



Manufacture of gluten-free products for gluten sensitive patients

L. O. Mallasiy

Muhayil Asir, Applied College, King Khalid University, Abha 61913, Saudi Arabia,

Email: lohosain@kku.edu.sa

Abstract:-

The research aimed to produce gluten-free products with modifications to improve product quality and expand the range of gluten-free products. The research questions were: Is it possible to produce gluten-free food products that are accepted by society for those with gluten sensitivity? And is it possible to produce gluten-free food products at a low price that is affordable for everyone? The research procedures were carried out by manufacturing gluten-free rusk and pasta, which obtained satisfactory percentages in the sensory evaluation. The rusk obtained in terms of general acceptance, shape, taste, flavor, fragility, and color: 100%, 100%, 100%, 100%, 98.52%, 97.05% respectively. Also, the pasta obtained in terms of color, consistency, flavor, general acceptance, shape, and taste: 90.46%, 90.46%, 76.19%, 71.4%, 62%, 49% respectively. An electronic questionnaire was also conducted, and it became clear that 88.1% of the people were not suffering from gluten sensitivity, among them were 11.9% who were suffering from gluten sensitivity. It became clear that there were 81.1% of the people who did not have a family member suffering from an allergy. Gluten among us: 18.9% of those who had a family member with gluten sensitivity were found to have it. It also turned out that 58.4% were aware that gluten is a wheat protein, while 41.6% were unaware of it. It also turned out that 68.6% were unaware of the symptoms of gluten sensitivity, while 31.4% were aware of the symptoms of this allergy. It turned out that 69.2% were unaware of the effect of gluten on those with gluten sensitivity, and 30.8% were aware of the effect of gluten on those with this allergy. We recommend reducing and limiting gluten consumption in the diet because it is one of the causes of obesity, high blood sugar, allergies, and infertility. We also recommend replacing wheat flour with millet flour, almond flour, chickpea flour, or gluten-free grains in your diet. We also recommend following a gluten-free diet for autistic people to prevent their condition from worsening, and we also recommend making gluten-free products available to everyone.

Received: 29 Jun 2024 **Revised:** 24 July 2024 **Accepted:** 28 Aug 2024

Published: 30 September 2024

Introduction :-

Gluten is the main storage protein of wheat grains. Gluten is a complex combination of hundreds of related and distinct proteins, especially gliadin and glutenin. Similar storage proteins such as cyclin are found in rye, horden in barley, and avenin in oats and are collectively referred to as "gluten" (Jessica R Biesiekierski, 2017)). Gluten is found in a high percentage in wheat or wheat, a genus of plants around me of the grass family, and wheat produces compound grains in the form of spikes, where these grains are the main food for many peoples of the world, competing only with corn and rice, where these grains share the food of humans on earth. When the body's immune system reacts to some factors that do not cause stimulation of the immune system in a normal situation and are not dangerous, such as: bee venom, pollen, pet dander, some foods, and proteins foreign to the body, where the immune system is antibodies in English: (Antibodies) interact with these factors that are known as allergens and lead to inflammation in different areas of the body such as: Sinuses, digestive system, skin, and airways, and the severity of allergies varies from one patient to another, it may range from simple irritation to anaphylaxis in English: (Anaphylaxis), which is an anaphylaxis that may threaten a person's life, and in general it can be said that allergies occur as a result of an exaggerated reaction by the immune system. (Dr. Ananya, 2020) Food allergies are an example of digestive allergies and are abnormal immune responses that usually occur within a short period after exposure to some allergenic proteins in food or lunch-related resources. Currently, the means of treating food allergies are still not clearly understood and the only known prevention method is to avoid consuming foods that contain allergens, and types of allergies vary such as milk, egg, soy, nuts, crustacean fish and gluten sensitivity. (Jae Huan Shin et al, 2022).

Protein allergy is a chronic multisystem autoimmune disorder caused by gluten and is characterized by microenteropathy in individuals and the symptoms of gluten sensitivity range from diarrhea, bad smell, flatulence, feeling tired, headache and peripheral neuropathy, depression and anxiety, when the patient eats food containing gluten, the immune system responds to this substance by attacking the small intestine, which leads to damage to the bumps that line it over time. These bumps are responsible for absorbing nutrients from Food. When these bumps are damaged, the nutrients will not be sufficiently absorbed in the body, the prevalence of gluten sensitivity in Saudi Arabia is estimated at approximately 1% among children, and wheat allergy is widely spread around the world, for example, among Chinese and sub-Saharan Africans about 5-10%.

This research aims to make gluten-free food products accessible to everyone so that people with gluten sensitivity or those who wish to abstain from eating

foods with completely gluten-free alternatives, and the target group of this research are people affected by gluten.

Search problem:

- Is it possible to make gluten-free food products that are accepted by the community for those with gluten sensitivity?
- Is it possible to make gluten-free food products at a low price that is affordable for everyone?

Research Objectives:

- Produce gluten-free products with adjustments to improve product quality.
- Expanding the range of gluten-free products.

The importance of research:

The importance of the study is due to the attention paid to the group affected by gluten.

Research hypotheses:

- Manufacture gluten-free food products at a low price that is affordable for everyone.
- Gluten has become a concern for diabetics.

Research Methodology:

Descriptive based on references from scientific research that serves the subject of research, experimental is the manufacture of gluten-free food products at a low price, analytical by conducting an electronic questionnaire to know the community's awareness of the harms of gluten use.

Spatial boundaries: Nutrition laboratories, Department of Home Economics, King Khalid University, College of Science and Arts in Tihama

Time limits: third semester 1444 AH

Previous studies

Gluten

Gluten: It is the main storage protein of wheat grains. Gluten is a complex combination of hundreds of related and distinct proteins, especially gliadin and glutenin. Similar storage proteins such as cyclin are found in rye, horden in barley, and avenin in oats and are collectively referred to as "gluten

(Jessica R Biesiekierski, 2017))

Gluten synthesis

Gluten consists of the protein types gliadin and glutinin. Wheat and seeds of some cereals contain varying proportions of these two types. The variety and quality of the grains that make up the dough determine the amount and capacity of gluten.

Gluten is a very complex compound, characterized by a high allelic polymorphism that encodes its own proteins, glutenin, and gliadin. Moreover, each wheat genotype produces unique types and quantities of these compounds, which can also vary depending on the growing conditions and technological processes. The protein expression (as well as carbohydrates) of one genotype can change depending on the environment in which it was grown, since the glycadin content increases with fertilization and temperature during maturation. The wheat kernel can be partially removed by cylindrical grinding.

Gluten, the main storage protein of wheat, is a complex protein structure consisting of monoproline and polymer glutenin also found in other grains such as rye and barley. (2021, Inken)

The benefits of millet flour

She explained (Majd Hatnawi, 2019) that there are many health benefits that can be obtained from consuming millet grains, including:

1. Protection and health.- Improves blood circulation. Maintain cholesterol levels
- a good food for diabetics. Helps in digestion- Detoxification of the body

Benefits of almond flour :

And also proved (Reham Daabbas 7/7/2021) Benefits of almond flour Almond flour may have many benefits, such as:

1. **Provide the body with a good dose of vitamin E.**
2. **Resistance to cardiovascular diseases**
3. **Improving the digestive process:**
4. **Regulate blood sugar levels**
5. **Losing excess weight**
6. **Other benefits of almond flour**

Studies (Yasmine Yassin 28/6/2020) have proven the following are the most prominent benefits of ground chickpeas:

1. **Increased feeling of fullness**

- 2. Promote heart health**
- 3. Blood sugar control**
- 4. Promote healthy bacterial growth**
- 5. Protection of the fetus from birth defects**
- 6. Suitable for people with gluten sensitivity**
- 7. Healthy weight gain**

The role of gluten in pasta:

The gluten matrix and the functions resulting from it are essential for determining the quality of bread dough and other baked products such as pasta, cakes, pastries and biscuits. Gluten is thermostable and has the ability to act as a binding and stretching agent and is commonly used as an additive in processed foods to improve texture, flavor, moisture retention and flavor. Therefore, less obvious sources of gluten include processed meats, reconstituted seafood, and plant-based meat substitutes. And as thickeners, emulsions, or crystallization agents in candy, ice cream, butter, spices, fillings, pickles, dressings; and as fillers and coatings used in medicines or confectionery.

Food allergy:

It is the reaction of the immune system in the human body to some substances such as: vaccine, mites, fungi, some foods, and others. Normally, the immune system fights harmful substances that enter the body, but in the case of allergies, it fights some substances as if they are harmful, (false alarm), by producing antibodies such as: histamine, which causes allergy symptoms.

The effect of gluten on human health:

In view of the accidental increase in gluten intake in general and the occurrence of autoimmune diseases, the potential biological adverse effects of gluten have been explored. The PubMed , MEDLINE , and Cochrane Library databases of reports published between 1964 and 2016 were examined regarding the harmful effects of gluten as well as the effects of a gluten-free diet on autoimmune diseases.

Gluten and digestive disorders:

Gluten intolerance or non-celiac gluten sensitivity, as it is also known, shares some of the same symptoms as celiac disease but is a less serious condition. Gluten intolerance still causes great discomfort, and people sometimes use lifestyle changes to try to control its symptoms.

Wheat allergy (gluten)

Gluten sensitivity, or gluten intolerance, is a disease that causes symptoms when eating wheat and everything that contains gluten inside. Markus MacGill, 2017)) is an abnormal immune system response to a wheat protein that results in serious complications for human health. Wheat allergy is widespread among a large number of people, and causes those affected by annoying symptoms and serious complications that greatly affect the health of the digestive system, so if you suffer from wheat allergy, this means that your immune system creates antibodies to the proteins found in wheat. This disease usually affects the small intestine, which is the most important organ in the digestion process and responsible for the absorption of food.

Symptoms of gluten sensitivity

The symptoms of gluten sensitivity are summarized as follows:

Bloating: - Diarrhea, or constipation: - Headache: - Feeling tired: - **Depression:**

The effect of gluten on diabetics:

Type I diabetes, an autoimmune disease, is caused by insulin deficiency due to the destruction of insulin-producing pancreatic beta cells. Several studies have shown the importance of proper blood sugar control in avoiding long-term complications of diabetes and that partial endogenous insulin production facilitates good blood sugar control.

Patients with type I diabetes have an increased risk of developing other autoimmune disorders such as Hashimoto's thyroiditis, Addison's disease, atrophic gastritis, pernicious anemia, vitiligo, and celiac disease. These autoimmune diseases share a similar genetic background and are associated with autoantibodies that can be detected before the development of clinical manifestations. Having an autoimmune disorder can complicate diabetes management.

The effect of gluten on autistic patients:

Autism: Autism spectrum disorder is a neurodevelopmental disorder characterized mainly by deficiencies in social communication and restrictive/repetitive behavior patterns .

Its phenotype is present in the spectrum, and it is generally estimated that it affects up to one in 69 children. Interest in the use of specialized diets in autism spectrum disorder, as a means of mitigating their behavioral and intellectual consequences, is increasing. Although many dietary interventions have been suggested, the gluten-free diet is among the most popular. Clinically, the gluten-free diet is well known as the primary treatment for patients with a gluten-

related disorder. The most prominent of these diseases is celiac disease, which is often expressed as an intestinal gastrointestinal condition. However, it is known that physiological sensitivity to gluten is present in other forms. These include other immune disorders (such as dermatitis herpetiformis and gluten ataxia), allergic reactions (wheat allergy), the clinical benefit of a gluten-free diet outside of these contexts is debatable, and elsewhere, its adoption within the general public as a "fashionable" diet sometimes increases this scrutiny.

Gluten and obesity:

Some studies have linked eating a gluten-free diet to reducing obesity and type II diabetes. (Ursula Krupa-Cusack and Ewa Lang , 2019)

Wenpeng you et al (2020) indicated that obesity prevalence was positively associated with gluten consumption but negatively associated with consumption of non-gluten cereal protein. Gluten consumption may have emerged as an unclear, but significant cause of obesity. While Westernization has prompted diet patterns around the world to incorporate more gluten crops, ways to project obesity prevalence may poorly estimate obesity rates in the future if gluten consumption is not considered.

Gluten and infertility

Uncontrolled celiac disease causes fertility changes and problems in achieving full-term pregnancy. For this reason, all women or couples diagnosed with infertility without an apparent cause should be tested for celiac disease, because simply eliminating gluten from the diet can solve many of these problems.(Juan Sebastian et al, 2014)

How to conduct research

An experiment was conducted by manufacturing a gluten-free shaboura containing almond flour, millet, oil and eggs and manufacturing gluten-free pasta containing almond flour, and chickpea flour has been purchased materials used in the manufacture of shaboura from Muhayil markets and we conducted the experiment in the nutrition laboratories of the Department of Home Economics at the College of Science and Arts in Mahayil Asir and was evaluated by faculty members, staff and students and the number of residents of the rusk was 17 people and the number of residents for pasta was 21 people.

Gluten Free Mist

Ingredients:

1 cup millet- 1 cup almond flour- 4 eggs- Three quarters cup of oil

Three quarters of a cup of sugar -tablespoon fine cardamom- Half a big spoon of anise seeds Vanilla spoon - Spoon and a half baking powder- Half a spoon of vinegar- pinch of salt

How to prepare the rusk:

First, add the eggs in the mixer, then beat well, then add vinegar, sugar, vanilla and cardamom and stir well until the ingredients are mixed with each other. Add three-quarters of a cup of oil, then anise and salt. Add the dry ingredients Baking powder, then stir, and then add a cup of almond flour and a cup of millet, stir well, and then pour into the appropriate tray, then put the mist in the oven at a temperature of 180 m from the bottom until it is cooked, and then from the top until browned, out of The oven is left to cool, then cut slices and stacked in a tray and returned to the oven and roasted from the top and bottom. Through the attached table

Rusk sensory assessment test

Gluten-free rusk

General Admission	Flavor	Coherence	Color	Bait	Shape	Item
						Shaboura

Give grades as follows:

Excellent =4. Very good =3. Good=2. Acceptable =1.

Gluten Free Pasta

Ingredients:

1 cup almond flour - 1 cup chickpea flour

3 eggs - a pinch of salt - a spoon of vinegar - a quarter cup of oil - a quarter cup of lukewarm water

How to prepare :

First, add the almond flour and chickpea flour in the mixer, then add salt, eggs and vinegar and stir well, then add the oil and water until they cohere, then let them rest for 10 minutes, then we spread them and cut them long using an individual machine, we leave them until they become solid, then they are ready to be cooked.

We boiled it in boiling water with salt and oil for 10 minutes, we prepared it together as a cooking cream.

After manufacturing, the pasta was evaluated sensually by faculty members and students at the College of Science and Arts in Mahayil Asir through the attached table

Sensory Evaluation Test for Pasta

Gluten Free Pasta

General Admission	Flavor	Coherence	Color	Bait	Shape	Item
						Pasta

Giving grades as follows:

Prominent =4. Jid separately =3. Jid = 2. Popular = 1.

Conducting the questionnaire

Conducted An electronic questionnaire to find out the extent of the culture of society and their knowledge of gluten and its impact on human health, and it contained 33 questions, and the questionnaire was published on social networking sitesY In the community of college students, parents and residents of the area, the number of responses was 185

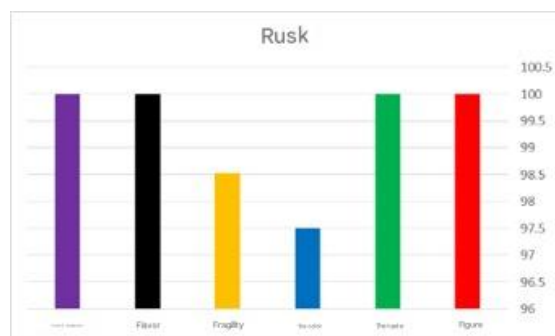
Online Questionnaire

<https://forms.gle/9uhPTwKM5DrSj47w6>

Results and discussion

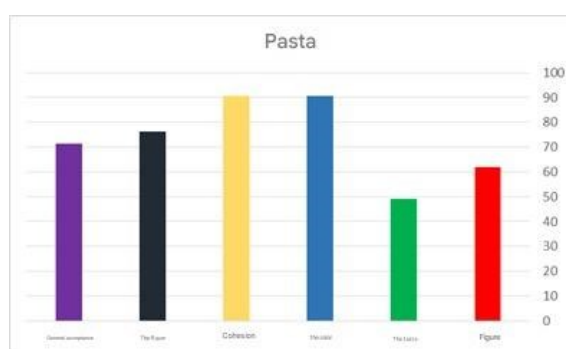
Gluten-free pasta and rusk containing almond flour, millet and chickpeas were manufactured instead of wheat flour, which contains gluten protein, which may cause allergies in people with gluten sensitivity and also affects many people such as diabetics and autistic patients, as it leads to a sense of hunger and eating more, which raises the rate of obesity, and gluten-free pasta and shaboura were evaluated sensually because there are no laboratories to carry out the necessary analyzes, so the results of the evaluation The sensory is as follows .

Sensory assessment scheme of the rusk:



As shown in the graph above, the gluten-free Shaboura got the highest percentage in the sensory evaluation in terms of general acceptance 100%, due to the presence of almond flour with a taste that is loved by all, millet flour rich in fiber and eggs, which gives the shaboura swelling and makes it light from the inside, and it got 100% in terms of shape, taste and flavor, and it got 98.52% in terms of fragility and got 97.5% in terms of color. This product is characterized by containing ingredients of high nutritional value such as almond flour and millet.

Sensory evaluation scheme for pasta



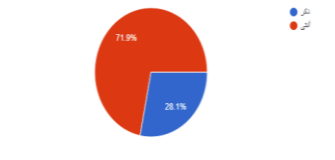
As shown by the graph of the results in the figure above, gluten-free pasta got the highest percentage in the sensory evaluation in terms of color and cohesion, as it got 90.46%, due to eggs and oil, which gave the dough a coherent texture and somewhat close to regular pasta, and the reason for the color is due to the presence of chickpea flour and granulated almond flour in color and rich in fiber, and the flavor has obtained 76.19% Because it differs from the usual joke and has obtained in general acceptance 71.4% because the product has an acceptable taste and good flavor and cohesion and the color is similar to regular pasta and the shape got 62% and the taste has received at least 49% and this is due to the difference in taste gluten-free pasta from regular pasta that most residents have become accustomed to.

Results and discussion of the questionnaire

Conducted An electronic questionnaire to find out the extent of the culture of society and their knowledge of gluten and its impact on human health The link

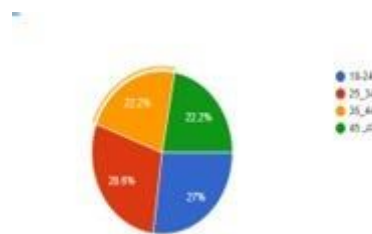
was published on social media channels and the number of responses was 185 and the results of the analysis were as follows:

1. Sex



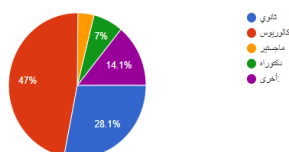
As shown in the figure above, 71.9% of the most interactive are females, including males who are less interactive by 28.1%, as the questionnaire was distributed to female students and employees of the College of Science and Arts in Mahayel Asir.

2_ Age



As shown in the figure above, the age groups are similar in proportions, but the highest percentage is from 25_34 by 28.6%. And the age group of 24-18% by 27%. The age group of 44-35% and from 45 and over is equal in proportions by 22.2%

3- Educational level



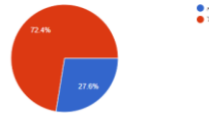
As shown in the figure above, the bachelor's stage is more interactive by 47% because it is published in a university environment, and then the percentage of the secondary stage is formed by 28%, another stage by 14%, the doctorate by 7%, and then the master's degree by 3.5%.

4- Do you know what food allergies are?



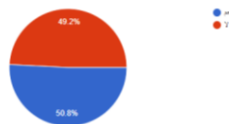
As shown in the figure above, 78.9% know about what food allergy is, which indicates the awareness of families about food allergy and the harms it causes, and 21.1% do not know about food allergy.

5 - Are you allergic to any kind of food?



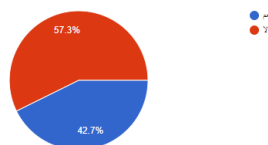
As shown in the figure above, 72.4% are not allergic to any type of food while 27.6% are allergic to some types of foods.

6 - Does your family member suffer from an allergy to any kind of food?



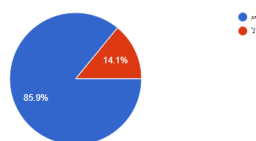
As shown in the figure above, 50.8% Suffering one Their family members are allergic to types of foods, while 49.2% do not suffer from any allergies to food types.

7- Did you know that anaphylactic shock leads to a severe drop in blood pressure?



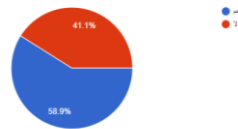
As shown in the figure above, 57.3% do not know that anaphylactic shock leads to a severe drop in blood pressure while 42.7% know about what anaphylactic shock causes a severe drop in blood pressure.

8 - Did you know that eggs, nuts and different types of foods act as triggers for allergies in some individuals?



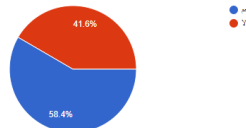
As shown in the figure above, 85.9% know that eggs, nuts and various types of foods act as allergens, while 14.1% do not know that eggs, nuts and other types of foods act as allergens.

9- Do you know what gluten is?



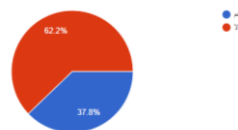
As shown in the figure above, 58.9% know what gluten is while 41.1% do not know what gluten is.

10- Did you know that gluten is one of the wheat proteins?



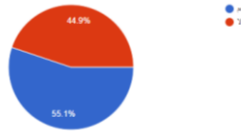
10- The results of the figure above indicate that 58.4% are aware that gluten is one of the wheat proteins, but 41.6% are not aware that gluten is one of the wheat proteins, and studies have shown that gluten is the main storage protein for wheat grains. Gluten is a complex combination of hundreds of related and distinct proteins, especially gliadin and glutenin.

11 - Did you know that gluten consists of glutenprotein and gliadin when mixing flour with water?



The results of the above figure indicate that 62.2% did not know that gluten consists of glutenin protein and gliadine when mixing flour with water while 37.8% were aware of this and studies have indicated that glutenin and gliadin are responsible for the consistency, elasticity, and height of the dough when baking, because these proteins form a sticky network when mixing flour with water.

12 - Did you know that gluten is important in increasing the volume of bread and pastries during baking?



The results of the above figure indicate that 55.1% are aware that gluten is important in increasing the volume of bread and pastries, and 44.9% of them could not know about this, and the study has proven that glutenin and gliadin are responsible for the consistency of the dough, its elasticity, and its height when baking, because these proteins form a sticky network when mixing flour with water .

13 - Do you suffer from gluten sensitivity?



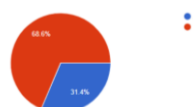
The results of the above figure indicated that 88.1% were not allergic to gluten, while 11.9% of them were allergic to gluten, and as shown in studies, gluten sensitivity or gluten intolerance, is a disease that causes symptoms when eating wheat and everything that contains gluten inside. Markus MacGill,2017))

14- Does a member of your family suffer from gluten sensitivity?



The results of the above figure indicated that 81.1% of their family members are not sensitive to gluten and there are 18.9% who had gluten sensitivity to one of their family members, and as shown in studies that gluten sensitivity or gluten intolerance, is a disease that causes symptoms when eating wheat and everything that contains gluten inside. Markus MacGill,2017))

15 - Do you know what are the symptoms of gluten sensitivity?



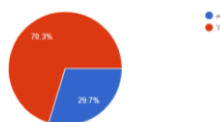
The results of the above figure indicate that 68.6% were not aware of the symptoms of this allergy, including 31.4% who were aware of the symptoms of gluten sensitivity, and studies have shown that people with wheat allergy show the following symptoms if they eat wheat or inhale wheat flour: swelling or irritation in the mouth or throat, rash accompanied by itching or swelling of the skin, nasal congestion, headache, itchy eyes or watery eyes, difficulty breathing, cramps, vomiting or Nausea and diarrhea.

16 - Do you know what is the effect of gluten on people with gluten sensitivity?



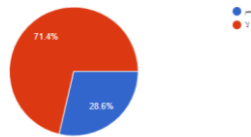
The results of the figure above indicate that 69.2% were not aware of the effect of gluten on people with gluten sensitivity and there were 30.8% aware of the effect of this sensitivity and studies have shown that gluten significantly affects the health of the digestive system, if you suffer from wheat allergy this means that your immune system creates antibodies to the proteins found in wheat.

17 - Did you know that people with gluten sensitivity are more likely to get headaches?



The results of the above figure indicate that 70.3% were not aware that people with gluten sensitivity are more likely to have headaches and there were 29.7% who were aware of this and studies have found that people with wheat allergies are usually more likely to suffer from headaches, and migraines in particular, if a person gets headaches frequently without any apparent reason, then he may be sensitive to gluten. (Adda Bjarnadottir 2016).

18 - Did you know that people with gluten sensitivity are more likely to be depressed?



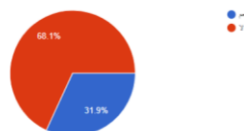
The results of the above figure indicate that 71.4% do not know that people with gluten sensitivity are more prone to depression , while the percentage of those who know that constitutes 28.6%, and studies indicate that people with digestive ailments are often more likely to suffer from anxiety, depression, and therefore several explanations, including the following: Low serotonin levels (English: SerotoninSerotonin is a neurotransmitter called the hormone of happiness, and low levels are associated with depression.

19 - Did you know that gluten sensitivity causes iron deficiency anemia?



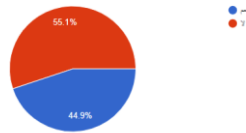
As shown in the figure above, 69.2% of people do not know that gluten sensitivity causes iron deficiency anemia, while 30.8% know that, as people with gluten sensitivity are more likely to feel tired, as studies have shown that (60-82) % of them suffer from fatigue, and fatigue after eating foods containing gluten,

20- Did you know that gluten opens the appetite?



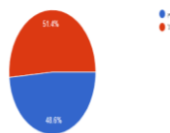
The results in the figure above indicate that 68.1% of people do not know that gluten opens the appetite while 31.9% know that Fred Brouns et al (2020) explained in his study that wheat gluten causes increased food intake due to early observations that the secretion of opioids in the human brain is associated with feelings of pleasure or euphoria. Similarly, eating a very tasty meal, which is associated with feelings of pleasure is easy to assume that opioid peptides produced by the digestion and absorption of gluten in Blood will reach the brain and lead to a feeling of pleasure and increased appetite.

21 - Did you know that gluten causes obesity?



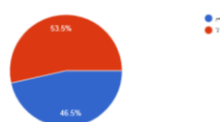
From the figure above, it is clear that 55.1% of people do not know that gluten causes obesity while 44.9% know that (Fred Brouns et al) explained (2022 Fred Brouns et al) that wheat gluten causes increased food intake due to early observations that the secretion of opioids in the human brain is associated with feelings of pleasure or euphoria. Similarly, eating a very tasty meal, which is associated with feelings of pleasure It is easy to assume that opioid peptides produced by the digestion and absorption of gluten into the blood will reach the brain. They lead to a feeling of pleasure and increased appetite.

22- Did you know that gluten negatively affects diabetics?



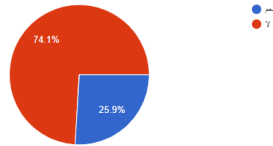
It appears from the above figure that 51.4% do not know that gluten affects diabetics while 48.6% know it, and (Ingo Eland, 2023) showed in his animal study a link between gluten and type I diabetes. It is suggested that gluten affects beta cells, with a possible association with the development of type I diabetes. Furthermore, gliadin has been shown to affect the pancreas . , possibly by inducing inflammation . and beta cell stress . The incidence of type I diabetes has been reduced from 64% to 15% by applying a lifelong gluten-free diet.

23- Did you know that consuming gluten in abundance may lead to type I diabetes?



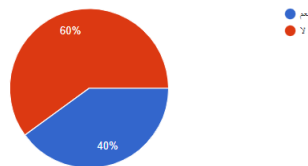
As shown in the figure above, 53.5% of people do not know that consuming gluten too much may lead to type I diabetes , while 46.5% know that.

24 - Did you know that gluten negatively affects autistic people?



The figure above shows that 74.1% of people do not know that gluten negatively affects autistic patients, while 25.9% of them know that, as (Vincent and Fred, 2014) indicated in his study that gluten affects autistic patients, so recent experiments that include gluten-free diets show significant improvements in psychological and behavioral categories and in vocal and non-vocal communication, attention and concentration, bouts of aggression, affection, motor skills, sleep patterns, and anxiety. , empathy, and responses to learning Furthermore, the reintroduction of gluten into the diet of autistic patients led to the deterioration of behaviors in the areas of hyperactivity, impulsivity, stereotyped and aggressive behaviors, language skills, and communication.

25- Did you know that gluten affects skin diseases ?



As shown in the figure above, 60% of people do not know that gluten affects skin diseases while 40% of them know that, as she mentioned (Rania Issa, 2018) People with wheat allergy show the following symptoms if they eat wheat or

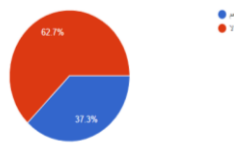
26- Did you know that gluten causes infertility in couples?



As shown in the figure above, 17.3% of those who know that gluten causes infertility is small, while 82.7% of those who do not know it.

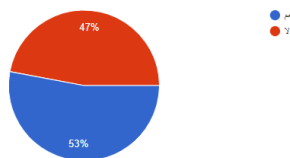
Uncontrolled celiac disease causes changes in fertility and problems in pregnancy, because couples who suffer from infertility for no reason are diagnosed with celiac disease because once gluten is eliminated in the diet, many problems are solved.

27- Do you know what are the gluten-free alternatives?



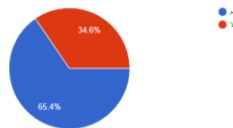
As shown in the figure above, 37.3% know what gluten-free alternatives are, while 62.7% do not know what the alternatives are.

28-Did you know that millet, almonds, rice, chickpeas, maize and lentils are all gluten-free foods?



As shown in the figure above, 53% know that millet, almonds, rice, chickpeas, maize and lentils are gluten-free foods, while 47% do not.

29- Did you know that people with gluten sensitivity can avoid it by following a gluten-free diet?

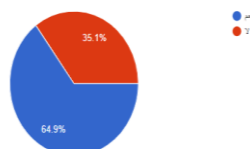


As shown in the figure above, 65.4% know they can avoid gluten with a gluten-free diet, while 34.6% do not.

.Gluten-free diets may help reduce the harmful effects of gluten

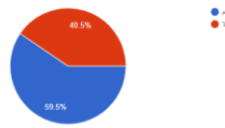
(Aaron Lerner et al, 2017

30- Did you know that a gluten-free diet helps to lose weight?



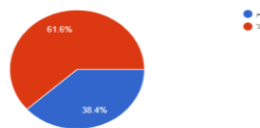
As shown in the figure above, 64.9% know that a gluten-free diet helps to lose weight, while 35.1% do not.

31- Did you know that a gluten-free diet lowers blood sugar?



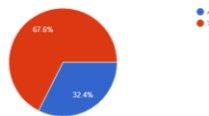
As shown in the figure above, 59.5% know that a gluten-free diet lowers blood sugar while 40.5% do not.

32- Did you know that a gluten-free diet contributes to alleviating the symptoms of autism and improving their behavior?



As shown in the figure above, 38.4% know that a gluten-free diet contributes to the relief of autism symptoms, while 61.6% do not know that.

33- Did you know that a gluten-free diet is a reason for treating infertility?



As shown in the figure above, 32.4% know that adhering to a gluten-free diet contributes to the treatment of infertility, while 67.6% do not know that.

Conclusion & Recommendations

The bottom line:

Has been manufactured rusk and pasta free of gluten and has obtained satisfactory proportions in the sensory evaluation and has gotten in terms of form general acceptance and shape and taste and flavor and fragility and color on: 100%, 100%, 100%, 98.52%, 97.05% respectively and also got pasta in terms of color, cohesion, flavor, general acceptance, shape and taste on: 90.46%, 90.46%, 76.19%, 71.4%, 62%, and 49% respectively. Also, an electronic questionnaire was conducted and it turned out that 88.1% of the people were not infected with gluten sensitivity among us, of which 11.9% were gluten allergic, and it turned out that there were 81.1% of people who did not have a family member with gluten sensitivity. Among us, 18.9% of those who had a gluten sensitive member in their family and it turned out that 58.4% were aware

that gluten is one of the wheat proteins and 41.6% were unaware of this, 68.6% were unaware of the symptoms of gluten sensitivity, 31.4% were aware of the symptoms of gluten sensitivity, 69.2% were unaware of the effect of gluten on people with gluten sensitivity, and 30.8% were aware of the effect of gluten on people with gluten sensitivity.

Recommendations:

- 1- We recommend reducing and limiting the consumption of gluten in diets because it is one of the causes of obesity, high blood sugar, allergies and infertility.
- 2- We recommend replacing wheat flour with millet flour, almond flour, chickpea flour, or gluten-free cereals in your diet.
- 3- We recommend a gluten-free diet for autistic patients so that their condition does not worsen
- 4-We recommend making gluten-free products that are affordable for everyone.

Acknowledgments :-

The authors extend their appreciation to the Deanship of Research and Graduate Studies at King Khalid University for funding this work through Large Research Project under grant number RGP.2/409/45.

References:-

1. Aaron Lerner, Yehuda Shoenfeld, Torsten Matthias 2017, Adverse effects of gluten ingestion and advantages of gluten withdrawal in non celiac autoimmune disease, Nutrition Reviews.
2. Adda Bjarnadottir ,May 17,2023 what is gluten,which foods have lots ,and how to tell if it is an intolerance vs. Sensitivity, Medical News Today.
3. Anna Roszkowska , Marta Pawlicka ,Anna Mroczek , Kamil Balabuszek Barbara Nieradko-Iwanicka ,2019,Non-Celiac Gluten Sensitivity: A Review Medical , MDPI.
4. Ayushi Naik , Akansha Tiwari and Kinjal Rana , 2023, Development of Muffins from Kodo Millet Flour using Fructooligosaccharide with the incorporation of Clitoria ternatea ,International Journal of Science and Research Archive
5. Claire L Jansson-Knodell , Mattie White , Carolyn Lockett , Huiping Xu , Alberto Rubio-Tapia , Andrea Shin , 2023 , Self-Reported Gluten Intolerance Is Prevalent, but Not All Gluten-Containing Foods Are Equal ,National Library of Medicine pubmed.

6. Claire L. Jansson-Knodell, Mattie White, Carolyn Lockett, Huiping Xu, Alberto Rubio-Tapia & Andrea Shin , 2023 , Digestive Diseases and Sciences
7. Dr. C. Debadarshini, Dr. D.Jena , Dr. S.Nanda , 2022, Proximate Composition and Sensory Evaluation of Developed Cakes from Composite Flour , IJFANS International Journal of Food and Nutritional Sciences.
8. Elaine K. Luo, 2018 , Symptoms of Celiac Disease, Wheat Allergy, and Non-Celiac Gluten Sensitivity: Which Is It? , healthline
9. Elisa Karhu, Ryan Zukerman, Rebecca S Eshraghi, Jeenu Mittal, Richard C Deth, Ana M Castejon, Malav Trivedi, Rahul Mittal, Adrien A Eshraghi Author Notes
10. Fred Brouns Peter R. Shewry ,2023 , "Do gluten peptides stimulate weight gain in humans.Wiley Online Library
11. Ingo Eland 1, Lars Klieverik 1, Abbas Ali Mansour and Abdulbaqi Al-Toma 2022 Gluten-Free Diet in Co-Existent Celiac Disease and Type 1 Diabetes Mellitus: Is It Detrimental or Beneficial to Glycemic Control, Vascular Complications, and Quality of Life
12. Jae Hwan Shin , Y Veera Manohara Reddy , Tae Jung Park , Jong Pil Park , 2022 , Recent advances in analytical strategies and microsystems for food allergen detection , National Library of Medicine pubmed.
13. jessica r biesiekierski , 2017 , What is gluten? , wiley online library.
14. Joanna Poceta , 2021 , Symptoms of a Wheat Allergy.
15. Karen Gill., 2018 ,What are the first signs of gluten intolerance?, MEDICAL NEWSTODAY
16. Kathy W. Warwick , 2023,The Gluten-Free Diet: A Beginner's Guide with Meal Plan, healthline.
17. Michael Kerr ,Kristeen Cherney , 2017 , Gluten Intolerance Food List: What to Avoid and What to Eat.
18. Lauren panoff, March2,2023 TheMost Common Signs of Gluten Intolerance ,healthline
19. Laurits J. Holm, Knud Josefsen and Karsten Buschard ,2018, Possible Prevention of Diabetes with a Gluten-Free Diet, MDPI.
20. Molina-Infante, S. Santolaria, D.s Sanders,F. Fernandez-Bañares-
21. -Natasha Klemm, Melinda J Gooderham, Kim Papp 2022 International Journal of Dermatology Oxford Academic