established blood glucose ranges defined as normal might still be outside of the tolerance for development of altered cerebral health.¹⁰⁵ What Cherbuin’s report is suggesting is that the ranges that define normal fasting blood sugar levels are probably too high, and that a significant portion of the population’s fasting glucose levels are too high, presumably from too much consumption of wheat and other carbohydrates, and that the actual normal human fasting glucose is lower than that prescribed as normal by the medical community. It is not too difficult to believe that society has become so sick that it cannot determine the true normal range for

blood sugar levels. Another issue with wheat is cerebellar ataxia, which occurs when the brain loses the ability to control the motor functions of the body and can range from balance to eye movement. This is important because researchers are seeing links between gluten, the protein found in wheat and a few other grains, and cerebellar ataxia.¹⁰⁶ The most disturbing part is that the brain is being impacted in people who show no other signs of problems with wheat or gluten. This is extremely important because repairs in the brain occur extremely slowly, if at all, and brain problems are usually identified when significant damage has already been done.

Conclusion

A significant portion of the population does not tolerate wheat, and even though many do not show obvious negative symptoms, most people are being negatively impacted by the interactions between gut and the brain. Wheat is very strongly linked to Alzheimer's, and sufferers of depression are often cured after removing wheat and gluten from their diets. Researchers have shown a very strong correlation between wheat consumption and schizophrenia, but the exact mechanism is not fully understood. Wheat appears to be the culprit in a host of other problems in the brain ranging from autism to dementia. Unfortunately, wheat is a staple in the diet of most Americans, and the American Heart Association considers wheat healthy. However, knowing that wheat is negatively impacting the greater population it can be assumed that it affects of service members in the same way. In fact, 27% of 17 to 24-year-olds in America are unable to serve in the military because they are overweight.¹⁰⁷ The military also discharges, because of obesity, roughly 1,200 first-term enlistees annually at a cost of \$50,000 per service member, resulting in \$60 million per year.¹⁰⁸ Diabetes is just as prevalent in the military as it is in the general population and the disease is preventable and reversible with diet

alone.¹⁰⁹ Therefore, it is important to investigate ways to reduce, or better yet, eliminate, wheat in the military diet.

Endnotes

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