Lactose Intolerance in Jazan: Awareness and Impact

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KEYWORDS

Lactose intolerance, Awareness, Nutrition, Dietary habits, Jazan, Saudi Arabia

ABSTRACT

Background: Lactose intolerance is a frequent disorder characterized by gastrointestinal symptoms (such as nausea, bloating, and discomfort) following dairy product consumption. LI can be considerably decreased with simple understanding of symptoms and the use of milk substitutes. **Aim**: The goal of this study was to look into the prevalence of lactose intolerance and its relationship to nutrition and dietary habits in Jazan, Saudi Arabia. **Methods**: This study used a cross-sectional descriptive design with a sample of 283 participants who met the qualifying requirements. A questionnaire was used to collect the data, which was then analyzed using statistical tools for social sciences (SPSS) and Microsoft Excel. **Results**: Dairy/dairy products were highly consumed on daily basis (64.7%) accompanied by abdominal distention and gases (18%), yet, only 13.8% had been diagnosed with lactose intolerance. The magnitude of lactose intolerance was mainly in late childhood (11-20 years) and emerging adulthood (21-30 years) (56.4%). only 36% had good knowledge about the disorder, with females had significantly higher levels of awareness compared to males ($p<0.05$). **Conclusion**: Almost one-third of the population in Jazan had good knowledge on lactose intolerance with females having significantly higher levels.

1. Introduction

Lactose intolerance is marked by digestive symptoms such as bloating, diarrhea, and gas, which commonly occur after consuming foods or beverages containing lactose [1]. Lactose is mainly found naturally in milk and dairy products like cheese and ice cream [2].

The primary cause of gastrointestinal discomfort in individuals with lactose intolerance is lactose malabsorption [3, 4], which occurs when lactose intake surpasses the small intestine's ability to digest it. Not all individuals with lactose malabsorption experience symptoms; only those who do are diagnosed with lactose intolerance [5-7].

The prevalence of lactose intolerance varies globally. While lactose malabsorption is common among populations in Asia and Africa, many individuals in Northern Europe have a genetic adaptation that enables continued lactose digestion beyond infancy, making lactose intolerance less prevalent in these regions [8-11]. In the United States, approximately one-third of the population experiences lactose malabsorption [10]. The most precise diagnostic method for lactose intolerance is a small intestine biopsy to directly assess lactase activity, although it is invasive and typically reserved for complex gastrointestinal cases.

Lactose, often referred to as "milk sugar" or β-galactosyl-1,4 glucose, is the main carbohydrate in milk produced by mammals through the mammary glands, except for species like walruses and sea lions that produce lactose-free, fatty milk [11].

Infant nutrition is specifically tailored to handle lactose, with studies indicating greater nutrient absorption in infants consuming breast milk or lactose-based formulas compared to those on lactose-free alternatives [12]. Unlike other sugars, lactose uniquely helps reduce dental caries. In North America and Europe, dairy products account for about 14% of caloric intake, although milk consumption has recently decreased. Conversely, in China and other emerging nations, milk contributes only 4% of total calorie intake, despite a notable rise in consumption [13].

A typical 250 ml serving of cow's milk contains about 12.5 g of lactose, or approximately 5 g per 100 ml. Cultured dairy products like yogurt, which is a major component of the fermentation industry, typically contain about 50% lactose, whereas aged cheeses have much lower lactose content [13].

Lactose malabsorption occurs due to reduced lactase enzyme activity or synthesis. In the small intestine, lactose is broken down by lactase into glucose and galactose, which are easily absorbed [14]. When lactase activity is insufficient, undigested lactose reaches the large intestine, where gut flora metabolizes it into short-chain fatty acids (SCFA) and gases such as hydrogen (H2), carbon dioxide (CO2), and methane (CH4). This can cause osmotic diarrhea and other gastrointestinal symptoms due to the by-products of bacterial fermentation [15].

Lactase non-persistence, where lactase production decreases after infancy, is the most common cause of lactose malabsorption. Infants with congenital lactase deficiency, a rare disorder, experience severe symptoms due to a complete lack of the enzyme. Acquired conditions such as small intestinal bacterial overgrowth, infectious enteritis, coeliac disease, inflammatory bowel disease, certain medications, gastrointestinal surgery, short bowel syndrome, and radiation enteritis can also impair lactase expression or function [16].

Lactose intolerance is uncommon in children under five, primarily affecting adolescents and young adults. Globally, about 65% of people have some degree of lactose intolerance, with significant variation across ethnic groups. It is least common among those of European descent and most prevalent among African Americans, Asians, and Hispanics/Latinos [17,18]. In populations with higher rates of lactose intolerance, lactase non-persistence is also more common [19,20].

Primary lactose intolerance, which can affect up to 70% of people worldwide, is often asymptomatic, while congenital lactase deficiency is extremely rare, with only about 40 cases reported globally [21–23]. Rates of lactose intolerance are higher among African Americans, American Indians, Hispanics, and Asians in the U.S., compared to White Americans. Conversely, Northern Europeans, Australians, and North Americans have the lowest rates of lactose intolerance, ranging from 2% to 15% [24–27]. In other groups, such as Ashkenazi Jews, Africans, and American Indians, the rates can be as high as 100% [24–27].

Lactase activity typically decreases during childhood, though it can extend into adolescence, particularly among White individuals. Ethnic variations play a significant role in the rate and duration of lactase reduction. For instance, 80-90% of Chinese and Japanese lose lactase activity within three to four years post-weaning, while it may take up to 18-20 years for Northern Europeans and North Americans to reach their lowest levels [21]. Mixed-ethnicity individuals often have lower rates of lactase non-persistence compared to their primary ethnic groups [29].

Primary lactose intolerance generally has a gradual onset, with symptoms usually manifesting in late adolescence or adulthood. However, symptoms tend to appear earlier in Native Americans, Asian-Americans, African-Americans, and Hispanics/Latinos compared to White Northern Europeans and Australians [24]. Secondary lactose intolerance is more common in children, especially in low-income countries where infections are prevalent, affecting both genders equally [29]. The enzyme lactase is found on the brush border of the small intestine mucosa. In cases of lactase deficiency, undigested lactose remains in the gut, leading to osmotic diarrhea and the production of gases by colonic bacteria, contributing to various abdominal symptoms [26,29].

Microscopic findings in the small intestine of individuals with lactose intolerance vary depending on the underlying cause of lactase deficiency. In cases of primary lactase deficiency, the intestinal mucosa generally appears normal, and measuring lactase activity can help determine the condition's severity. Conversely, in secondary lactase deficiency, mucosal abnormalities may be present, often linked to underlying conditions like celiac disease. Biopsy results may appear normal if mucosal abnormalities are localized or patchy [30].

After consuming milk or dairy products, symptoms of lactose intolerance typically appear within 30 minutes to 1-2 hours. The severity of symptoms is influenced by the amount of lactose consumed, the remaining lactase activity, and the transit time through the small intestine [31]. Common symptoms include diarrhea, abdominal bloating, pain, nausea, vomiting, fullness, and flatulence [32,33]. Less

frequently, it can cause headaches, muscle and joint pain, mouth ulcers, urinary problems, and difficulty concentrating [34,35].

Lactose intolerance (LI), like other functional gastrointestinal disorders, significantly impacts quality of life and nutrition. Anxiety can exacerbate symptoms, as the fear of experiencing bloating, discomfort, and diarrhea after consuming lactose-containing foods can be a source of additional stress. Research indicates that both diagnosed and self-diagnosed LI patients report a lower quality of life compared to those not concerned about food intolerance [36]. This anxiety can extend to other foods, leading LI patients to report intolerance to various foods known to cause bloating, such as beans and dried fruit, which can result in restrictive eating habits with potential health implications [36]. In severe cases, this behavior can be classified as avoidant/restrictive food intake disorder according to the DSM-5, a type of eating disorder associated with weight loss but not body dysmorphia [37].

The primary limitations of genetic, enzymatic, and gaxilose testing are that lactose malabsorption (LM) is common among healthy individuals, and a positive test does not necessarily indicate that symptoms are due to this condition. In clinical practice, the hydrogen breath test (HBT) is often preferred as it provides reliable information on digestive function and symptoms. Proper diagnosis of LI requires careful evaluation of symptoms using validated questionnaires designed specifically for this purpose [38].

A consensus from a National Institute of Health conference defined lactose intolerance (LI) as the onset of gastrointestinal symptoms following a blinded, single-dose challenge of ingested lactose in individuals with lactose malabsorption (LM), while these symptoms are absent when the individual consumes an indistinguishable placebo [39]. Although blinded testing is rarely utilized outside of clinical trials, it could be beneficial in clinical practice due to the often weak correlation between self-reported symptoms and objective lactose digestion test results [36]. Research indicates that nearly half of individuals with normal lactose digestion report discomfort during a hydrogen breath test (HBT) after an unblinded lactose challenge. Moreover, lactose intolerance is reported by approximately 20% of the general population and up to 70% of patients with irritable bowel syndrome (IBS) in European regions with a low genetic prevalence of lactase non-persistence (LNP).

Blinded, repeated dosage challenges could provide valuable insights into individual lactose digestion capacities and safe consumption levels. For those diagnosed with LNP, these challenges can even be conducted at home using a negative control and varying lactose doses, such as low (12.5 g) and intermediate (25 g) amounts, equivalent to 250 ml and 500 ml of milk, respectively [40]. This approach has the potential to better inform patients since real-life symptom reports often align more closely with actual food choices than with objective test outcomes [36].

To date, blinded home-based testing has not been conducted in routine clinical practice. There is a pressing need for a well-accepted, practical, and cost-effective assessment method for food intolerance that can accurately predict the success of dietary interventions. Such a tool would be a valuable metric for evaluating symptoms and guiding treatment decisions [40].

The treatment of lactose intolerance primarily aims to relieve symptoms and reduce the risk of long-term nutritional deficiencies. A lactose-free diet is often recommended, supported by both clinical evidence and practical experience [41]. However, unlike conditions such as celiac disease or food allergies, a strict lactose-free diet is not required, as individuals with lactose intolerance can often tolerate up to 250 ml of milk (approximately 12 g of lactose) without symptoms, particularly when consumed with other foods [42]. Additionally, prebiotics have been shown to improve lactose tolerance by modifying the gut flora [43].

In a randomized, placebo-controlled study involving 85 individuals with lactose intolerance, regular consumption of short-chain galacto-oligosaccharides (GOS, RP-G28) significantly reduced hydrogen production and alleviated abdominal pain during the hydrogen breath test (HBT). After one month, 30% of participants treated with GOS and 6% of those given a placebo reported being lactose-tolerant.

Microbiological analysis revealed a temporary increase in lactose-fermenting Bifidobacterium spp. following GOS treatment, with a negative correlation between Bifidobacterium levels and abdominal pain. Upon reintroduction of milk, additional alterations in the gut microbiota were observed, including an increase in the genus Roseburia [44].

Lactose-free dairy products with added lactase enzymes are widely available and generally safe, although allergic reactions have occasionally been reported. Treating milk with lactase reduces lactose crystallization, enhancing its sweetness and improving the fermentation process in yogurt. However, the residual proteolytic activity of lactase can break down casein, potentially altering the flavor, especially during prolonged storage [40].

Lactase supplements in tablet form can improve lactose digestion and reduce symptoms, though the effects are modest (e.g., an 18% reduction in symptoms) [45,46]. An alternative approach is consuming probiotics such as Lactobacillus spp., Bifidobacterium longum, or Bifidobacterium animalis, which produce lactase in the gut. A recent systematic review of this treatment found overall positive effects, although the impact was not consistently greater than lactase supplementation, and the quality of evidence was low [47]. In clinical studies, only a minority of individuals with LI undergoing HBT report significant symptom improvement following treatment with lactase supplements or dietary adjustments. Furthermore, it remains unclear to what extent the therapeutic effect and patient expectations influence the outcomes [40].

2. Methodology

2.1. Study design and settings:

A quantitative cross-sectional study design was employed for this research. An anonymous survey was developed to assess the prevalence and awareness of lactose intolerance among the population of Jazan region. The eligibility criteria included adults aged 18 years or older residing in Jazan, Saudi Arabia, who were willing to participate in the study.

2.2 Data collection tools and methods:

The survey instrument was designed based on a comprehensive review of previous studies and included validated items to capture various dimensions, such as participants' age, gender, monthly income, and other sociodemographic factors. The second section of the survey explored dairy consumption and associated symptoms, while the third section focused on the participants' personal and family history of glucose intolerance. To assess awareness levels, multiple-choice questions with exclusive responses were utilized.

The questionnaire was distributed online via social media platforms from September 25th to October 10th, 2023, by the researchers and their team. Participants were required to read and consent to an online form before participating. The survey was kept open for two weeks, with measures implemented to minimize nonresponse bias, including keeping the survey duration brief (under 10 minutes) and sending email reminders every three days. Only fully completed questionnaires were included in the final analysis, resulting in a total sample of 283 participants.

2.3 Data analysis

Using IBM SPSS v, the completed survey responses were arranged into a data matrix. 24 for Microsoft Excel 2016 and Windows. Numerical variables were reported as mean ± standard deviation, while categorical variables were summarized using frequencies (numbers and percentages). Utilizing the Chi-Square test and Analysis of Variance (ANOVA), associations between variables were investigated; statistical significance was established at $p \leq 0.05$.

3. Result and Discussion

The purpose of the study was to evaluate the level of awareness, prevalence, and effects of lactose intolerance in the Jazan region's population. The findings are shown in terms of participant knowledge

of managing lactose intolerance, awareness levels, symptoms related to dairy consumption, and demographics. Significant conclusions about participant demographics, eating patterns, and general lactose intolerance awareness were obtained from data analysis. These findings highlighted important areas where there are knowledge gaps and opportunities for public health interventions.

With 576 participants aged between 18 and 25, young adults made up the majority of the study sample. Seventy-four percent of the participants were female, and seventy-one percent had a university degree. According to this demographic profile, the results appear to represent the knowledge and experiences of a comparatively youthful and well-educated population in the Jazan region.

Figure 1 depicts the gender distribution of the study participants, revealing that a majority (74.6%) were female, while the remaining 25.4% were male. This highlights the predominance of female respondents in the survey sample.

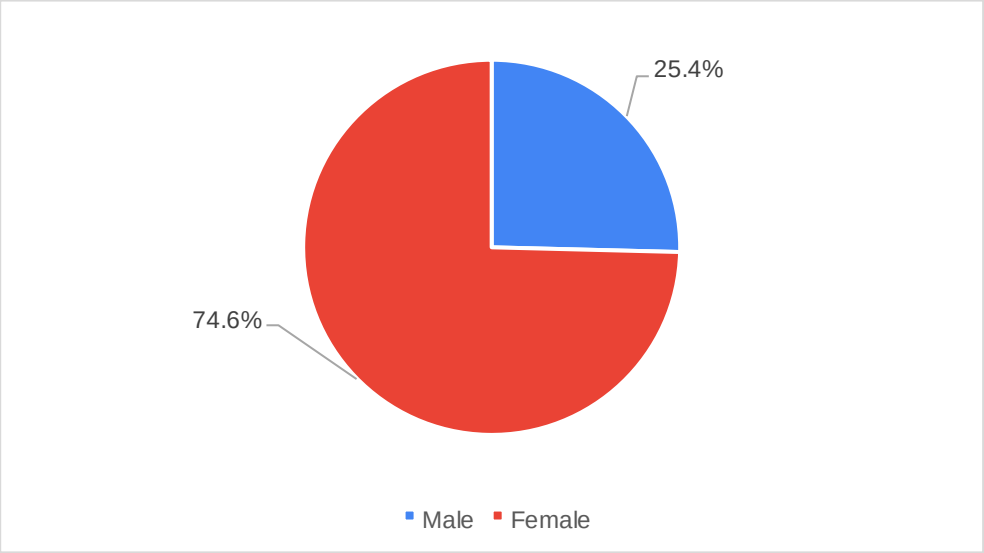

Figure 1: Gender Distribution of Participants

The data presented in Figure 2 indicate that the largest proportion of participants (57.6%) were aged 18-25 years. Participants aged 35 years and above comprised 30.4% of the sample, while those between the ages of 26-34 accounted for 12%.

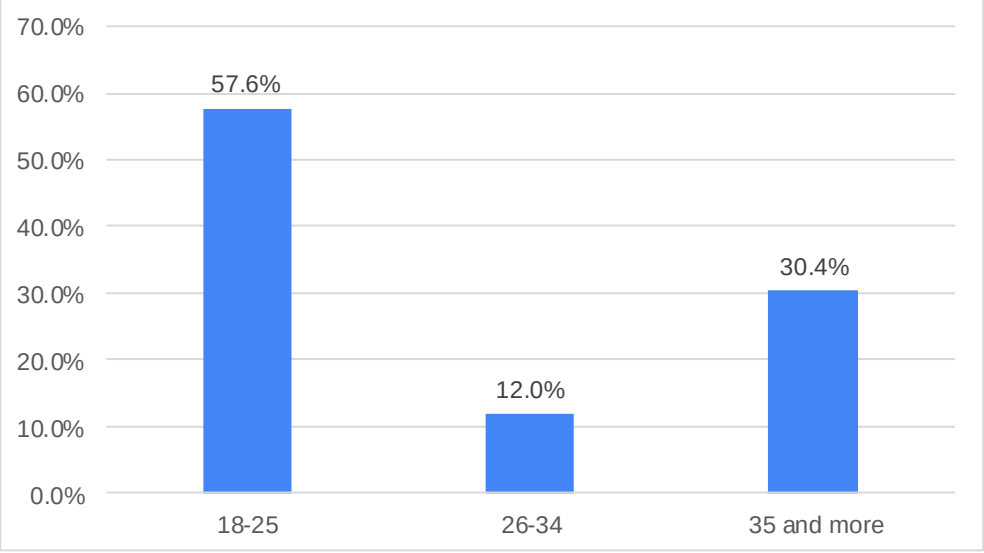

Figure 2: Age Group Distribution of Participants

As illustrated in Figure 3, the vast majority of participants (93.6%) were Saudi nationals, whereas only a small fraction (6.4%) were non-Saudis.

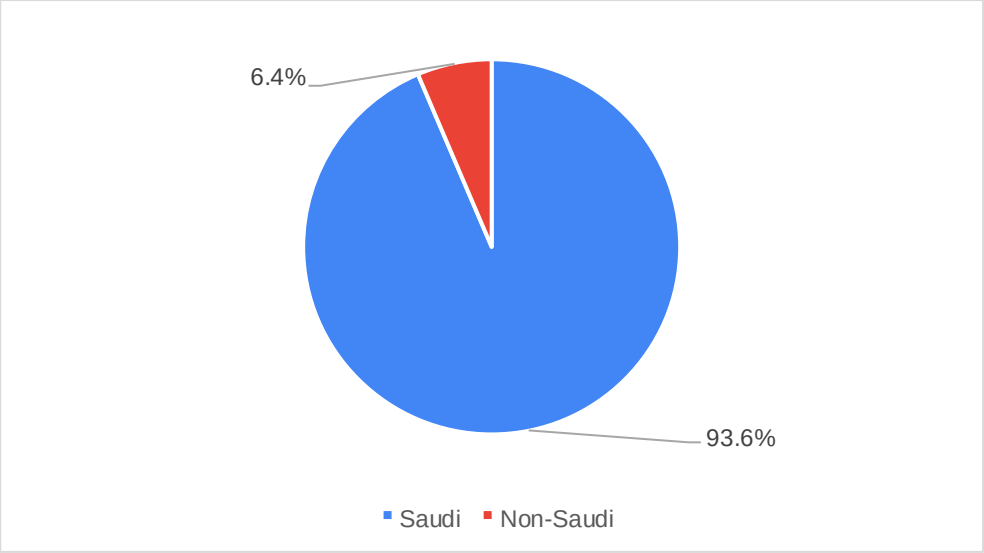

Figure 3: Nationality of Participants

Figure 4 reveals that the majority of participants (71%) held a university degree, while 17.3% had completed secondary education.

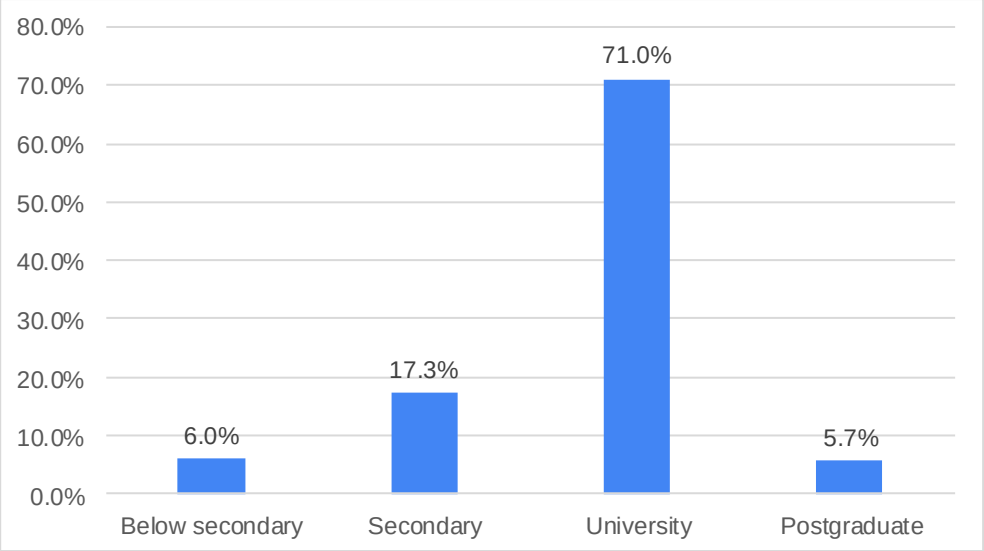

Figure 4: Educational Level of Participants

From the results illustrated in figure 5, the majority of participants (78.1%) reported having sufficient family income, while 18% indicated that their family income was less than sufficient.

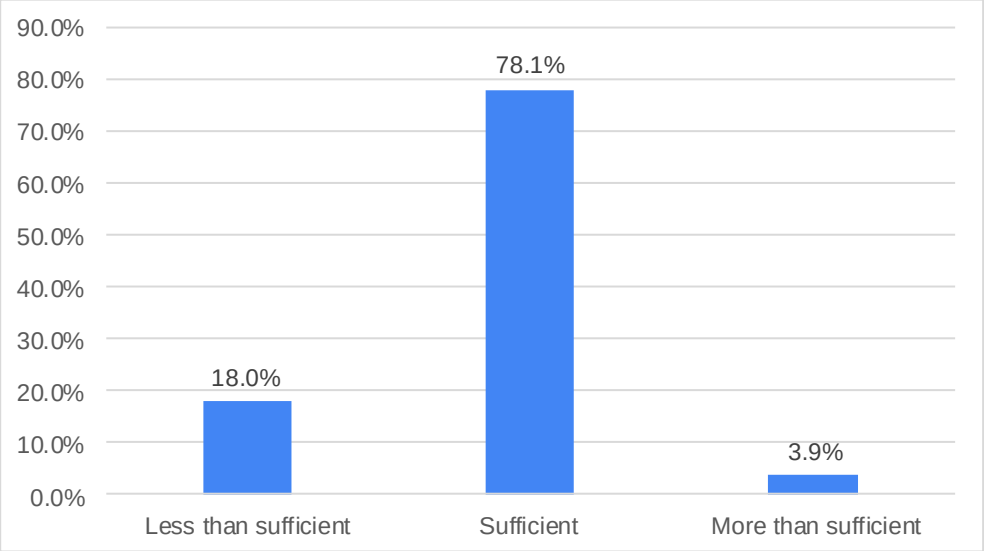

Figure 5: Income Level of Participants

Figure 6 shows that the majority of participants (54.8%) reported having good knowledge of lactose intolerance, while 45.2% indicated they lacked sufficient knowledge about the disorder.

Overall, 36% of participants demonstrated good knowledge of lactose intolerance, with significantly higher awareness observed among females compared to males ($p = 0.024$). Despite a general understanding of lactose intolerance symptoms, knowledge gaps were evident, particularly regarding diagnostic methods and the condition's complications.

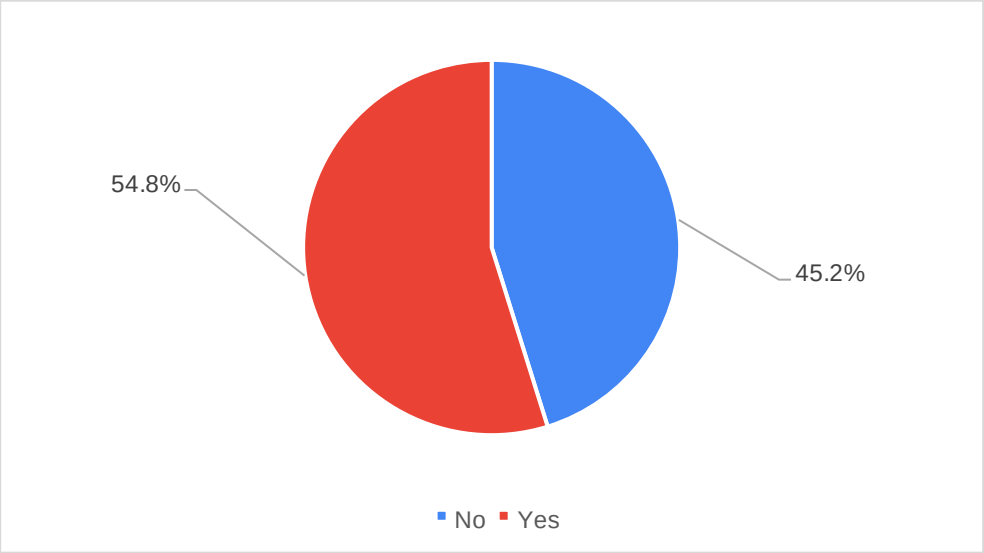

Figure 6: Proportion of participants with good knowledge about lactose intolerance disorder, illustrating the level of awareness among the surveyed population regarding the condition and its associated symptoms, causes, and management.

Figure 7 illustrates that the majority of participants (64.7%) consumed dairy products or their derivatives daily, while the remaining 35.3% did not include these items in their regular diet.

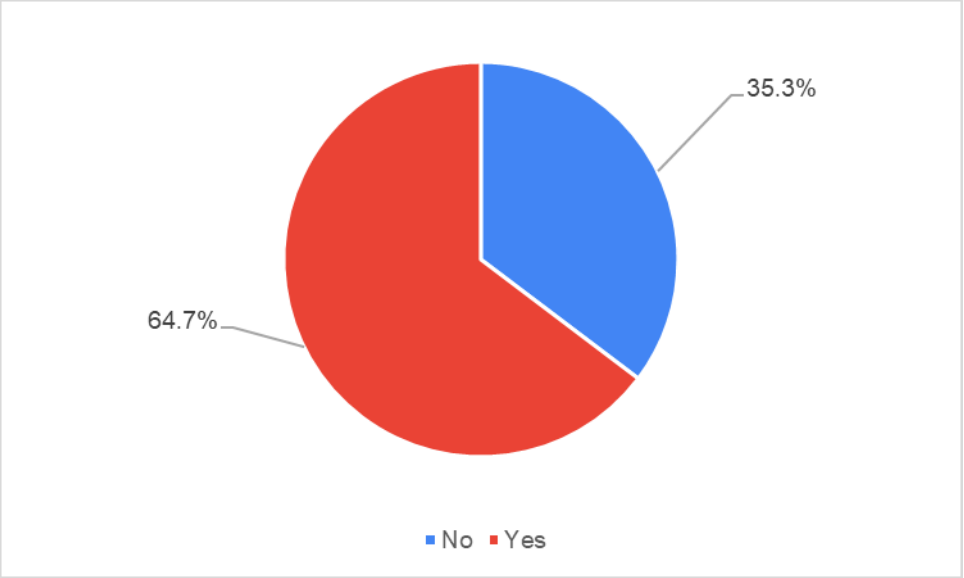

Figure 7: Daily consumption of dairy products or their derivatives among participants, highlighting the proportion of individuals who regularly include these items in their diet versus those who do not.

As depicted in Figure 8, nearly one-fifth (18%) of participants who consumed dairy products or their derivatives reported experiencing abdominal distention and gas. Additionally, smaller percentages of participants reported other symptoms, including abdominal pain (3.8%), nausea (2.2%), diarrhea (1.6%), and vomiting (0.5%).

Symptoms commonly reported among participants included abdominal distention and gas (18%), abdominal pain (3.8%), and diarrhea (1.6%). Despite these prevalent symptoms, only 13.8% of participants had been formally diagnosed with lactose intolerance, indicating a potential underdiagnosis within the population. This highlights the need for improved diagnostic awareness and access to appropriate medical advice.

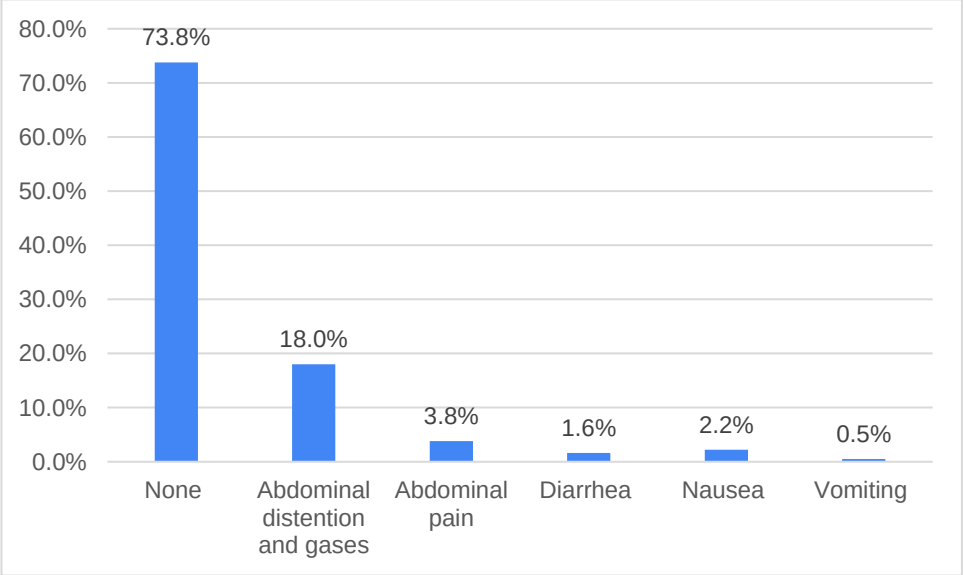

Figure 8: Reported symptoms among participants consuming dairy and dairy products, highlighting the frequency of abdominal distention, gas, and other gastrointestinal symptoms such as abdominal pain, nausea, diarrhea, and vomiting.

The results in Figure 9 indicate that 13.8% of participants were diagnosed with lactose intolerance, while a significant portion (44.2%) were unsure about their condition.

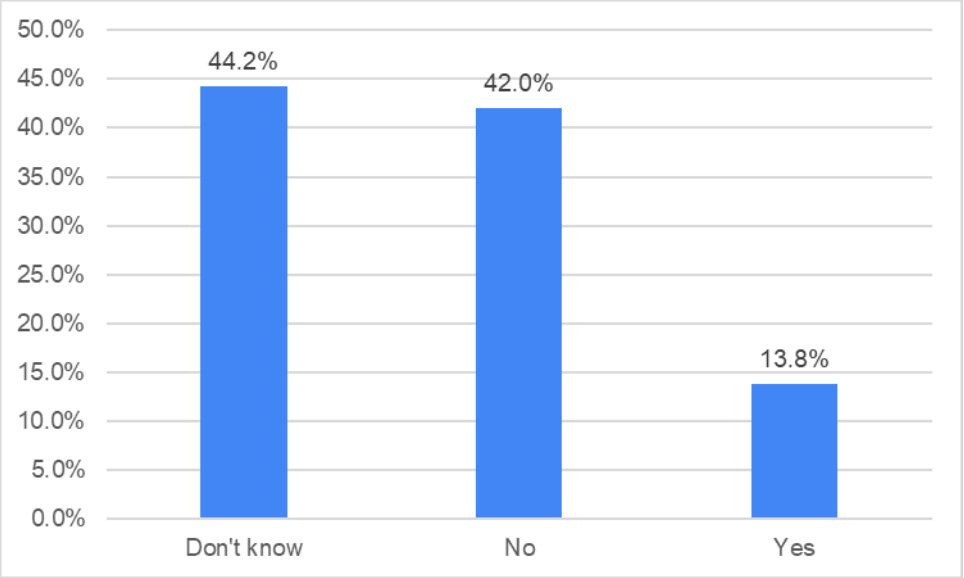

Figure 9: Participant responses to the question, "Do you have lactose intolerance?" illustrating the prevalence of self-reported lactose intolerance and the uncertainty among respondents regarding their condition.

Figure 10 illustrates that those who were diagnosed with lactose intolerance at 11-20 years and 21-30 were equally represented (28.2%). Who were diagnosed with the disorder at over 30 years were less than one quarter (23.1%), while 20.5% reported 10 years and less.

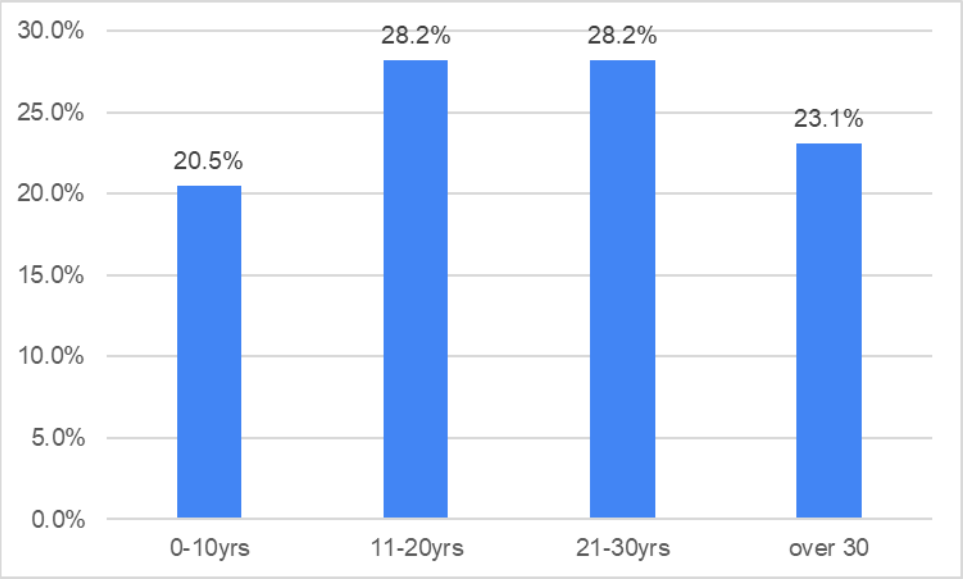

Figure 10: Age at Diagnosis of Lactose Intolerance (Years)

Figure 11 reveals that 29.7% of participants reported knowing someone who has lactose intolerance.

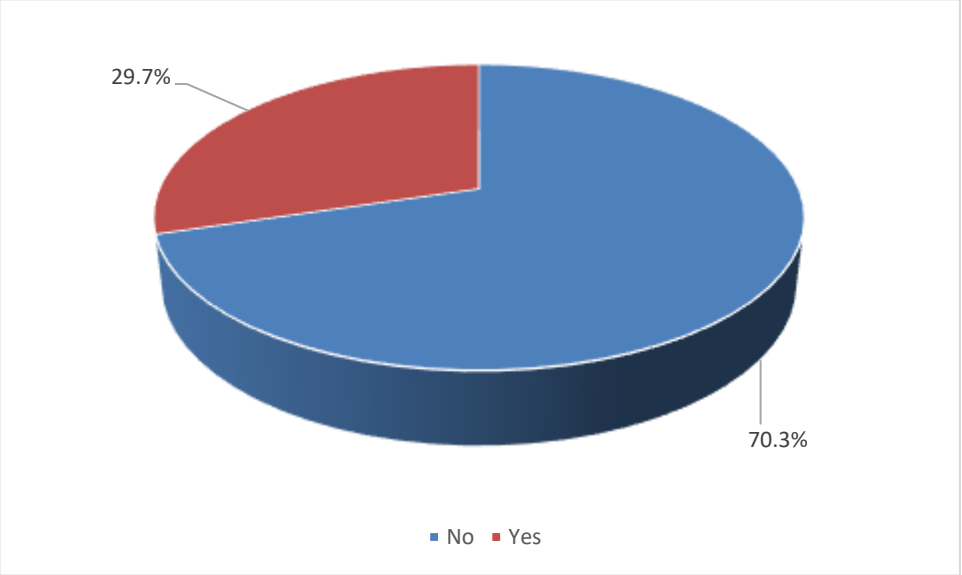

Figure 11: Participants' responses to the question, "Do you know anyone who has lactose intolerance?" highlighting the proportion of individuals who are aware of someone with the condition.

Half of the participants who knew someone with lactose intolerance (50%) identified the individual as a first-degree relative, 10.7% as a second-degree relative, and 9.5% as a third-degree relative as shown in Figure 12.

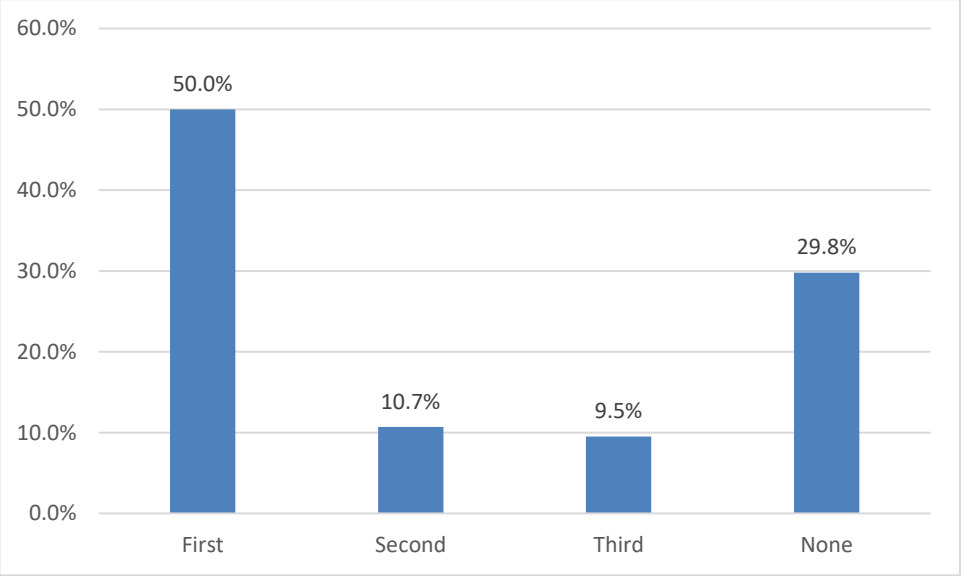

Figure 12: Relationship Degree with Individuals Diagnosed with Lactose Intolerance

Table 1: Public awareness regarding lactose intolerance disorder

Question	Response	Frequency (F)	Percentage (%)
When do symptoms of lactose intolerance typically occur?	After consuming dairy products	199	70.3
	During the day	62	21.9
	At night	22	7.8
How can symptoms of lactose	Avoid dairy and use	140	49.5

intolerance be managed?	lactose-free products		
	Consult a physician	110	38.9
	Use pain relievers	33	11.7
What are the known causes of lactose intolerance?	Uncertain	107	37.8
	Following gastrointestinal infections	159	56.2
	After gastrointestinal surgery	2	0.7
	Due to certain medications	15	5.3
Do people with lactose intolerance need nutritional supplements?	No	100	35.3
	Yes	183	64.7
Is it necessary to consume lactose-free alternatives?	No	54	19.1
	Yes	229	80.9
Do lactose-free products lack the nutritional value of regular dairy?	No	122	43.1
	Yes	161	56.9
Is leaky gut syndrome related to symptoms of lactose intolerance?	No	120	42.4
	Yes	163	57.6
Is lactose intolerance a curable condition?	No	117	41.3
	Yes	166	58.7
Does the severity of lactose intolerance vary between individuals?	No	39	13.8
	Yes	244	86.2
Are milk allergy and lactose intolerance the same?	No	145	51.2
	Yes	138	48.8
Can lactose intolerance develop even if parents are unaffected?	No	100	35.3
	Yes	183	64.7
Can lactose intolerance develop suddenly?	No	97	34.3
	Yes	186	65.7
What are the complications of lactose intolerance?	Don’t know	262	92.6
	Calcium and vitamin D deficiency	14	4.9
	Osteoporosis	6	2.1
	Neurological disorders	1	0.4
How is lactose intolerance diagnosed?	Uncertain	168	59.4
	Stool acidity test	34	12.0
	Blood glucose test	69	24.4
	Hydrogen breath test	12	4.2
Which ethnic group is most	Asians	148	52.3

susceptible to lactose intolerance?			
	Africans	47	16.6
	Europeans	57	20.1
	Latins	31	11.0

The majority of participants (70.3%) were aware that symptoms of lactose intolerance typically manifest after consuming dairy products or their derivatives. Nearly half (49.5%) suggested avoiding dairy and related products to manage symptoms, and a significant portion (56.2%) identified gastrointestinal disorders or infections as potential causes of lactose intolerance. Participants demonstrated varying levels of knowledge on different aspects of lactose intolerance: 64.7% recognized the need for nutritional supplements, 80.9% understood the importance of lactose-free alternatives, and 56.9% were aware that lactose-free products might lack the nutritional value found in regular dairy. Additionally, 57.6% associated symptoms of lactose intolerance with leaky gut syndrome, and 86.6% acknowledged that the severity of intolerance can vary between individuals. However, 51.2% mistakenly equated milk allergy with lactose intolerance, 64.7% believed that lactose intolerance could develop even if parents are unaffected, and 65.7% thought it could occur suddenly. Only 41.3% correctly identified that lactose intolerance is incurable.

Regarding the condition's consequences, 4.9% of participants mentioned calcium and vitamin D deficiencies, and 2.1% noted osteoporosis as possible outcomes. Awareness of diagnostic methods was notably low, with only 12% familiar with the stool acidity test for diagnosing lactose intolerance. Among high-risk groups, Asians were the most frequently identified (52.3%), followed by Europeans (20.1%).

Overall, the findings revealed that only 36% of participants had a good level of knowledge about lactose intolerance, indicating significant gaps in awareness and understanding of the disorder.

Figure 13 illustrates the varying degrees of knowledge among participants, highlighting the proportion of individuals with good, moderate, and poor awareness of lactose intolerance and its associated symptoms, causes, and management strategies.

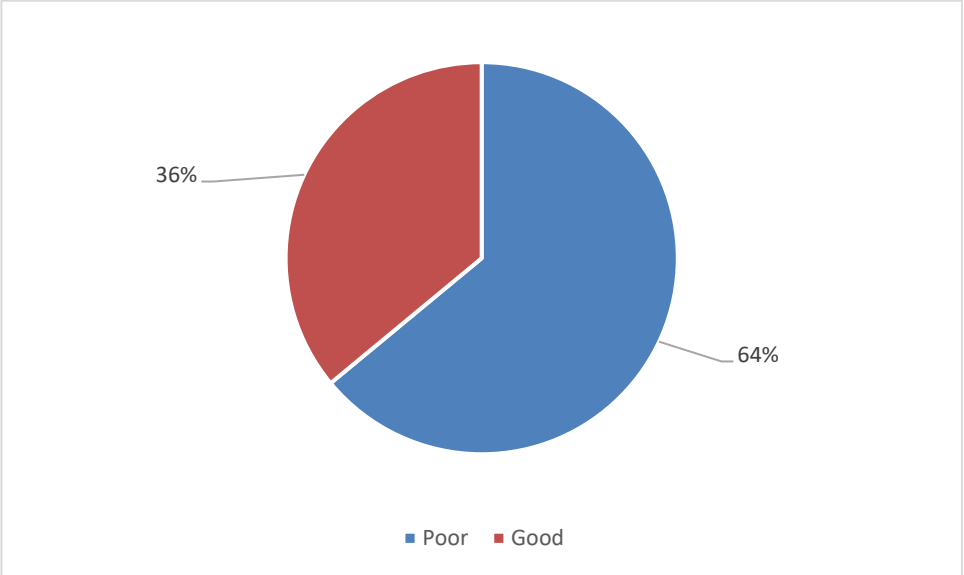

Figure 13: Awareness Levels of Lactose Intolerance Among the General Population in Jazan Region

Figure 14 demonstrates that the primary sources of information on lactose intolerance were relatives and friends (49.1%), followed by the internet (25.8%). The reliance on non-professional sources could contribute to the observed gaps in knowledge, underscoring the importance of promoting reliable health

information through healthcare providers and educational campaigns.

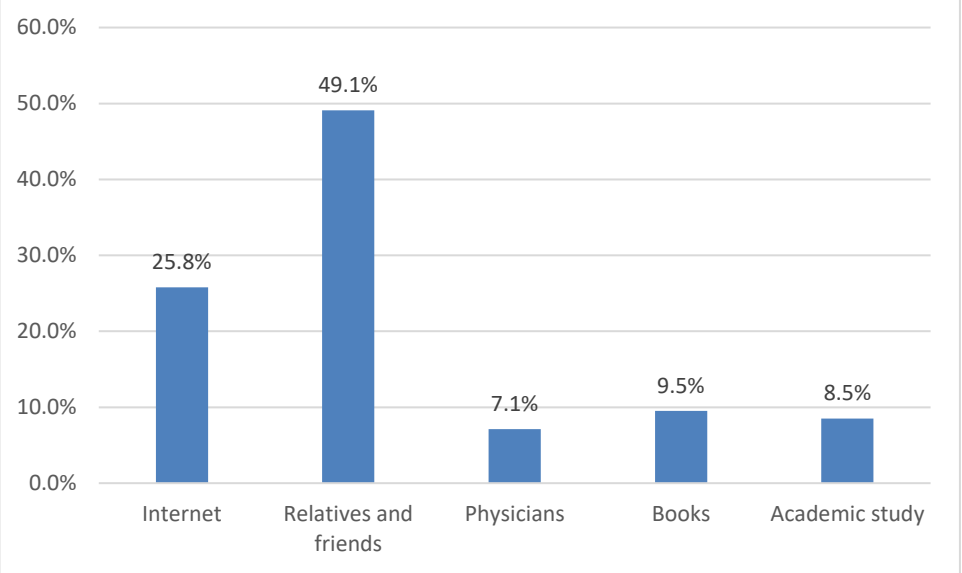

Figure 14: Sources of Information on Lactose Intolerance Among Participants

Table 2: Association between level of awareness and certain variables.

Variable	Overall Awareness Level	Total Count	p-value
	Poor Awareness	**Good Awareness**	
Gender			0.024
Male	Count	54	18
	%	29.8%	17.6%
Female	Count	127	84
	%	70.2%	82.4%
Age (years)			0.110
18-25	Count	96	67
	%	53.0%	65.7%
26-34	Count	25	9
	%	13.8%	8.8%
35 and above	Count	60	26
	%	33.1%	25.5%
Nationality			0.202
Saudi	Count	172	93
	%	95.0%	91.2%
Non-Saudi	Count	9	9
	%	5.0%	8.8%
Lactose Intolerance Status			0.313
Don't know	Count	86	39
	%	47.5%	38.2%
No	Count	71	48
	%	39.2%	47.1%
Yes	Count	24	15
	%	13.3%	14.7%

This table shows the association between the overall awareness level of lactose intolerance and certain demographic and health-related variables, highlighting statistical significance in the gender variable (p-value = 0.024).

The population of Jazan appears to be less aware of lactose intolerance than reported in similar studies from India, where awareness levels reached 71.6 percent [50], when compared to studies conducted in other regions. These results point to the necessity of focused public health campaigns in Jazan to increase understanding and awareness of lactose intolerance.

Discussion

There may be a substantial discrepancy between the identification of symptoms and a formal diagnosis of lactose intolerance, given the high prevalence of dairy consumption in Jazan region and the comparatively low diagnosis rate. The underdiagnosis could be caused by cultural dietary practices that emphasize dairy consumption despite symptoms, as well as a lack of awareness among the general public and medical professionals. The findings are consistent with other research showing comparable patterns in other Middle Eastern populations, where a lack of public and medical awareness frequently leads to an underreporting of lactose intolerance.

The purpose of this study was to evaluate the prevalence and knowledge of lactose intolerance in the Saudi Arabian region of Jazan. The majority of participants in the sample (93 point 6 percent) were Saudi nationals, and 57 point 6 percent of them were between the ages of 18 and 25. The sample was primarily female (74 point 6 percent). Furthermore, 71 percent of the individuals had a college degree.

This study's awareness of lactose intolerance was noticeably lower than that of studies carried out in other places, like India, where more than 70% of participants showed adequate knowledge [50]. Differences in public health education and cultural views on dairy consumption may be the cause of this discrepancy. Alzahrani et al. reported similar results. [49] in Saudi Arabia, indicating a pattern of low awareness that is constant throughout the nation. These parallels highlight the necessity of region-specific educational initiatives to raise public awareness of lactose intolerance. Although milk consumption has somewhat declined recently in Europe and North America, dairy products still account for 14% of adults' total energy intake in these regions. On the other hand, although milk consumption is rising quickly, it only makes up 4% of the energy intake in China and many other developing nations [13]. 64.7% of participants in this study said they regularly consumed dairy products or their derivatives, demonstrating how common dairy consumption is in Jazan. As per Misselwitz et al. [16], people with the lactase non-persistence phenotype may experience symptoms when eating a diet high in lactose. Undigested lactose increases intestinal lumen motility and may cause diarrhea, which is why symptoms like bloating, flatulence, and abdominal pain happen [24].

Just 13.8 percent of participants had been diagnosed with lactose intolerance, despite the fact that nearly one-fifth (18%) of them reported experiencing gas and distention in their abdomens, and others reported abdominal pain and diarrhea. Notably, 297 percent of participants knew someone who was lactose intolerant; of these cases, half (50 percent) involved first-degree relatives, highlighting the disorder's familial component. Genetically determined, lactase persistence—the ability to produce lactase into adulthood—is prevalent in populations from the Middle East, Europe, Africa, and Southern Asia [48].

The results have significant ramifications for Jazan region's public health. Targeted education campaigns are necessary to support early diagnosis and management of lactose intolerance, as evidenced by the high prevalence of symptoms among undiagnosed individuals and low awareness of the condition. Enhancing early detection and lessening the burden of untreated symptoms could be achieved by integrating lactose intolerance education into community health initiatives and school health programs. Furthermore, educating medical professionals on how to identify and treat lactose intolerance could close the current diagnostic and treatment gap.

The study found that individuals with lactose intolerance were most frequently diagnosed in late

childhood (aged 11–20 years) and early adulthood (aged 21–30 years), making up 28.2% of the total. Less people received a diagnosis before the age of ten (20 points5 percent) or in late adulthood (23 points1 percent). Adults who are widely known to be lactose intolerant may find it difficult to consume foods that contain dairy. Shaukat and associates. [42] observed that the majority of Northern European populations have low levels of lactose intolerance in their early years and into adulthood. But among African American, Hispanic, Asian, and American Indian populations, rates are higher—especially in late childhood and adulthood.
The results revealed that only 36% of participants had a good understanding of lactose intolerance, indicating a low level of awareness about the condition. Considerable gaps in knowledge were discovered, particularly with regard to the difficulties and techniques of assessment related to lactose intolerance. This is consistent with Alzahrani et al.'s findings. [49], who found that approximately one-third of Saudi Arabians are aware of lactose intolerance and how to treat it. On the other hand, Diandra and Patil [50] discovered that awareness levels were higher in India, where 71.6% of participants showed that they were aware of the condition. The low level of awareness in this study may be related to participants' reliance on unreliable information sources, with 491 percent citing friends and family and 258 percent using the internet.

This study has various shortcomings even though it offers insightful information. The sample may not accurately reflect the larger Jazan population because it was primarily made up of young, educated females. Furthermore, recall bias or underreporting of symptoms could be introduced by relying solely on self-reported data. In order to validate self-reported diagnoses of lactose intolerance, future research should strive to include a more diverse demographic profile and incorporate clinical assessments.

The genetic and environmental components causing lactose intolerance in Jazan region require more investigation. For those with lactose intolerance, longitudinal studies evaluating the effects of dietary interventions on symptom management may offer evidence-based suggestions. Furthermore, investigating how education for healthcare providers affects diagnosis rates may provide important information for creating specialized training initiatives.
In addition, the study found that, in line with the conclusions of Alzahrani et al., women were considerably more aware of lactose intolerance than men were. [49]. This gender gap indicates that in order to improve knowledge and management of lactose intolerance in Jazan region, targeted educational interventions are needed, especially for men.
The study concludes that there is a notable deficiency in the knowledge and diagnosis of lactose intolerance in Jazan region, which could have substantial consequences for public health. To lessen the burden of untreated symptoms and enhance the quality of life for those who are affected, it is imperative to address these gaps through focused education and better diagnostic procedures. Prioritizing lactose intolerance as a public health issue and acting proactively to improve community awareness and access to care are important tasks for legislators and healthcare professionals.

4. Conclusion and future scope

According to the study, approximately one in three people in Jazan region are aware of lactose intolerance, including its symptoms and management techniques. Women are noticeably more aware of the condition than men are. Approximately two-thirds of the participants said they regularly consume dairy products or their derivatives. Gas and distention in the stomach were the most commonly reported symptoms associated with dairy consumption, followed by discomfort in the abdomen and diarrhea. These results highlight the need for more readily available information and increased awareness of lactose intolerance in the area.

The results show that there is a substantial lack of knowledge and treatment regarding lactose intolerance, which can cause persistent symptoms and lower quality of life. The high daily dairy consumption despite the prevalence of symptoms points to a general public that is ignorant of lactose intolerance and the available treatments. This disparity emphasizes the necessity of focused

interventions that lessen the burden of untreated symptoms by educating the public and motivating people to seek appropriate diagnosis and management techniques.

Recommendations:

It is crucial to educate medical professionals about lactose intolerance. Educating physicians, dietitians, and other healthcare professionals can enhance patient care by facilitating better diagnosis and treatment decisions and encouraging the use of lactose-free substitutes in food. Important suggestions include: Raising Public Awareness: Educate the public more through media, online resources, and campaigns; also, incorporate lactose intolerance into curricula. Accessibility: To enhance public health, make lactose-free products easily accessible. Additional Research: To inform medical interventions, carry out additional research throughout Saudi Arabia. By putting these measures into practice, lactose intolerant people will experience improved health outcomes due to improved diagnosis, treatment, and public awareness. To encourage the availability and unambiguous labeling of lactose-free products, policy changes are required

Ethical Approval

Ethical approval for this study was obtained from Jazan University Research Ethics Committee. Participants were informed about the study objectives, and their voluntary participation was ensured through informed consent.

Author Contribution

Conceptualization: W.M, O.A, A.A.A, L.S; Methodology: H.H, M.A, A.A, N.K; Data collection: R.A, N.M, S.K.I; Formal analysis: W.M, N.K, A.A.A; Writing—original draft preparation: O.A, N.A, M.E; Writing—review and editing: H.H, S.H; Supervision: N.K. All authors have read and approved the final manuscript.

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Data Availability Statement

The data supporting the findings of this study are included within the article.

Conflicts of Interest

The authors declare no conflict of interest.

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