

# Knowledge and Attitude of Food Borne (E. coli) Disease in Hail

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**Abstract:** Purpose: This research aim to contribute to greater awareness, identify the knowledge and attitude of food borne disease caused by *E. coli* (bacteria *Escherichia coli*) at Hail and highlighting the update methods to prevent food borne disease, make these methods more applicable of grate use for all family member. Design: This research study the knowledge and attitude of food borne disease caused by *E. Coli* at Hail. 2013 Method: 150 Questionnaire was set to collect information randomly from both male and female in hail, to identify their knowledge and attitude about the food borne disease caused by *E. coli*. Results: The results are set in tables and graphs to illustrate the knowledge of food borne disease in Hail. No cases of food borne disease reported from the respondents. The knowledge about the *E. coli* is poor. Conclusion: Personal hygiene in general is good. Increase the knowledge about disease is very important through nutrition education.

**Keyword:** E. coli, Personal hygiene, Nutrition education

## 1. Introduction

According CDC 2010 estimates norovirus in the most common of the known pathogens, responsible for 5.4 million illnesses and 149 deaths each year. Salmonella is now estimated to cause more than a million illnesses and 378 deaths annually. *E. coli* toxins are estimated to cause 176,000 illnesses and 20 fatalities a year. *Campylobacter* is estimated to cause 845,024 illnesses and 76 deaths. *Listeria* is one of the most lethal pathogens, estimated to cause 1,591 illnesses and 255 deaths in USA (The Centers for Disease Control and Prevention (CDC) 2010) [1]

The bacteria *Escherichia coli* was named for the Austrian doctor, Theodor von Escherich (1857-1911), who first isolated the genus of bacteria belonging to the family enterobacteriaceae, tribe Eschericheae. These bacteria are the common inhabitant of the intestinal tract of man and other animals. Because of its difficult name, it is usually referred to as *E. coli*. [2]

We need these bacteria to breakdown cellulose and it assists in the absorption of vitamin K, the blood clotting vitamin. But not all forms are so helpful. *E. coli* O157:H7, which was first identified in 1982, is a particularly nasty version. It secretes a powerful poison, called a verotoxin, which binds to receptors on human kidney, brain and gut cells and kills them. [3]

According the United States Department of Agriculture, the muscle of cattle, which we eat as meat, is sterile. It is only after this meat comes in contact with the contents of the intestines or the feces of infected cattle does it become contaminated. [2][3]. Sometimes an entire animal carcass falls unto the filthy floor of the slaughter house and it is hung back on the line with insufficient or even no cleaning whatsoever. And sometimes during the cutting of the carcass, the intestines of the animal are accidentally sliced and their contents explode over the exposed meat [2].



The most common meat to be infected with *E. coli* bacteria is hamburger meat. This is because normally the hamburger you buy is made from the meat of up to 100 different head of cattle. Usually it is not the finest top quality animals that are ground up as hamburger, but old non-milk producing cows. Because it only takes a microscopic amount of meat from one infected animal to contaminate an entire batch of meat and then this large batch of meat is divided and sent to stores and restaurants throughout a large geographic area [4]

*Escherichia coli* (*E. coli*) is a gram-negative bacterium that can survive in an environment with or without air (facultative anaerobe) and, depending on the environment, may or may not produce thin hair-like structures (flagella or pili) that allow the bacteria to move and to attach to human cells. These bacteria commonly live in the intestines of people and animals worldwide [5].

There are many serotypes or strains (over 700) of *E. coli*. Most of the *E. coli* are normal inhabitants of the small intestine and colon and do not cause disease in the intestines. (They are non-pathogenic.) Nevertheless, these non-pathogenic *E. coli* can cause disease if they spread outside of the intestines, for example, into the urinary tract (where they cause bladder or kidney infections), or into the blood stream (sepsis). Other *E. coli* strains (enterovirulent *E. coli* strains or EEC) cause "poisoning" or diarrhea even though they usually remain within the intestine by producing toxins or intestinal inflammation. There are four to six groups (some researchers combine groups) of *E. coli* serotypes that comprise EEC. Their names are derived from descriptions of the characteristics that separate them from the other groups.(4)(5)

- EHEC (enterohemorrhagic *E. coli*)
- ETEC (enterotoxigenic *E. coli*)
- EPEC (enteropathogenic *E. coli*)
- EIEC (enteroinvasive *E. coli*)
- EAEC (enteroadherent *E. coli*)
- EAaggEC (enteroaggregative *E. coli*)

*E. coli* were first isolated by T. Escherich in 1885 and were named after him. The over 700 serotypes are identified by small antigenic changes in their surface "O" antigens (lipopolysaccharides or molecules on the bacterial surface of gram-negative bacteria), for example *E. coli* 0157 or *E. coli* 055. These serotypes are identified by immunological tests using antibodies to the antigens. *E. coli* strains are further distinguished by "H" protein antigens (different types of flagella that make the bacteria motile). Consequently, a particular *E. coli* strain can be identified as H, followed by a number, and this identifier is added to the "O" name; for example, *E. coli* 0157:H7. Although this name designation seems complicated, researchers and clinicians use these antigenic identifiers to track specific *E. coli* strains that cause outbreaks of disease [5][6]. *E. coli* strain, *E. coli* 0157:H7 is notorious for its potential to cause complicated disease in humans; the research will focus on this *E. coli* strain.

### 1.1 *E. coli* 0157:H7

*E. coli* 0157:H7 is the predominant serotype of *E. coli* that form one group of EEC. This EEC group is termed enterohemorrhagic *E. coli* or EHEC. Unfortunately, other terms in the medical literature describe this group (VTEC or Vero toxin-producing *E. coli* and STEC or Shiga toxin-producing *E. coli*). Research suggests that only a small number of *E. coli* 0157:H7 are needed to cause infection (ingestion of about 10–100 organisms) instead of the thousands to millions needed for infections by other *E. coli* serotypes. Infection is aided by adhesive receptors (pili or fimbriae) that attach the bacteria to human intestinal cells. Most of the problems caused by the bacteria are due to two Shiga toxins, termed Stx 1 and Stx 2 and also termed Vero toxins. (Toxins are chemicals that are produced by the bacterium and that damage human cell.) These toxins are almost identical to toxins produced by another related bacterium, *Shigella spp* that causes dysentery and can damage and kill intestinal cells and occasionally cause anemia, damage to platelets, and death of cells in other organs, especially the kidneys. [1][7]

*E. coli* 0157:H7 is a major health problem. It is estimated to cause infection in more than 70,000 individuals a year in the United States, and the U. S. Centers for Disease Control and Prevention (CDC) suggests *E. coli* 0157:H7 is responsible for the majority of "*E. coli*" outbreaks in the U. S. It has been reported to cause both large outbreaks as well as outbreaks in small numbers of individuals [5]. The illnesses were associated with eating hamburgers at the restaurants of a national chain; some patients experienced hemorrhagic colitis (inflammation and bleeding of the colon). Thus, hemorrhagic colitis due to *E. coli* 0157:H7 is commonly referred to as **hamburger disease**. Since that time, *E. coli* 0157:H7 also has been associated with contaminated water, foods, and unpasteurized or incorrectly pasteurized (heat treated) dairy products [6]

#### 1.1.1 The symptoms of *E. coli* 0157:H7 infections?

The initial symptoms of *E. coli* O157:H7 infection usually appears about three to five (though occasionally in as few as one day or as many as 10 days) after a person ingests the bacteria; the symptoms include;

- Nausea
- vomiting,
- Stomach cramps, and
- Diarrhea that often is bloody.

The person may have a mild fever of about 100 to 101F (37.7 to 38.3 C). These symptoms can be seen in infected children and adults [5].

#### 1.1.2 Later symptoms *E. coli* 0157:H7 infections

The majority of people (especially normal adults) are infected resolve the infection without antibiotics in about five to seven days. However, some people (about 10% of people infected, especially children under the age of 5 and the elderly) develop more severe signs and symptoms, and these people usually require hospitalization and aggressive treatment. These patients develop the usual symptoms listed above, but do not resolve the infection. They develop symptoms that last longer (at least a week) and, if not treated promptly, the infection may lead to disability or death (11)

These symptoms or complications fall into three main categories;

- **Hemorrhagic (bloody) diarrhea:** Hemorrhagic (bloody) diarrhea symptoms are an increased amount of blood in the diarrheal stool that does not seem to resolve and is usually accompanied by severe abdominal pain. Although this may resolve within a week, some individuals can develop anemia and dehydration that can cause death.(1)
- **Hemolytic-uremic syndrome (HUS):** Hemolytic-uremic syndrome symptoms of pallor (due to anemia), fever, bruising or nosebleeds (due to destruction of blood platelets that are needed for blood to clot), fatigue, shortness of breath, swelling of the body, especially hands and feet, jaundice, and reduced flow of urine may be seen. HUS symptoms usually develop about 7 to 10 days after the initial diarrhea begins. HUS is the most common cause of kidney failure in children; children under 10 years old are the most likely to develop HUS. *E. coli* 0157:H7 produces toxins that damage the kidneys and destroys platelets that can lead to kidney failure, excessive bleeding, seizures or death. (1)
- **Thrombotic thrombocytopenic purpura (TTP):** Thrombotic thrombocytopenic purpura is caused by the loss of platelets; however, the symptoms that occur are somewhat different and occur mainly in the elderly. The symptoms are fever, weakness, easy, rapid or "spontaneous" bruising, renal failure, and mental impairment that can rapidly progress to organ failures and death. Until the 1980's, TTP was considered a fatal disease, but since the 1980's, plasma exchange and infusion techniques have reduced the death rate in TTP patients to about 10% (1)

For most people (about 90%), the *E. coli* infection clears and a good outcome or prognosis occurs. However, if any of the above mentioned complications happen, the prognosis may range from good to poor. The variable prognosis depends on

the severity of the complication, the quickness of diagnosis and treatment, the response of the individual to adequate treatment and the overall health of the individual. Children and the elderly are at higher risk for adverse outcomes [12]

### 1.1.3 An infection with *E. coli* O157:H7 diagnosed

The diagnosis of *E. coli* O157:H7 infection begins with an accurate history, physical exam, and an analysis of a sample of stool from the patient. A presumptive diagnosis is frequently made if the patient has symptoms of bloody diarrhea and a history of being exposed to persons, foods or liquids known to be a source of an *E. coli* O157:H7 outbreak.

Because other disease-causing bacteria (for example, *Shigella* and *Salmonella*) can give patients similar initial symptoms, a definite diagnosis is based on culture of *E. coli* O157:H7 from the patient's sample of stool on special culturing plates that then are tested with antiserum (antibodies) that react only with *E. coli* O157:H7 (8). Because of the high frequency of outbreaks of *E. coli* O157:H7, the CDC in 2009 recommended that all patients being screened for community-acquired diarrheal infections have their stool samples analyzed with antisera for Shiga toxins, the toxins that are produced by *E. coli* O157:H7 and a few other bacteria, in addition to having cultures of their stool. This approach may result in faster diagnosis of *E. coli* O157:H7 infections (18). Blood tests such as a complete blood count (CBC), and blood levels of electrolytes, platelets, blood urea nitrogen (BUN), and creatinine (blood tests that measure function of the kidney) are performed periodically to look for the development of HUS or TTP.(19)

### 1.1.4 The treatment for *E. coli* O157:H7?

Patients, especially healthy adults, often require no treatment for *E. coli* O157:H7 since many infections are self-limited. Moreover, for the acute diarrheal illness, antibiotics have not proven useful. In fact, some studies have shown that antibiotics may increase the chances of developing HUS (up to 17-fold). This effect is thought to occur because the antibiotic damages the bacteria, causing them to release even more toxin. Most investigators suggest antibiotic use only if a patient is septic, that is, there is evidence that the bacterium has spread to parts of the body other than the intestine. In addition, use of atropine and diphenoxylate (Lomotil), drugs that are commonly used to control diarrhea, also may increase symptoms and trigger complications. (13)

When necessary, treatment includes the replacement of fluids and electrolytes to treat or prevent dehydration. Infection with *E. coli* O157:H7 should be treated by a physician especially in children and the elderly. HUS and TTP require complex supportive care (for example, plasma exchange) in the hospital. Patients with kidney failure may need dialysis. Consultation with a critical care specialist often is recommended for the care of patients that develop HUS or TTP.(14)

### 1.1.5 The complications and outcomes of infection with *E. coli* O157:H7

Although these conditions have been presented in the symptoms section, they are presented here again because they are actual complications that can occur after the initial disease begins. Patients without these complications usually

have excellent outcomes (a good prognosis). Individuals who develop the following complications have outcomes that range from good to poor, depending on their overall health and how quickly they are diagnosed, treated, and respond to treatment (15)

#### 1.1.5.1 Hemorrhagic diarrhea (hemorrhagic enterocolitis)

The incubation period between exposures to EHEC bacteria, including *E. coli* O157:H7 and the onset of symptoms is usually three to four days but may be longer in some individuals. Symptoms of EHEC infection include severe abdominal pain and abdominal tenderness which often is associated with bloody diarrhea. Curiously, there often is little or no fever. The diarrhea typically lasts for six to eight days. Dehydration and blood loss can lead to death in some patients if not corrected early (20)

#### 1.1.5.2 Hemolytic-uremic syndrome (HUS)

Hemolytic-uremic syndrome (HUS) is the most worrisome complication of EHEC infection, especially in children, because it is a serious and potentially fatal complication. "Hemolytic" refers to the breakup of red blood cells which leads to anemia. There also is destruction of platelets which leads to low blood levels of platelets (thrombocytopenia), which in turn promotes abnormal bleeding. "Uremic" refers to failure of the kidneys. In addition, problems in the brain with seizures and coma may occur. (17)(16). Hemolytic-uremic syndrome most commonly affects children under the ages of 10 years and is the most common cause of acute kidney failure in infants and young children. It occurs in about 6% to 10% of hemorrhagic colitis caused by *E. coli* O157:H7 and usually occurs approximately 7 to 10 days after the onset of diarrhea. Early intervention usually results in better outcomes. (18)

#### 1.1.5.3 Thrombotic thrombocytopenic purpura (TTP)

Persons infected with *E. coli* O157:H7, particularly the elderly, can develop a syndrome similar to HUS called thrombotic thrombocytopenic purpura or TTP with clotting of blood within small blood vessels; anemia due to fragmentation of red blood cells; and a shortage of platelets (thrombocytopenia) that results in easy bruising, neurologic abnormalities, impaired kidney function, and fever. TTP is a serious consequence of *E. coli* O157:H7 infection that requires early and aggressive treatment since it results in death in about 10% of all patients who develop it (19)

#### 1.1.6 How do people contract *E. coli* O157:H7?

Most commonly, *E. coli* O157:H7 comes from eating raw or undercooked ground beef (for example, hamburger) or from drinking raw milk. The bacteria are found in animal feces, particularly cattle feces, and contact with the feces can lead to contamination of many types of food and fluids. In 2010, the FDA recalled several productions of beef, including beef placed in pet food. Less commonly, *E. coli* O157:H7 can be transmitted from one person to another, usually by direct physical contact. *Escherichia coli* O157:H7 remains viable for more than 2 months in feces and soil, and survives well in ground beef. It remains infectious for weeks to months in acidic foods such as mayonnaise, sausage, apple cider and cheddar at refrigeration temperatures. It is destroyed fairly quickly in slurry systems; in one experiment, organisms could no longer be recovered after 9 days (21)

**1.1.7 E. coli 0157:H7 and prevention of outbreaks**

The following to prevent infections from *E. coli* 0157:H7 are recommended:

1. **Wash hands thoroughly** after using the bathroom or changing diapers, and before preparing or eating food. Wash hands after contact with animals or their environments (at farms, petting zoos, fairs, even your own pets in your own yard or house).
2. **Cook meats thoroughly.** Ground beef and meat that has been needle-tenderized should be cooked to a temperature of at least 160 F (70 C). It's best to use a thermometer, as color is not a very reliable indicator of "doneness."
3. **Avoid raw milk, unpasteurized dairy products, and unpasteurized juices** (like fresh apple cider).
4. **Avoid swallowing water** when swimming or playing in lakes, ponds, streams, swimming pools, and backyard "kiddie" pools.
5. **Prevent cross contamination in food preparation** areas by thoroughly washing hands, counters, cutting boards, and utensils after they touch raw meat.(19)

In addition, many researchers suggest that hamburgers ordered in a restaurant should be cooked through completely, so that no pink hamburger meat is visible inside. This cooking reduces the chance that *E. coli* serotypes will remain alive in the meat. All foods involved in a recall should be put in the trash. No one should attempt to cook the recalled material and eat it. Because *E. coli* 0157:H7 is routinely found in the intestines of cattle, companies have developed a vaccine to reduce the number of these bacteria in cattle. The first vaccine for cattle was FDA approved in 2009. There is no vaccine available for *E. coli* 0157:H7 in humans.(19)

**1.1.8 Pathogen Reduction**

Pathogens are bacteria which cause disease in humans. The FFPA, calls for USDA to:

- Set standards for pathogens in meat based on the best scientific data.
- Require meat and poultry processors to microbial test their products before they reach consumers.
- Define acceptable standards as those protecting all consumers, including children and the elderly, not just the "average" consumer.
- Set definitions for pathogens as "adulterants" under the law meaning that they are then the government's responsibility to exclude from commerce wherever they are found (20)

**1.1.9 Farm-To-Table Protections**

Current regulations focus only at slaughter and processing plants. The FFPA would require protection for the consumer from farm to table and permit USDA to:

- Trace contaminated meat to its source and thus develop animal husbandry practices that minimize the presence of harmful bacteria.
- Require slaughter and processing plants to utilize processing controls to prevent meat and poultry from becoming contaminated.

- Establish an Advisory Board to the Secretary of Inspection which would include consumers as well as industry.
- Assist states in developing and monitoring microbial standards programs in retail establishments to minimize bacterial contamination and more uniformly protect the public's health. (20)

**1.1.10 Enforcement**

Any country should have the ability to respond quickly and appropriately to public health threats by:

- Mandatory recall authority over contaminated meat and poultry products.
- Unbelievably, the current system only permits voluntary recall.
- Withdrawing Federal Inspection from plants that are repeat violators
- Mandating civil fines for meat and poultry plants that violate processing controls.
- Instituting whistleblower protection for private plant employees to protect their jobs when they report processing violations.

**1.1.11 Disinfection**

*E. coli* 0157:H7 can be killed by numerous disinfectants including 1% sodium hypochlorite, 70% ethanol, phenol or iodine-based disinfectants, glutaraldehyde and formaldehyde. It can be inactivated by moist heat (121° C for at least 15 min) or dry heat (160–170° C for at least 1 hour). Foods can be made safe by cooking them to a minimum temperature of 160°F/71°C. The infective dose is very low; washed vegetables may contain enough organisms to cause disease (19)

**1.1.12 Summary of E. coli, from sources to prevention**

<i>Sources</i>	<ul style="list-style-type: none"> <li>• Contaminated food, especially undercooked ground beef, unpasteurized (raw) milk and juice, soft cheeses made from raw milk, and raw fruits and vegetables (such as sprouts)</li> <li>• Contaminated water, including drinking untreated water and swimming in contaminated water</li> <li>• Animals and their environment: particularly cows, sheep, and goats. If you don't wash your hands carefully after touching an animal or its environment, you could get an <i>E. coli</i> infection.</li> <li>• Feces of infected people</li> </ul>
<i>Incubation Period</i>	1-10 days
<i>Symptoms</i>	Severe diarrhea that is often bloody, severe abdominal pain, and vomiting. Usually, little or no fever is present. Symptoms of HUS include decreased urine production, dark or tea-colored urine, and facial pallor.
<i>Duration of Illness</i>	5-10 days. Most people will be better in 6-8 days. If HUS develops, it usually occurs after about 1 week.
<i>What Do I Do?</i>	Drink plenty of fluids and get rest. If you cannot drink enough fluids to prevent dehydration or if your symptoms are severe (including blood in your stools or severe abdominal pain), call your doctor. Antibiotics should not be used to treat this infection.

How Can I Prevent It?

- Avoid eating high-risk foods, especially undercooked ground beef, unpasteurized milk or juice, soft cheeses made from unpasteurized milk, or alfalfa sprouts.
- Use a food thermometer to make sure that ground beef has reached a safe internal temperature of 160° F.
- Wash hands before preparing food, after diapering infants, and after contact with cows, sheep, or goats, their food or treats, or their living environment. (5)

Figure 2 Show that the majority of the respondents of this research are Saudi an.

2. Results and Discussion

Table 1: Socio-demographic characteristics of the respondents n (%)

Characteristics		Total
Sample Size		150 (100)
Age Groups (year)	11-20	30(20.0)
	21-30	47 (31.1)
	31-40	35 (23.4)
Sex	≥ 41 years	38 (25.5)
	Male	64(42.7)
	Female	86(57.3)
Education	School	32 (21.4)
	No school	7 (4.6)
	University & high edu.	111(74.0)
Employment	Employed	95(63.3)
Marital Status	Unemployed	55 (36.7)
	Married	88(58.7)
	Unmarried	56(37.3)
	Other	6(4.0)

Table 1 Show the socio-demographic characteristic of the respondents which indicated that majority of the respondent 31.1% their age 21-34 year, 86% are female, 74.0% studying till university and high education level, and 95.0% of the research respondent are employed, 58.7% are married.

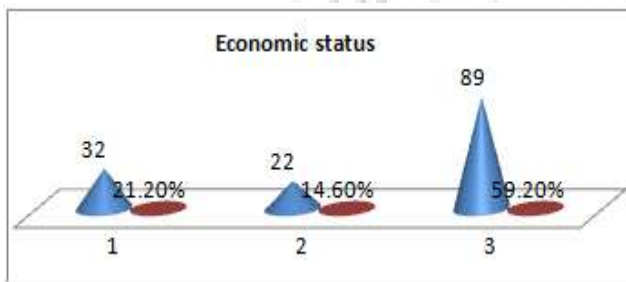


Figure 1: Economic Status of the respondent

Figure 1 Represent the economic status of the interviewers, the majority 59.2% consider as high economic status but not rich one. (Over 5000Riyal/ month).

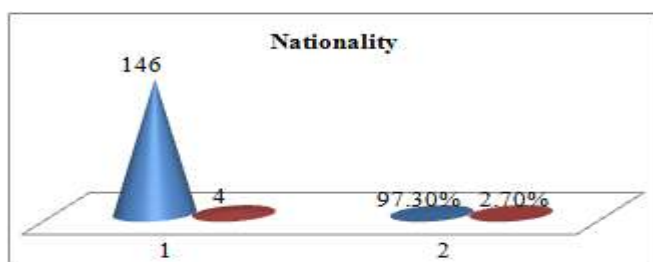


Figure 2: Nationality

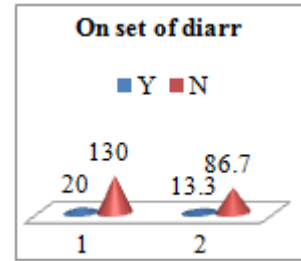


Figure 3: Onset of diarrhea

Figure No. 3 represented the onset of diarrhea between the interviewers. 86.7% of respondents are not having diarrhea on the last three month. The fewer have to learn how to protect them self from the onset of diarrhea. . Diarrhea is not bloody, No abdominal pain, and vomiting. Usually, little or no fever is present. No decreased in urine production, No dark or tea-colored urine, and facial pallor. So this diarrhea has no relation with E. coli disease may have related to any other causes.

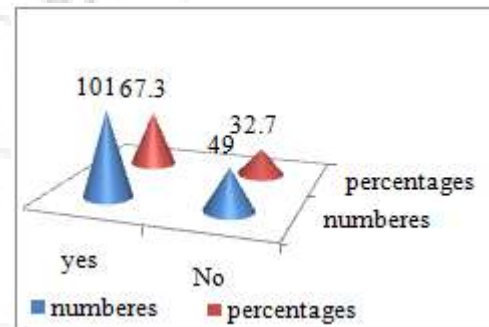


Figure 4: Eating outside the home

Figure No. 4 Represented practice of eating outside the home between the interviewers. The respondents Who eat outside their home (67.3%), While who are not eat outside home (32.7%).

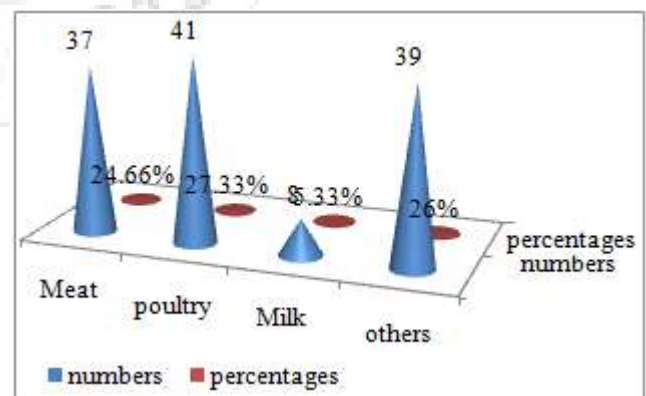


Figure 5: The type of food taken outside the home

Figure 5 interprets (27.33%) of the respondents in the research eat poultry taken outside the home , While the 24.6% take all type of meat outside their home. lowest percentage was taken milk and milk products (5.33%). Other type taken outside home includes juices, cakes, pizza.

Note: The number of people who did not put their answers to this question (25) person.

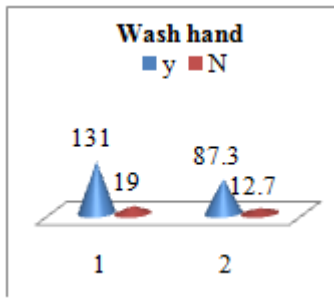


Figure 6: Washing hand practices

Figure No. 6. 87.3% of the respondents in the research have good practices by washing hand before preparing, eating foods. The other respondents need health education to have knowledge about benefit of washing hand before handling food and after come out of latrine.

Figure No.7 Knowledge about E. coli

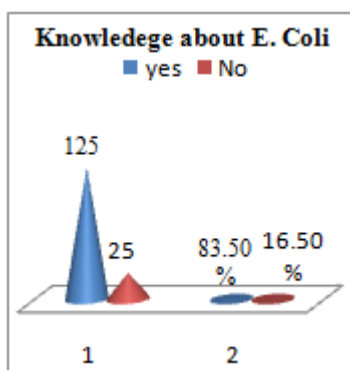


Figure 7: shows that 83.5% of the respondents in this research know the bacteria E. coli. but most of them have some degree of bad food habits which may create health problem.

### 3. Conclusion

This research concluded that no cases of E. coli in Hail community. The knowledge about disease is not satisfactory. Personal hygiene in general good increase the knowledge about disease is very important through nutrition education.

### 4. Recommendation

- Increased attention to education programs, health and nutrition education
- Further investigation about causes of diarrheal infections.

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