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Title: Iron Deficiency Anaemia awareness and its relation to dietary habits of First Year Students at the University of the West Indies St Augustine Campus

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IRON DEFICIENCY ANAEMIA AWARENESS AND ITS RELATION TO DIETARY HABITS OF FIRST YEAR STUDENTS AT THE UNIVERSITY OF THE WEST INDIES ST. AUGUSTINE CAMPUS

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Background:

Among the many types of anaemia, iron deficiency anaemia is a highly prevalent worldwide problem. From research, it has been seen to affect the female population more than the male. It was also found to be significant in developing countries and the prevalence for Trinidad was found to be 24.9% in 2008 (Benoist et al. 2008). This nutritional problem occurs when there is less iron in the blood which affects haemoglobin levels in the blood. This anaemia causes symptoms that have a negative effect on mental and physical aspects of individuals. This type of anaemia can be tested through blood levels. The three stages for this anaemia ended in a reduction of iron stores so low that it affects haemoglobin levels in the blood. Dietary intake varies based on gender and age. The recommended intake for females is 18mg/day and 8mg/day for males aged nineteen to fifty. Treatment includes iron supplementation or a high iron diet. Two types of iron exist; heme iron and non-heme iron. Meat sources provide heme iron, which are highly absorbed and vegetables are a good source of non-heme iron, but these are not absorbed as much as heme iron.

Objective:

To assess the level of awareness, dietary habits and risks for iron deficiency anaemia among the year one students at the University of the West Indies (UWI), St Augustine Campus stratified by gender, ethnicity and vegetarian status in the first semester of academic year 2013/2014.

Design:

A questionnaire was used to assess awareness and dietary practices. A food frequency questionnaire (FFQ) was used to determine eating patterns of the subjects. The risk of iron deficiency anaemia was calculated based on three day dietary records. The statistical programs SPSS and Microsoft Excel were used to assess the data using ANOVA tests and descriptive statistics. This project was completed in Semester 1 of the year 2013 between September and December.

Method:

A total of one hundred and seventy year one students were involved in this research. The studied participants were divided equally based on gender. Data collection was conducted at UWI, St. Augustine Campus in Trinidad. A questionnaire was used to assess information about awareness of iron deficiency also looked into dietary habits focusing on the frequency of consumption of high iron foods, foods that reduce iron absorption, foods that increase absorption and a three day dietary record used to assess the risk for the development of this anaemia.

Results:

Overall, the participants were aware of this anaemia and had high confidence. There was less consumption of high iron foods, more consumption of foods that reduce and those that help increase iron absorption. The risk for the deficiency was higher among the female population (43.5%, sig. 0.000). Females were more aware and confident about this anaemia than the male population. The East Indian and African participants were less confident than the mixed participants. The African participants consumed more high iron foods then the other ethnicities. Non-vegetarians were less aware of this anaemia. Vegetarian status prevented the intake of high iron meat sources, but it was found that non-vegetarians also did not consume these foods. Those not at risk and at risk consumed foods that inhibit iron absorption.

Conclusion:

Overall, awareness of iron deficiency among the subjects was high. Participants of this study claimed to be aware of high-iron foods, but did not frequently consume them; this can be due to a lack of knowledge in the relation to the diet and the deficiency. The risk for the development of iron deficiency was high among the female participants due to insufficient consumption of high iron foods in the diet. There was no significance with vegetarian status or ethnicity when compared to the risk for the deficiency. An educational program should be implemented to educate the students and correct any false information they may have about the deficiency. The areas that lacked awareness and confidence should be addressed as the population is at high risk for the deficiency (57%). The aim is to increase knowledge in the dietary aspect of the deficiency and reduce the risk for the deficiency.

Key words: Iron deficiency, UWI St. Augustine, Awareness, Dietary Habits, Risk

CHAPTER 1: INTRODUCTION

1.1 Background:

Iron deficiency anaemia is a very important nutritional deficiency. It has a great influence on the well-being of humans, especially female individuals of child bearing age, and is one of many types of anaemia. Iron deficiency anaemia is a world-wide problem (Harper 2013).

This deficiency can be defined as an insufficient amount of iron found in the blood. It is frequently observed and occurs when individuals cannot produce enough haemoglobin, therefore there is a reduced capacity of red blood cells to carry oxygen (Mayo Foundation for Medical Education and Research 2011).

Anaemia can be defined as the condition associated with a decline in the concentration of red blood cells in the blood (National Institutes of Health 2013). Therefore a deficiency of iron is where there is a decline of iron and reduced red blood cell capacity, leading to a loss of functionality. It is heavily related to the diet as iron comes from the food consumed (World Health Organisation 2013).

Iron deficiency anaemia can be seen as an extremely established nutritional disorder. It is characterised by a decrease in red blood cell levels and haemoglobin levels. When the diet lacks iron and blood iron levels are lower than the normal range, which is 8mg/day for males and 18mg/day for females, this deficiency can occur (Centers for Disease Control and Prevention 2011; Massachetts Institute of Technology 2007). Oxygen capacity is decreased in red blood cells. Iron is essential for cell growth, transport of oxygen, storage and use of oxygen and enzyme reactions. When there is not enough iron in the body, haemoglobin production decreases and affects the carrying capacity of oxygen by erythropoietin (Mayo Clinic 2013).

This worldwide deficiency affects “2 billion people, over 30% of the world’s population” (World Health Organisation 2013). The prevalence of iron deficiency anaemia in Trinidad was investigated by the use of a survey. It stated that in 1968, “30% of the participants examined had haemoglobin levels less than 12 grams per 100 ml” (Chopra and Byam 1968). From 1993 to 2005, “the population group with the greatest number of individuals affected is non-pregnant women (468.4 million, 95%)” (Benoist et al. 2008).

Trinidad and Tobago was ranked 74th among 192 countries around the world for the prevalence of anaemia (World Health Organisation 2011). “Anaemia contributes to 20% of all

maternal deaths" (World Health Organisation 2013). Trinidad prevalence was estimated to be 24.3% (Benoist et al. 2008). According to World Health Ogranisation (WHO 2011), it was stated that if the prevalence of this anemia is between 20% to 39%, it is a moderate public health concern. Blood haemoglobin levels will be between 80 to 109mg/dl.

Iron deficiency is more prevalent in South Asia since it was found that in India, 88% of pregnant and 74% of non-pregnant women were affected by this type of anaemia. About 50% of the pregnant and 40% of the non-pregnant population from Africa were anaemic. "In the Caribbean, prevalence's of anaemia in pregnant and non-pregnant women are about 40% and 30% respectively" (World Health Organization 2001).

Iron status can be used as an indicator of iron deficiency anaemia. Iron-deficiency anaemia results from decreased iron stores caused by inadequate iron intake, poor absorption, or blood loss. According to World Health Organisation, iron deficiency is a result of a negative iron balance over a long period of time. The more severely deficient the iron store, the more associated iron deficiency is with anaemia (Benoist and Hempstead 2001). The stages for this deficiency include the point where iron stores are diminished so much that it is insufficient to meet the needs of iron turnover in the body. The final stage is where iron stores are insufficient to maintain normal haemoglobin production (Carley 2003). Haemoglobin is the oxygen carrying molecule and is a crucial part of red blood cells and contains iron as its functional group. This gives the cell its red colour and helps oxygen to be temporarily bonded by red blood cells for transportation (Lee 2013).

Many different aspects of anaemia exist. The first is iron deficiency anaemia where there is a shortage in the carrying capacity and production of erythrocytes due to iron deficiency. The two main types are macrocytic and microcytic anaemia. Macrocytic anaemia occurs when the red blood cells are larger than normal (Knott 2011). This can cause problems like pernicious anaemia. It can diminish the carrying capacity erythrocytes in oxygen transport and can cause an increase in blood clots (The Free Dictionary 2013). Vitamin B_{12} and folate deficiencies can be seen with this anaemia (Nelms, et al. 2011). Microcytic anaemia is the opposite as this is where there is reduction in the amount and size of erythrocytes which causes depletion in blood and iron in the body. It is associated with iron and Vitamin C malabsorption (Nelms, et al. 2011).

Haemolytic anaemia is where the quantity of red blood cells is limited in the blood due to cellular damage. There are many types of haemolytic anaemia such as sickle cell anaemia where

there are less healthy red blood cells formed in irregular crescent shapes or thalassemia where oxygen carrying capabilities of red blood cells. It is an inherited microcytic disorder and can be treated by blood transfusions (Mayo Foundation for Medical Education and Research 2011; Nelms, et al. 2011). The abnormalities in the red blood cells can be classified by intrinsic or extrinsic factors preventing the red blood cells from carrying oxygen to tissues (University of Maryland Medical Center 2011). Red blood cells are therefore broken down faster than they can be produced from the bone marrow (The Free Dictionary 2013).

Diagnosis of iron deficiency anaemia can be done through blood tests for haemoglobin or hematocrit levels. This can include a complete blood, serum iron, ferritin and haemoglobin tests (American Society of Hematology 2011). "Blood haemoglobin concentration is the most reliable indicator of anaemia" (Benoist et al. 2008).

Focused treatment for this type of anaemia should be diet based, "efforts should be directed towards promoting the availability of, and access to, iron-rich foods. Examples include meat and organs from cattle, fowl, fish, and poultry; and non-animal foods such as legumes and green leafy vegetables" (World Health Organization 2001). Oral supplementation can also be suggested (American Society of Hematology 2011). With a lack of iron from food sources, the iron stores in the body can decrease (Mayo Foundation for Medical Education and Research 2011). "Tea and coffee inhibits iron absorption when consumed with a meal or shortly after a meal. Heme food sources, predominately red meats, contain highly absorbable iron and promote the absorption of iron from other less bioavailable food sources. Vitamin C (ascorbic acid) is also a powerful enhancer of iron absorption from non-meat foods when consumed with a meal" (World Health Organization/Centers for Disease Control and Prevention 2004).

Iron requirements depend on the ages of individuals. Infants need more iron than adults due to their fast growth. About 10mg/day of iron is needed between ages 4 to 8 years. After adolescence, ages 19 to 50 years, iron needs of women increase up to 18mg/day due to menstruation (Massachetts Institute of Technology 2007; Centers for Disease Control and Prevention 2011; Watson 2013). Those at risk for this type of anaemia include those who lack Vitamin C and iron in their diet, those with gastrointestinal blood loss, females, young adults and those with low socioeconomic statuses (National Institutes of Health 2011).

There are two forms of iron, namely heme and non-heme iron. Heme iron is found in haemoglobin. It comes from animal foods such as meat, fish, and chicken. Iron in plant foods is

called non-heme iron. This includes lentils and beans. Heme iron is better for the body than non-heme iron (National Institutes of Health 2007).

The deficiency of iron can cause loss of colour in skin, lack of energy, headaches, weak nails, hair loss, rapid heart-beat and a craving for ice (American Society of Hematology 2011). According to studies with iron deficiency anaemia, it can affect the cognitive state and cause behavioural changes. This can affect their mental development and academic success leading to poor results and socialization. Writing, reading and memory can be affected by this nutritional disorder (McGregor and Ani 2001). Decreased work capacity, lowered endurance, increased lead and risk of pregnancy complication was also found to relate to this deficiency (Alton 2005).

According to the Centers for Disease Control and Prevention (2011), it is recommended that screening should be done for all females at least one time every five years due to their increased risk (Pasricha, et al. 2010; Abrams 2013). Males can be screened if they have signs and symptoms associated with iron deficiency. Studies have shown that the level of awareness of this nutritional disorder is low while the prevalence is high worldwide (Kaur, Bassi and Sharma 2011).

Iron deficiency anaemia can be seen often during rapid growth periods. Low birth weight or premature babies as well as adolescents also show significance with iron deficiency anaemia. Anaemia can also be seen in endurance athletes (Pasricha, et al. 2010, 525). Vegetarian and vegan diets can increase the risk for being iron deficient due to the reduction of iron loaded foods (National Institutes of Health 2011; American Society of Hematology 2011; Mayo Foundation for Medical Education and Research 2011).

Less developed countries have a higher risk for this disorder due to lack of education as well as lack of iron containing foods (World Health Organisation 2013). Anaemia can be caused by many other health related problems including, “malaria, hookworm disease (whether ancylostomiasis or necatoriasis), schistosomiasis and other infections play an important role in tropical climates” (DeMaeyer, et al. 1989).

1.2 Purpose of Study:

The purpose of this study was to investigate the relationship between the awareness of having iron deficiency and the dietary impact among year one participants at the UWI St. Augustine campus as well as to assess their risk for the deficiency.

1.3 Rationale:

The prevalence of iron deficiency in Trinidad was estimated to be 24.3% in 2008. This was based on the population haemoglobin levels being less than 110mg/dl among women of reproductive age (Benoist, et al. 2008, 1-51). It was found that the prevalence decreased from 30% since 1968, but it is still very prevalent in Trinidad (Chopra and Byam 1968). "Iron deficiency anaemia is most prevalent and severe in young children and women of reproductive age, but is often found in adolescents and may be found in adult men" (World Health Organization/Centers for Disease Control and Prevention 2004). The concern for this deficiency is high because it affects about 2 billion individuals worldwide (World Health Organisation 2013).

This deficiency is hazardous to the health of post-adolescents. Depleted iron stores causes less oxygen to be delivered, used and stored by muscles. Haemoglobin levels are affected which leads to anaemia. "Thinking, cognitive functioning, processing skills, behavioural and neural development are affected by this deficiency. It can cause fatigue that impairs the ability of adults to do physical work" (Centers for Disease Control and Prevention 2011; Beard 2003).

Iron deficiency anaemia is important as iron affects, "metabolism, DNA synthesis, growth, healing, immune function, reproduction, enzyme reactions, haemoglobin, myoglobin and proteins in carrying oxygen to blood and muscles" (Massachetts Institute of Technology 2007).

This University was chosen as no research of this kind has been conducted at this location and because female post-adolescents (who are at high risk for this deficiency) make up most of the population. Iron deficiency anaemia can put strain on the post-adolescent students and prevent them from showing their true capabilities through their academic performance. The aim is to raise concern for the nutritional disorder and decrease the risk through awareness and dietary habit changes in this university in Trinidad.

1.4 Problem Statement:

Iron deficiency anaemia is a severe health issue that has a high risk for a large number of adolescents and post-adolescent population. It can affect their ability to function properly academically due to a lack of iron in the blood; the risk for this type of anaemia as well as the level of awareness among male and female students at the UWI St. Augustine is unknown. Females make up most of the population in this university and they are at higher risk than males since they lose blood during menstruation. With education and dietary changes, iron can be provided by the diet to decrease the risk for this type of anaemia in a high risk population.

1.5 Research question:

Is there a relationship between the level of awareness for iron deficiency anaemia and the dietary habits of the year one students in the UWI St. Augustine in increasing the risk for this type of anemia?

1.6 Significance of study:

Due to the high prevalence among the female post-adolescent population, assessing the risks for the students and finding associations with diet and awareness can raise concern for this nutritional disorder. There was no previous research found on this topic in the University of the West Indies, St Augustine Campus. This will be the only study assessing knowledge and risks for the development of iron deficiency anaemia through dietary habits of students.

1.7 Scope of the study:

This study was done in the year 2013, from September to December. The study group included the male and female year one participants of the UWI St. Augustine, Trinidad. The questionnaire must be completed by the sampled participants. Compared to other research, this study is unique as it assesses the awareness and dietary habits as well as the risks among the student participants.

1.8 Objectives:

To assess the level of awareness, dietary habits and risks for iron deficiency anaemia among the year one students at the University of the West Indies (UWI), St Augustine Campus stratified by gender, ethnicity and vegetarian status in the first semester of academic year 2013/2014.

1. To assess the levels of awareness of the nutritional disorder as well as the dietary habits among the first year students at the UWI St. Augustine Campus.
    a. Frequency analysis used to measure the level of awareness and dietary habits from the questionnaire for all participants.
    b. ANOVA analysis used to measure the level of awareness and dietary habits by the questionnaire based on gender.
    c. ANOVA analysis used to measure the level of awareness and dietary habits by the questionnaire based on ethnicity.
    d. ANOVA analysis used to measure the level of awareness and dietary habits by the questionnaire based on vegetarian status.
2. To find a relationship between the level of awareness of iron deficiency anaemia and dietary habits with the risk for the deficiency among the year one participants at the UWI St. Augustine Campus.
3. To suggest ways in which awareness of iron deficiency anaemia can be increased among year one university students in the UWI St. Augustine Campus.
    a. Provide recommendations for increasing awareness among the first year students and to provide dietary and lifestyle changes to reduce the risk of iron deficiency anaemia.

1.9 Hypothesis:

Null Hypothesis: There is no relationship between knowledge of this type of anaemia as well as dietary habits for the University students.

Alternate Hypothesis: There is a relationship between knowledge of this type of anaemia as well as dietary habits for the university students as the more aware, the better the iron content in meals and decreased risk for the deficiency.

- The awareness for the deficiency is poor overall in the year one participants in the UWI St. Augustine.
- The dietary habits was poor for the year one participants as they consumed less high iron foods, more foods that reduce iron absorption and less foods that help increase iron absorption.
- The knowledge of this deficiency of iron in the year one participants in the UWI St. Augustine is higher for the female than the male sample participants.
- The dietary habits for the male and female participants both lack sufficient iron loaded foods to provide for their daily needs in the University.
- The awareness of iron deficiency anaemia for the year one participants in the UWI St. Augustine is the same for all ethnicities.
- The dietary habits for all ethnicities lack sufficient iron loaded foods to provide for their daily needs in the University.
- The awareness of iron deficiency anaemia for the year one participants in the UWI St. Augustine is higher for vegetarians than the other status.
- The dietary habits for the vegetarian participants lack sufficient iron loaded foods to provide for their daily needs in the University compared to the others.
- The risk when compared to awareness showed that the participants were less aware, but more at risk for the deficiency.
- The participants more at risk consumed less high iron foods, more foods that reduce iron absorption and fewer foods that increase iron absorption.

CHAPTER 2: LITERATURE REVIEW

Iron Deficiency Anaemia Awareness and Dietary Relation

Iron deficiency anaemia occurs when iron levels in the blood are low which is represented by low haemoglobin and hematocrit blood levels (shown in Table 1). This leads to a decrease in red blood cells which in turn leads to oxygen depletion in the blood. Severe health defects can be caused by this lack of iron (Chen 2012). "Iron deficiency is a state in which there is insufficient iron to maintain the normal physiological function of tissues such as the blood, brain, and muscles." This type of anaemia can occur when haemoglobin concentrations fall below normal for a specific sex or age group. This type of anaemia can be detected by the blood, brain and tissue systems (World Health Organization/Centers for Disease Control and Prevention 2004).

This type of anaemia is a significant nutritional disorder as it is common among the female population. The diet holds great importance because it affects the blood iron levels. Consuming more iron rich foods such as liver, dates and prunes or even meat, such as beef and lamb, can help to reduce the probability of being at risk (BloodBook.com 2010). This disorder occurs when iron blood levels decrease significantly which causes a reduction in erythropoiesis, which is the ability of the body to produce red blood cells. This leads to anaemia (Harper 2012). This disorder reduces oxygen transportation to parts of the body and can cause irregular heartbeats and, in some cases, can lead to heart failure (National Institutes of Health 2011).

There are many different types of anaemia that exist, the most prevalent being iron deficiency. When there is low iron in the body, not enough red cells in the blood can be produced due to the lowered haemoglobin levels. This causes iron deficiency anaemia. This deficiency can occur due to a poor iron diet, which can be seen in infants, children, adolescents, vegans, and vegetarians. Menstruation, frequent blood donation, endurance training, certain drugs, foods, and caffeinated drinks can have a negative impact on the deficiency (Edmundson 2013). A relation was found "where hookworm infection is endemic (prevalence 20-30% or higher) and anaemia is very prevalent," this means that hookworm infection can cause anaemia (World Health Organization/Centers for Disease Control and Prevention 2004).

There are three stages to iron deficiency anaemia, the first being iron depletion. This is where iron stores are reduced due to lack of iron supplied by the diet. This cannot be detected by

haemoglobin or hematocrit screening. The second stage occurs where there is iron store depletion. This is where haemoglobin synthesis is affected. The final stage is iron deficiency anaemia caused by negative body iron. Iron stores are insufficient to maintain normal haemoglobin production. This is where blood values change and there are low haemoglobin and hematocrit levels. Iron loss can occur through the gastrointestinal tract, skin and urine. Dietary iron needs to be high enough to support growth and replenishment losses in the body. Supplementation is recommended to help provide for the depletion of iron in the body. Anaemia refers to the red blood mass and amount of haemoglobin in the blood (Carley 2003).

A low level of iron in the body can be caused by blood loss, rapid growth, poor diet, inability to absorb enough iron and can be affected mostly by age and gender. When an individual loses blood, there is iron loss. Without enough iron stored in the body, this type of anaemia can develop as the stores cannot make up for the iron lost. This blood loss can come from menstrual periods in women, internal bleeding, injuries, surgery and blood donations can. A poor diet is related to this deficiency since iron comes from the food consumed by individuals. High iron sources include meat, poultry, fish and fortified foods. There can also be a problem with absorption of iron, even if enough iron is consumed, there can be a decrease in uptake from foods as it passes through the intestinal tract (National Institutes of Health 2011).

The high risk individuals include infants, children, adolescents, vegetarians, chronic blood losses, infections, blood donators, pregnant women and endurance training athletes. Symptoms include rapid heart rate, fatigue, deep breathing, brittle nails, pale skin, soreness of tongue and headaches (National Institutes of Health 2011; Nutri-Facts 2012).

This type of anaemia can be tested by the use of blood tests as well as physical examination of nails, skin, heart rate, and gums. Complete blood count tests are more accurate in diagnosis for this type of anaemia (National Institutes of Health 2011). “Iron deficiency generally develops slowly and is not clinically apparent until anaemia is severe.” It affects mainly children and female adolescents of reproductive age. With effective control programs, there can be improved cognitive development and better iron sources to help with later pregnancies in women. Improved behaviours and fitness capacity can be observed (World Health Organization/Centers for Disease Control and Prevention 2004).

Table 1. Haemoglobin and Hematocrit levels for identification of anaemia (Alton 2005)

Characteristic	Haemoglobin (g/dL)	Hematocrit (%)	Iron Deficiency Anaemia
Age (years)			
Females			
12-14	11.8	35.7	Less than normal value
15 to17	12.0	35.9	Less than normal value
18 +	12.0	35.9	Less than normal value
Males			
12-14	12.5	37.3	Less than normal value
15 to17	13.3	39.7	Less than normal value
18 +	13.5	39.9	Less than normal value

Treatment for this type of anaemia includes dietary changes, iron supplementation, Vitamin C supplementation and treatment to stop bleedings depending on cause of bleed. Consuming high iron foods such as fortified cereals, lentils, soybeans, meat and green leafy vegetables can help reduce the risk for the deficiency. The body can better absorb iron from meat which has more heme iron available than non-meat items. Vitamin C helps iron absorption from vegetables and fruits which are non-heme iron sources (Sabah, Fatima and Ramzan 2010; National Institutes of Health 2011). "Iron supplements are essential for the rapid treatment of severe iron deficiency anaemia in all sex and age groups." Dietary improvement can be more possible due to dietary changes and economic status (World Health Organization/Centers for Disease Control and Prevention 2004). Treatment with iron supplementation or increasing dietary iron sources can result in improved mental health and less fatigue among women of child bearing age (Patterson, Brown and Roberts 2001).

A deficiency of iron can lead to tiredness, shortness of breath, less physical performance, learning problems and increases the chance of infections. The deficiency can occur with a poor bio-available diet (Martínez-Navarrete et al. 2002).

"Anaemia is a public health problem that affects populations in both rich and poor countries. Its primary cause is iron deficiency." It can reduce work capacity of individuals. Proper treatment can restore the health of individuals and raise productivity levels by 20%. Due

to the fact that this type of anaemia drains the life of individuals, it is important to help increase interventions to help reduce the prevalence for this anaemia. This can be done by educational programs and increasing iron rich foods (World Health Organisation 2013).

"2 billion people, over 30% of the world's participants, are anaemic, many due to iron deficiency, and in resource-poor areas, this is frequently exacerbated by infectious diseases" (World Health Organisation 2013). The prevalence of this type of anaemia was investigated by the use of a survey in Trinidad. About 30% of participants had haemoglobin levels below 12 grams per 100ml (Chopra and Byam 1968). A study conducted on three hundred and ten young female university students from Saudi found that "ages ranged between 18 and 23 years had a 25.9% deficient in iron stores and 23.9% iron deficiency anaemia prevalence among the population. There was a significant correlation between iron deficiency and iron deficiency anaemia with inadequate meat intake and impaired exercise capacity". This supports a high prevalence among the adolescent population. Diagnosis was made based on blood haemoglobin levels less than 12mg/dl (Al-Sayes et al. 2011). The growing population of infants, children and adolescents need more iron for their growing red cells and body tissues (DeMaeyer et al. 1989).

Benoist et al. (2008) estimated Trinidad prevalence at 24.3%. This was based on the population haemoglobin levels being less than 110mg/dl among women of reproductive age. Trinidad has two basic ethnicities. This includes Indians (35.4%) and Africans (34.2%) (Bethel 2013). It is interesting to note that in ancestral countries, the Indian population was 52% prevalent for this type of anaemia among women of reproductive age and 26.4% in South Africa (Benoist et al. 2008). Unfortunately, no data was found for the prevalence of this type of anaemia in Trinidad in the year 2013. According to World Health Ogranisation (WHO 2011), it was stated that if the prevalence of this anemia is between 20% to 39%, it is a moderate public health concern. Blood haemoglobin levels will be between 80 to 109 mg/dl. Interventions should be put in place to decrease this health concern. This is because at this stage of anemia, cognitive performance, behaviours, immune system, risks for infants, work capacity and academic performance can be altered negatively (World Health Organisation 2001).

Anaemia is highly prevalent in developing countries. "In developing countries every second pregnant woman and about 40% of preschool children are estimated to be anaemic" (World Health Organisation 2013). Due to the vulnerability of women and young children, strategies should be implemented to help prevent this type of anaemia from growing. "Strategies

should include addressing other causes of anaemia and should be built into the primary health care system and existing programs." It is best if tactics are adjusted to local conditions affecting the prevalence of iron deficiency among a population (Benoist et al. 2008).

Due to the higher prevalence among the female population, the hypothesis is that girls know more about anaemia than the male population. This was supported by an article that found that awareness of the deficiency was not equal throughout gender. It was also found that awareness levels decreased with education levels (Abalkhail and Shawky 2002).

This type of anaemia causes a health risk as it affects the mental abilities of the population. It can cause fatigue and reduce the quality of work by students. Childs et al. (1997) supported this finding since it was found that the prevalence of this anaemia was high among the student population and affected the cognitive development of children.

Iron deficiency anaemia is higher among the female adolescent population. Children and adolescents are at risk due to their high growth rate. Women are at more risk due to blood loss by menstruation. "Up to 15 years of age, there was no sex difference in the prevalence of anaemia and iron deficiency anaemia." Among older female adolescents, iron deficiency was most significant as these individuals were at child bearing age (Tatala, Svanberg and Mduma 1998).

Women of child bearing age are at an increased risk for the deficiency due to insufficient dietary sources of iron to replace menstrual losses. Harvey et al. (2003) and Liebman, et al. (2005) also supported that iron absorption is highest from heme sources such as meat and lowest from plant sources that provide non-heme iron. The type of diet consumed affects the absorption of iron, but the iron stores were not found to be significantly affected between those who consume a meat diet and those who consumed a vegetarian diet (Harvey et al. 2005).

This type of anaemia can lead to less working capabilities, strange neurotransmitter functioning and changed inflammatory responses. The risk increases due to iron loss, low iron intake, poor iron absorption and iron demands not being met. Ross (2008) also supported that females of child bearing capabilities are most at risk for the deficiency.

According to an article, anaemia, iron deficiency and iron deficiency anaemia has been on an increase since 1985 to 2000. There are many other contributing factors to the deficiency. "They include other nutrient deficiencies (e.g., folate, Vitamin A), other infectious diseases, sickle cell disease and other inherited anaemia's" (Stoltzfus 2001).

Adolescents are an age group that had are at greater risk for anaemia. Due to the high risk and prevalence in this age group, nutrition education should be implemented to increase the level of knowledge among the population. A study found that with a nutrition education package, students became more aware of the nutritional deficiency (Yusoff, Wan Daud and Ahmad 2013).

Females of menstruation statuses have a higher prevalence for anaemia than those who are not of menstruating status. This shows that women have a higher risk for the deficiency at ages over 11 to 13 years. This was supported by an article on anaemia among 800 individuals including male and female students. Anaemia was also seen to be more prevalent with governmental school students whose mothers were less educated (Abalkhail and Shawky 2002).

When comparing the deficiency to school performance, anaemia was found to have a negative impact as grades were lower for those who were anaemic. Implementation of health programs for students can help to improve knowledge and nutritional habits as well as increase awareness (Abalkhail and Shawky 2002).

Childs et al. (1997) supported Abalkhail and Shawky (2002) suggestion that education can help increase awareness and decrease the risk for the deficiency. Increasing the availability of information on can allow lifestyle changes to help reduce the risk for the deficiency. The more educated individuals were, the better the food choices. This deficiency can be decreased by consuming more meat, eggs, cereals, vegetables, legumes and fruits.

The problem is the lack of awareness for this type of anaemia among students. The hypothesis is that there is a lack of knowledge of iron deficiency among male and female adolescents. This was supported by a study conducted on 385 women aged 18 to 45 years as it was found that women who were not part of the working population had a fair understanding that the diet contains iron and is important for health. Health promotions helped to bring awareness to the target population. The aim was to increase financial resources to help the population and enhance their access to iron rich foods (Hussainab and Shua 2010).

This type of anaemia is not commonly discussed and has a low awareness among male and female individuals. The deficiency is related to the symptoms of tiredness, pale skin and fragile nails and students may not be aware due to a lack of knowledge about the deficiency. This was supported by articles on students (Abalkhail and Shawky 2002; National Institutes of Health 2011).

"Iron deficiency anaemia affects physical and cognitive development," which can lead to outcomes that cannot be reversed. Beinner and Lamouneir (2003) also found that there was a lack of concern for this type of anaemia that needed to be addressed. Anaemia was more prevalent in females and therefore more precautions should be taken to ensure their safety.

Challenges arise when women are unaware of how to prevent anaemia and when there is a lack of knowledge on this type of anaemia. Iron supplementation programs face these challenges as individuals may hold false information about the deficiency. Awareness of this anaemia as found to be of great importance to reducing the high risk among female individuals (Stoltzfus and Dreyfuss 2003).

Sabah, Fatima and Ramzan (2010) found that a low level of education and low economic status increased the risk factors and prevalence for anaemia. If the population does not have the resources to purchase high iron foods, the prevalence of the deficiency can be increased. Without a balanced diet, including protein foods, the risk for the deficiency can increase significantly. "Animal protein when compared to plant protein has strong association with the development of iron deficiency anaemia."

Dietary habits are very important as it can be the main cause of this type of anaemia. With a lack in iron containing foods, a low bioavailability of iron from diets and poor dietary practices with poor hygiene and sanitation, the problem for this anaemia can be raised. This was supported by an article in Pakistan. Iron deficiency anaemia was identified as a severe problem in Pakistan and it affected the health and survival of individuals. Iron deficiency leads to "22,000 maternal deaths (WHO)". Deficiencies were said to be larger with the female population who were at the age of having children in the Caribbean (Sabah, Fatima and Ramzan 2010).

Schultink and Gross (1996) found that consuming Vitamin C supplements, foods high in Vitamin C as well as green leafy vegetables can help increase iron in the body and decrease the risk for the deficiency. The best way to improve the iron status of populations is through dietary changes. Developing counties were said to not pay attention to the need for iron containing foods. The study recommended that fortifying products locally accepted by the population can help to reduce anaemia among the population. Xie, et al. (2003) found that Africans consumed more vegetables than other ethnicities.

Anaemia can be decreased when individuals increase their intake of high iron containing foods. Abalkhail and Shawky (2002) supported that consuming more fruits as vegetables that are

high in Vitamin C can help increase iron absorption from foods. Fruit consumption was found to be related to a decrease in anaemia.

Students, especially the female population, have been found to not be consuming enough iron containing foods to provide for their daily needs. The minimum daily requirement for adolescents was said to be between 12mg to 15mg per day and is increased during pregnancy. In a study conducted on fifty adolescent females in a university in India, the awareness of iron deficiency anaemia and the appropriate diet to reduce the risk was poor in the adolescent population. Over a half of the population sampled were prevalent with anaemia. The association of low iron intake for vegetarians linked to anaemia. Adolescents consumed many 'junk' foods and less nutritious foods which caused their anaemic status. Heme iron sources are significant enhancers of iron absorption and are present in meat, chicken and fish. Plant foods, non-heme sources, are less effective in providing iron to satisfy daily requirements. "Nutrition education is one of the appropriate, effective and sustainable approaches to combat iron deficiency anaemia" (Kaur, Bassi and Sharma 2011).

Iron inhibitors include tea, whole wheat products, cereals and coffee. Iron enhancers included poultry, meat and Vitamin C. Heme bioavailability was found to be high in meat, but it was not found to significantly increase iron absorption enough to reduce the risk for the deficiency. Vitamin C consumption was related to high iron absorption. Coffee consumption after a meal reduces iron absorption (Morck, Lynch and Cook 1983; Cook, Dassenko and Lynch 1991). This was also supported as it was found that cocoa, tea and polyphenol beverages can reduce iron absorption 71% and over which therefore increases the risk for the deficiency (Hurrell, Reddy and Cook 1999). Iron bioavailability can be reduced with a diet high in fibre. Increasing phytates in the diet can have a significant effect on iron status (Hallberg et al. 1987).

There is low bioavailability of iron in cereal based (not fortified) and legume diets. A diet with low iron bioavailability in foods increases the risk for iron deficiency. This type of diet can cause iron imbalance and less iron absorption from foods (Zimmermann, Chaouki and Hurrell 2005).

Consuming foods that inhibit iron absorption can increase the risk for this anaemia. This includes foods such as coffee and tea. This was supported by an article that found that "higher tea and lower citrus fruits, red meat and fish consumption by boys may provide an indication about the possible role of certain dietary patterns in the different manifestation of this medical

condition." The socio-economic status, based on education and income, affected the deficiency as it affected dietary habits (Keskin et al. 2005).

Mufloz et al. (1988) also supported that tea and coffee consumption significantly lowers iron absorption from food. It can lead to iron deficiency anemia and it was recommended by the Food and Drug Association that women should avoid coffee consumption, especially during pregnancy as it can be transferred to breast milk and affect iron absorption in infants. The lower the coffee consumption by individuals, the lower the risk for the deficiency.

Certain foods can help increase iron absorption as well as those that help decrease iron absorption. To reduce the risk for the deficiency, the aim is to consume more high iron foods as well as foods that help increase iron absorption and reduce the intake of those that help reduce iron absorption. Reddy, Hurrell and Cook (2006) found that, "the higher iron status associated with the consumption of an omnivorous diet is due more to the intake of heme iron than to the enhancing effect on non-heme iron absorption." Consuming more meat products can significantly reduce the risk for the deficiency (Reddy, Hurrell and Cook 2006; Sabah, Fatima and Ramzan 2010).

Vegetables, legumes and foods that contain non-heme iron are not as effective in satisfying iron needs as foods that contain heme iron such as meat. Tatala, Svanberg and Mduma (1998) supported that a vegetable base diet that contains a high amount of phytate and polyphenols inhibit iron absorption from foods.

Cereal (fortified) diets as well as legumes and vegetables have low bioavailability, but high iron. This means that the absorption of iron from these foods is low. "The iron availability, measured as iron solubility after in vitro digestion, was on average 1.7% in cereal preparations, 24.7% in legume sauces, and 10.0% in vegetables. In the mixed foods, cereals mixed with legumes or vegetables, the percentage of iron available for absorption ranged from 0.9% to 7.5%" (Tatala, Svanberg and Mduma 1998).

Xie, et al. (2003) found a relationship with ethnicity and consumption of meat and vegetables. Africans were found to have a higher intake of vegetables than other ethnicities. This was because of socioeconomic factors and educational status.

Vegetarians should be at greater risk for this type of anaemia because of the lack of high iron containing foods such as meat. In 2003, a study was done by Hunt on vegetarians since these individuals lacked meat, poultry and fish in their diet which were said to have higher

bioavailability of iron and zinc. Bioavailability of iron to the body was said to be dependent on the foods eaten in the diet. Hunt (2003) discovered that iron and zinc stores were less with vegetarian diets due to lack of meat intake. Vegetarian diets have greater exclusion of iron than non-vegetarian diets. This increased the risk for anaemia, but screening was said to be needed for further evaluation. It was also concluded that phytate containing legumes and whole grains decrease iron and zinc absorption, especially in vegetarian diets.

With a vegetarian diet, iron stores may be reduced due to the restrictions of the diet, but Western vegetarians consume a variety of foods and therefore have better iron statuses than those in developing countries. Limiting fortified cereals can decrease iron absorption. When phytates and other constituents found in vegetarian diets inhibit non-heme iron absorption, Vitamin C and organic acids can counter act the inhibition and increase iron absorption from vegetarian diets (Craig 1994).

Iron stores are difficult to be met by vegetarians. With a lack of heme iron from meat products, the restricted diet can increase the risk for the deficiency. Lönnerdal (2009) supported that legumes, vegetables and soybean consumption can increase iron absorption and help provide iron in a vegetarian diet. Soybean is a plant product that is ferritin bound and helps prevent this type of anaemia. However, Shaw et al. (1995) found that without animal products, soybean and vegetarian lifestyles cannot provide sufficient iron balance in both males and females.

Vegan and vegetarian dietary practices puts individuals at greater risk for iron deficiency and also affects the mental development of students. With dietary changes and increase in foods that help increase iron absorption, the increased risk can be decreased for iron deficiency (Sanders 1995).

"Menstrual iron loss and dietary practices were significant predictors of iron status." Harvey et al. (2005) supported that chicken and fish consumption was associated with higher iron stores than with lacto vegetarain diets. Serum ferritin concentration was lower for those who consumed red meat, than for those who consumed fish and chicken, but not statistically significant. It was also supported that preventing iron deficiency was linked to identification of high menstrual losses in women as well as dietary practices (Harvey et al. 2005).

Diets without heme iron are more at risk for the deficiency. This is because heme iron is better absorbed by the body. A study found that women absorbed three times more non-heme iron from a non-vegetarian diet than a lacto-vegetarian diet (Hunt 2003). Lacto-vegetarian was

another word for vegetarians who does not consume meat, poultry, fish or any animal product, but consumes dairy products (Hackett 2013).

Vegetarians cannot consume meat items, which should increase the risk for iron deficiency anemia. However, George et al. (2000) found that vegetarian status did not affect prevalence of the deficiency as both non-vegetarians and vegetarians were at risk.

With consumption of high iron bioavailability foods, the risk for this type of anaemia can decrease. "With higher iron content, rich in phytase and cysteine-peptide, there is a great potential to substantially improve iron nutrition in populations where iron deficiency is so widely spread." Iron supplements can help in decreasing the risk for the deficiency and improve iron status in individuals especially for female adolescents (Ballin et al. 1992; Lucca, Hurrell and Potrykus 2013). Iron supplementation can help the learning process and increase school achievement in the younger growing population (Soemantri, Pollitt and Kim 1985).

With higher absorption from high iron foods, the risk for the deficiency can decrease. "A relatively low absorption with mean values ranging from 1.7-7.9 was found for wheat, corn, black beans, lettuce and spinach; higher mean values ranging from 15.6-20.3 were observed with soybeans, fish, veal and haemoglobin." There was a higher absorption of iron from fish, legumes, soybeans and veal. Lettuce, spinach, corn and wheat were associated with lower absorption of iron (Layrisse et al. 1969). More dietary fibre and cereals were found to inhibit iron absorption. Meat items were found to increase iron absorption (Sullivan 1981).

High ascorbic acid (Vitamin C) and animal products can help increase the absorption of non-heme iron from foods such as vegetables, fruits and grains. This can help increase iron stores in the body. With a high fibre diet, the absorption of nutrients can be decreased significantly (Kelsay, Behall and Prather 1979).

Low intake of foods that have high bioavailability of iron, such as meat, and consuming foods rich in inhibitors such as phytate and fibres can cause iron deficiency. Behavioural changes and performance impairment are related to this type of anaemia (Sandstead 2000).

Gossard and York (2003) found that meat consumption was based on social influence. Those of higher education were found to consume less beef and total meat. Beef consumption was seen to increase with income. It was also found that American women consumed more beef than men. Ethnicity was related to beef consumption. Women in general consumed less meat, especially beef, than men. Liebman, et al. (2003) and Prättälä et al. (2006) also supported that

men consumed more meat than women. Women were seen to consume more fruits and vegetables.

Consuming high iron from meat sources significantly increases iron in the body and reduces the risk for the deficiency. It was supported that meat consumption was related to haemoglobin and iron stores more than hookworm. Iron supplementation was recommended for anaemic patients (Pasricha et al. 2008).

By increasing iron in the diet, it can help benefit the student population in work abilities as well as reduce symptoms such as fatigue and headaches associated with the deficiency. "Adolescent girls whose diet was supplemented with iron felt less fatigued." This means that they were able to concentrate better in school and their mood was also improved (World Health Organization 2001).

Food preparation and processed items can reduce bioavailability of iron. "Thermal or enzymatic action can reduce the phytic acid and the hexa- and penta-inositol phosphate content." All inositol phosphates prevent iron absorption. When food is processed, the number of phosphate groups that improve bioavailability of non-heme iron is reduced (World Health Organization 2001).

Heme iron and Vitamin C helps enhance iron absorption from food. Iron inhibitors include phytates present in legumes, nuts, tea, cereal and whole wheat products. Recommendations of consuming tea 2 to 3 hours after mealtime can help decrease iron absorption inhibition (World Health Organization 2001).

Enhancing awareness by educational means was suggested to help reduce the occurrence of iron deficiency anaemia. Stressing the importance of education to awareness of iron deficiency anaemia shows that with knowledge, the risks of iron deficiency anaemia can be reduced among a population. In one article, it was established that because this type of anaemia was a nutritional disorder; the diet was related to the risk of iron deficiency anaemia. If there was consumption of less iron containing products, the risk increased. This was seen in the study of Saudi school children and relation to breakfast intake by Abalkhail and Shawky (2002). If nutritional habits were improved by educational practices, studies showed that it led to a decrease in the prevalence of the disorder. This shows that the diet plays a very important role when considering the risks of iron deficiency anaemia. The review supported that there is a greater risk with vegetarian diets as they consume less iron containing foods. The studies found

all focused on the dietary impact and educational impact on different populations. Studies concerning the prevalence of iron deficiency anaemia showed that increasing educational programs to increase iron intake in the body. All studies found that education and the diet plays a key role with this type of anaemia. Consuming more meat, containing heme iron, can be beneficial to reducing the risk for the deficiency than consuming non-heme products such as vegetables (Reddy, Hurrell and Cook 2006).

1.1 Theoretical Framework

The effects of awareness and dietary habits on iron deficiency anemia were explored. The prevalence of iron deficiency in Trinidad was estimated to be 24.3% (Benoist et al. 2008). The prevalence decreased as it was estimated to be 30% in 1968 (Chopra and Byam 1968). Unfortunately, no data was found for the prevalence of this type of anaemia in Trinidad in the year 2013. About 30% of the global population is affected by this anaemia (World Health Organisation 2013). Skipping breakfast was also related to an increased risk for the deficiency (Abalkhail and Shawky 2002). There were no studies concerning awareness of this deficiency. Also, there were no articles found on the risks for students at the UWI St. Augustine. Studies related an increase in education to a reduction in the risk for the deficiency (Sabah, Fatima and Ramzan 2010). Increasing the availability of iron rich sources was the main concern in other articles (Hussainab and Shua 2010). Childs et al. (1997) supported that females were mostly affected by this deficiency. There was a high risk and prevalence among the older adolescent age group, but with education, the risks for the deficiency can be reduced (Yusoff, Wan Daud and Ahmad 2013). With a diet high in heme iron, the risk for the deficiency can decrease significantly (Cook, Dassenko and Lynch 1991; Reddy, Hurrell and Cook 2006). Eating irregularly was found to increase the risk for anaemia. Females over the age of 12 were at most risk for this deficiency which had an impact on school performance (Abalkhail and Shawky 2002). Consuming iron inhibiting foods can also reduce iron absorption such as whole grains, tea and coffee (Hallberg et al. 1987; Cook, Dassenko and Lynch 1991; Hunt 2003). Vegetarians were found to be at risk due to their lack of iron containing foods when compared to non-vegetarian diets (Hunt 2003). This can be overcome by a diet high in iron foods and foods that help increase iron absorption (Kelsay, Behall and Prather 1979; Schultink and Gross 1996). Africans were found to consume more vegetables than other ethnicities (Xie et al. 2003). Consuming foods high in phytates can decrease iron absorption (Craig 1994). Low income families were at greatest risk due to lack of iron in their diets (Sabah, Fatima and Ramzan 2010). Research shows that with an increase in consumption of iron containing foods by means of education to increase knowledge, the risks for this anaemia can be reduced significantly and help students to function successfully.

CHAPTER 3: METHODOLOGY

1.1 Materials:

- Year one participants
- Questionnaires
- Nutritiondata.com
- SPSS program

1.2 Independent variables:

- Awareness

1.3 Dependant variables:

- Dietary habits

1.4 Sample participants:

One hundred and seventy year one (undergraduate) students at the UWI St. Augustine were recruited for this research. This included male and female students consisting of eighty five males and eighty five females. This sample size was chosen based on the number of questionnaires given out and recovered in a two to three week period to allocate sufficient time for analysing information. Subjects were instructed to complete a questionnaire which included a three day diet record. The control was by year group as any male and female year one student in the university were suitable for this experiment. Trends and findings help to bring about awareness and address the risks among the young adult participants where awareness and risks by dietary habits were unknown. Gender, ethnicity and vegetarian status were recorded.

1.5 Quota Sampling:

Quota sampling method was used to group the sample participants. This included grouping the year one sample participants based on their gender, either male or female. This technique was used to help simplify the participants' size by separating them into two even subgroups. The distribution between the male and female participants ensured that results could be compared accurately under the condition that the sample size was equal.

1.6 Procedure:

There was a pre-testing group, involving any five students in year one, who assisted in making changes to better the questionnaire. After the pre-testing stage, students around campus were asked randomly to complete the questionnaire. Students were chosen based on their year in the University and were found by means of the grounds of the University, by social media, networking or email. Any year one student of the UWI St. Augustine could have been used in this research.

1.7 Design:

This study was approved by the Faculty of Food and Agricultural Science Department of the University. It investigated how aware students were about the nutritional disorder iron deficiency anaemia as well as assessing risks for the deficiency. The awareness, confidence and dietary patterns were assessed to observe the difference in knowledge for all the students and consumption of certain foods.

The questionnaire entailed thirty three questions. The first one to three questions were on demographic including gender, ethnicity and vegetarian status. Questions four to sixteen assessed awareness of the deficiency and dietary awareness. Questions seventeen to twenty eight assessed confidence in knowing about areas of the deficiency. Frequency of consumption of high iron foods was then assessed on question twenty nine and iron supplementation in question thirty. Frequency of consumption of foods that reduce and increase iron absorption was then assessed in question thirty one. The diet record was assessed in question thirty two and the final question assessed the thoughts of the students towards their daily iron intake.

1.8 Data Collection:

Each student in this study was interviewed in a questionnaire that was either taken home and completed or done on the spot. Awareness of iron deficiency anaemia was targeted through a list of questions, including background information about the individual (such as family related anaemia) as well as assessing the level of confidence the students felt toward the topic. Questions diets were asked to assess the frequency of consumption of high iron foods, iron supplementation, foods that decrease iron absorption and foods that increase iron absorption. The last section entailed a three day record. This was used to assess the dietary risk for the deficiency. The thoughts students had about the iron levels in their daily meals were then assessed.

1.9 Conditions

Only year one students in the UWI were recruited. This is because the research focused on the comparison between the male and female participants. Information gathered from individuals was kept confidential and discarded after the project was complete. Those who agreed to participate were asked to fill out a questionnaire only entailing a diet record. Students can be between nineteen to fifty years of age in year one.

2.0 Three day record:

This entailed detailed recording what was consumed within two days during the week and one weekend day. This gave a basic idea of what students normally consume on a regular basis. Iron content in each item listed was calculated using nutritiondata.com to find the total iron intake for each day. An average was then taken for a better conclusion of the daily iron intake for each student. This information helped assess the risk for the deficiency as each iron intake was compared to the recommended daily intake for males and females. This was 18mg of iron daily between ages nineteen to fifty years for females and 8mg of iron daily for males (Watson 2013).

2.1 Analysis of information:

Questionnaires were recovered from one hundred and seventy students from the year one undergraduate individuals in the UWI St. Augustine. The diet records were analysed using a database called nutritiondata.com. This gave the iron content in foods consumed daily. Each questionnaire was computed into SPSS. Statistical significance in data was then found and conclusions were drawn toward hypothesis testing.

Cross tables, ANOVA and frequency tables were used to analyse the information. SPSS program is a reliable source for analysing statistical information. Frequency (%) analysis was done for all the questions to assess the overall participants. This was done by the use of frequency tables. This was a dialogue box that calculates percentages. ANOVA was used to find significance between awareness and dietary habits with gender, ethnicity and vegetarian status. The dietary risk of participants for the deficiency was also assessed with ANOVA analysis with awareness and frequency tables. This analysis was chosen to test the differences between two means and to observe significances among the comparisons.

Microsoft Office Excel 2007 was used to represent the siginifance found in ANOVA analysis as bar graphs.

CHAPTER 4: RESULTS

Demographics:

1) Gender

This study included eighty five males and eighty five females totaling one hundred and seventy students. This allowed for an even distribution through gender allowing an equal comparison between genders. 49% of the non-vegetarians were male, 51% were female. 60% of the vegetarian sample participants were male, 40% were female. 67% of the lacto-vegetarian were males, 33% were female. There was one male pescatarian.

2) Ethnicity

There were one hundred and six individuals of East Indian descent which represents 62% of the sample participants, twenty two individuals were of African descent which represented 13% of the sample participants and forty two individuals were of mixed descent representing 25% of the sample participants in this study. No individuals of Chinese or Caucasian descents were recorded. When compared to gender, 53% of the East Indian were male, 47% were female. 45% of the African sample was male and 55% were female. 45% of the mixed decent sample were male, 55% were female.

3) Vegetarian status

Results found that of one hundred and seventy sampled individuals, one hundred and sixty one were non-vegetarians, representing 94.7% of the sample participants, five individuals were vegetarian representing 2.9% of the sample participants, three individuals were lacto-vegetarian representing 1.8% of the sample participants and one individual was a pescatarian representing 0.6% of the sample participants. No vegan individuals were recorded. 14% of the non-vegetarians were African, 61% were East Indian and 25% were of mixed decent. None of the vegetarian sampled were African, 60% were East Indian and 40% were of mixed decent. All lacto-vegetarian and pescatarian were of East Indian decent.

Table 2. Frequency (%) of awareness of the term, function, worldwide relation, having the deficiency, family relation and symptoms of iron deficiency

Questions			Options	Frequency	Percent	Standard deviation	Valid	Missing
4	Heard of the term for the deficiency		Yes	140	82.4	.38235	170	0
			No	30	17.6			
			Total	170	100.0			
5	Iron helps store and use oxygen		Yes	113	66.5	.86748	170	0
			No	14	8.2			
			I don't know	43	25.3			
			Total	170	100.0			
6	Heard of the deficiency as being worldwide		Yes	54	31.8	.46694	170	0
			No	116	68.2			
			Total	170	100.0			
7	Have the deficiency		Yes	14	8.2	.59887	170	0
			No	98	57.6			
			I don't know	58	34.1			
			Total	170	100.0			
8	Family members have the deficiency		Yes	27	15.9	.71387	170	0
			No	73	42.9			
			I don't know	70	41.2			
			Total	170	100.0			
9	Symptoms	Tiredness	Yes	128	75.3	.43258	170	0
			No	42	24.7			
			Total	170	100.0			
		Light skin	Yes	51	30.0	.45961	170	0
			No	119	70.0			
			Total	170	100.0			
		Weakness	Yes	118	69.4	.46214	170	0
			No	52	30.6			
			Total	170	100.0			
		Loss of Breath	Yes	76	44.7	.49866	170	0
			No	94	55.3			
			Total	170	100.0			
		Headache	Yes	69	40.6	.49251	170	0
			No	101	59.4			
			Total	170	100.0			
		Light Headedness	Yes	82	48.2	.50116	170	0
			No	88	51.8			
			Total	170	100.0			

Most subjects heard of the nutritional disorder, knew iron and oxygen relationship, but they were unaware of it being a worldwide problem, did not have the deficiency and whose family members did not have the deficiency. Tiredness was said to be related to the deficiency while light skin, weakness, loss of breath, headache and light headedness was not.

Table 3. Frequency (%) of awareness of symptoms and that the diet affects the deficiency

Questions			Options	Frequency	Percent	Standard deviation	Valid	Missing
9	Symptom	Chilly hands and feet	Yes	24	14.1	.47349	170	0
			No	146	85.9			
			Total	170	100.0			
		Belly pain	Yes	24	14.1	.34923	170	0
			No	146	85.9			
			Total	170	100.0			
		Irritability	Yes	41	24.1	.42906	170	0
			No	129	75.9			
			Total	170	100.0			
		Soreness of tongue	Yes	29	17.1	.37726	170	0
			No	141	82.9			
			Total	170	100.0			
		Weak nails	Yes	42	24.7	.43258	170	0
			No	128	75.3			
			Total	170	100.0			
		Fast Heartbeat	Yes	48	28.2	.45147	170	0
			No	122	71.8			
			Total	170	100.0			
		Deprived Appetite	Yes	40	23.5	.42544	170	0
			No	130	76.5			
			Total	170	100.0			
		Strange Craving	Yes	40	23.5	.42544	170	0
			No	130	76.5			
			Total	170	100.0			
		All of the above	Yes	20	11.8	.32314	170	0
			No	150	88.2			
			Total	170	100.0			
		None of the above	Yes	3	1.8	.13205	170	0
			No	167	98.2			
			Total	170	100.0			
		I don’t know	Yes	29	17.1	.37726	170	0
			No	141	82.9			
			Total	170	100.0			
10	The diet can affect anaemia		Yes	163	95.9	.19929	170	0
			No	7	4.1			
			Total	170	100.0			

Results showed that chilly hands and feet, belly pain, irritability, soreness of tongue, weak nails, fast heartbeat, deprived appetite and strange cravings were not said to be symptoms of iron deficiency. Overall, symptoms listed were not said to be related to iron deficiency. Only 17 % of the sample participants did not know of the symptoms. The sample participants knew that diet could affect the deficiency.

Table 4. Frequency (%) of awareness of diet risk, iron in food, high iron foods, what reduces uptake, vegetarian risk, testing and confidence in the meaning, effect and risk of the deficiency

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
11	Well balanced diet reduce the risk	Yes	150	88.2	.49883	170	0
		No	11	6.5			
		I don't know	9	5.3			
		Total	170	100.0			
12	Know that there is iron in food	Yes	165	97.1	.16946	170	0
		No	5	2.9			
		Total	170	100.0			
13	Aware of high iron containing foods	Yes	140	82.4	.38235	170	0
		No	30	17.6			
		Total	170	100.0			
14	Aware of foods that reduce iron absorption	Yes	60	35.3	.47930	170	0
		No	110	64.7			
		Total	170	100.0			
15	Vegetarians are at greater risk	Yes	74	43.5	.49726	170	0
		No	96	56.5			
		Total	170	100.0			
16	Aware of how the deficiency is tested	Yes	34	20.0	.40118	170	0
		No	136	80.0			
		Total	170	100.0			
17	Meaning of the term	Very high	27	15.9	1.12936	170	0
		High	46	27.1			
		Neutral	53	31.2			
		Low	34	20.0			
		Very low	10	5.9			
		Total	170	100.0			
18	Effects on the body	Very high	17	10.0	1.05247	170	0
		High	53	31.2			
		Neutral	57	33.5			
		Low	33	19.4			
		Very low	10	5.9			
		Total	170	100.0			
19	What increases risk	Very high	13	7.6	1.07403	170	0
		High	44	25.9			
		Neutral	53	31.2			
		Low	47	27.6			
		Very low	13	7.6			
		Total	170	100.0			

Subjects knew a balanced diet can reduce the risk, that food has iron and aware of such foods, but were unaware of foods that reduce iron uptake; vegetarian risk or the test for the deficiency. Most felt neutral towards the meaning, effect on the body and the risk of the deficiency.

Table 5. Frequency (%) of awareness of treatment, foods to reduce risk, function of iron, consequences, haemoglobin relation and women risk for iron deficiency

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
20	What to do when iron levels are low	Very high	24	14.1	1.10104	170	0
		High	53	31.2			
		Neutral	50	29.4			
		Low	34	20.0			
		Very low	9	5.3			
		Total	170	100.0			
21	What foods can help reduce your risk	Very high	22	12.9	1.16055	170	0
		High	61	35.9			
		Neutral	37	21.8			
		Low	37	21.8			
		Very low	13	7.6			
		Total	170	100.0			
22	Functions of iron in the body	Very high	37	21.8	1.12132	170	0
		High	51	30.0			
		Neutral	48	28.2			
		Low	27	15.9			
		Very low	7	4.1			
		Total	170	100.0			
23	Consequences of anaemia	Very high	23	13.5	1.15413	170	0
		High	56	32.9			
		Neutral	43	25.3			
		Low	35	20.6			
		Very low	13	7.6			
		Total	170	100.0			
24	Haemoglobin and iron relationship	Very high	48	28.2	1.25081	170	0
		High	44	25.9			
		Neutral	39	22.9			
		Low	27	15.9			
		Very low	12	7.1			
		Total	170	100.0			
25	Risk is greater for women	Very high	37	21.8	1.30910	170	0
		High	42	24.7			
		Neutral	35	20.6			
		Low	38	22.4			
		Very low	18	10.6			
		Total	170	100.0			

The participants of the study felt high confidence in knowing what to do when iron levels are low, what foods can reduce the risk, the functions of iron in the body, consequences of anaemia and that women are at greater risk for the development of iron deficiency anaemia. There was a higher ranking toward knowledge of the relationship between haemoglobin and iron.

Table 6. Frequency (%) of confidence in knowing children risk, social risk, heart risk of the deficiency as well as beef and chicken consumption

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
26	Children are at greater risk due to poor diet	Very high	24	14.1	1.07018	170	0
		High	52	30.6			
		Neutral	60	35.3			
		Low	24	14.1			
		Very low	10	5.9			
		Total	170	100.0			
27	Low socio-economic status and risk of deficiency	Very high	11	6.5	1.18819	170	0
		High	19	11.2			
		Neutral	43	25.3			
		Low	50	29.4			
		Very low	47	27.6			
		Total	170	100.0			
28	Anaemia can lead to heart problems	Very high	30	17.6	1.20679	170	0
		High	48	28.2			
		Neutral	39	22.9			
		Low	41	24.1			
		Very low	12	7.1			
		Total	170	100.0			
29	Beef	Twice per day	0	0.0	1.85622	169	1
		Every day	2	1.2			
		Twice per week	15	8.8			
		Once per week	29	17.1			
		Twice per month	24	14.1			
		Once per month	25	14.7			
		Once per Year	8	4.7			
		Never	66	38.8			
		Total	169	99.4			
	Chicken	Twice per day	12	7.1	1.37148	169	1
		Every day	65	38.2			
		Twice per week	75	44.1			
		Once per week	8	4.7			
		Twice per month	1	.6			
		Once per month	0	0.0			
		Once per Year	0	0.0			
		Never	8	4.7			
		Total	169	99.4			

Most subjects felt neutral towards knowing children were at risk for the deficiency, low confidence knowing that low socio-economic status can affect the risk for the deficiency and high confidence in knowing that anaemia can lead to hear problems. All participants of the study declared that they never consumed beef, while chicken was mostly consumed twice per week.

Table 7. Frequency (%) of consumption of liver, turkey, fish and fortified cereal (high iron food)

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
29	Liver	Twice per day	0	0.0	1.64928	169	1
		Every day	1	0.6			
		Twice per week	10	5.9			
		Once per week	11	6.5			
		Twice per month	20	11.8			
		Once per month	29	17.1			
		Once per Year	12	7.1			
		Never	86	50.6			
		Total	169	99.4			
	Turkey	Twice per day	1	0.6	1.38444	169	1
		Every day	0	0.0			
		Twice per week	7	4.1			
		Once per week	16	9.4			
		Twice per month	16	9.4			
		Once per month	41	24.1			
		Once per Year	63	37.1			
		Never	25	14.7			
		Total	169	99.4			
	Fish	Twice per day	0	0.0	1.46681	169	1
		Every day	3	1.8			
		Twice per week	34	20.0			
		Once per week	39	22.9			
		Twice per month	46	27.1			
		Once per month	30	17.6			
		Once per Year	3	1.8			
		Never	14	8.2			
		Total	169	99.4			
	Fortified cereal	Twice per day	1	0.6	1.97010	169	1
		Every day	32	18.8			
		Twice per week	45	26.5			
		Once per week	31	18.2			
		Twice per month	13	7.6			
		Once per month	19	11.2			
		Once per Year	8	4.7			
		Never	20	11.8			
		Total	169	99.4			

Results showed that a large number of students never consumed liver, but consumed turkey once per year, fish twice per month and fortified cereal twice per week.

Table 8. Frequency (%) of consumption of lentils, soybean, broccoli and spinach (high iron food)

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
	Lentils	Twice per day	0	0.0	1.43814	169	1
		Every day	6	3.5			
		Twice per week	39	22.9			
		Once per week	59	34.7			
		Twice per month	31	18.2			
		Once per month	21	12.4			
		Once per Year	1	.6			
		Never	12	7.1			
		Total	169	99.4			
	Soybeans	Twice per day	0	0.0	1.81704	169	1
		Every day	5	2.9			
		Twice per week	11	6.5			
		Once per week	20	11.8			
		Twice per month	22	12.9			
		Once per month	33	19.4			
		Once per Year	11	6.5			
		Never	67	39.4			
		Total	169	99.4			
	Broccoli	Twice per day	1	0.6	1.67971	169	1
		Every day	2	1.2			
		Twice per week	32	18.8			
		Once per week	39	22.9			
		Twice per month	39	22.9			
		Once per month	22	12.9			
		Once per Year	11	6.5			
		Never	23	13.5			
		Total	169	99.4			
	Spinach	Twice per day	1	0.6	1.62934	169	1
		Every day	2	1.2			
		Twice per week	23	13.5			
		Once per week	44	25.9			
		Twice per month	42	24.7			
		Once per month	27	15.9			
		Once per Year	4	2.4			
		Never	26	15.3			
		Total	169	99.4			

Results showed that a large number of students consumed lentils once per week, never consumed soybeans, consumed broccoli once or twice per week and consumed spinach once per week. These are all high iron containing foods.

Table 9. Frequency (%) of consumption of clams, oysters, pumpkin seeds and raisin (high iron foods)

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
29	Clams	Twice per day	0	0.0	.91845	169	1
		Every day	0	0.0			
		Twice per week	1	0.6			
		Once per week	2	1.2			
		Twice per month	6	3.5			
		Once per month	10	5.9			
		Once per Year	24	14.1			
		Never	126	74.1			
		Total	169	99.4			
	Oysters	Twice per day	1	0.6	1.28188	169	1
		Every day	1	0.6			
		Twice per week	3	1.8			
		Once per week	2	1.2			
		Twice per month	7	4.1			
		Once per month	23	13.5			
		Once per Year	23	13.5			
		Never	109	64.1			
		Total	169	99.4			
	Pumpkin seeds	Twice per day	0	0.0	1.45218	169	1
		Every day	2	1.2			
		Twice per week	6	3.5			
		Once per week	6	3.5			
		Twice per month	7	4.1			
		Once per month	25	14.7			
		Once per Year	21	12.4			
		Never	102	60.0			
		Total	169	99.4			
	Raisins	Twice per day	0	0.0	1.73248	169	1
		Every day	7	4.1			
		Twice per week	15	8.8			
		Once per week	30	17.6			
		Twice per month	32	18.8			
		Once per month	37	21.8			
		Once per Year	15	8.8			
		Never	33	19.4			
		Total	169	99.4			

Results showed that clams, oysters, pumpkin seeds, which are high iron foods, were never consumed by most of the sample participants. Raisons were said to be consumed once per month.

Table 10. Frequency (%) of taking iron supplement and consumption of coffee, tea, diary and cocoa products (reduce iron absorption)

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
30	Take iron supplement	Yes	34	20.0	.40118	170	0
		No	136	80.0			
		Total	170	100.0			
31	Coffee consumption	Twice per day	9	5.3	2.37864	169	1
		Every day	28	16.5			
		Twice per week	29	17.1			
		Once per week	21	12.4			
		Twice per month	16	9.4			
		Once per month	14	8.2			
		Once per Year	11	6.5			
		Never	41	24.1			
		Total	9	5.3			
	Tea consumption	Twice per day	9	5.3	1.88841	169	1
		Every day	52	30.6			
		Twice per week	31	18.2			
		Once per week	29	17.1			
		Twice per month	14	8.2			
		Once per month	20	11.8			
		Once per Year	3	1.8			
		Never	11	6.5			
		Total	169	99.4			
	Dairy consumption	Twice per day	12	7.1	1.31181	169	1
		Every day	88	51.8			
		Twice per week	41	24.1			
		Once per week	15	8.8			
		Twice per month	5	2.9			
		Once per month	4	2.4			
		Once per Year	0	0.0			
		Never	4	2.4			
		Total	169	99.4			
	Cocoa products	Twice per day	1	0.6	1.76207	169	1
		Every day	29	17.1			
		Twice per week	46	27.1			
		Once per week	45	26.5			
		Twice per month	16	9.4			
		Once per month	13	7.6			
		Once per Year	3	1.8			
		Never	16	9.4			
		Total	169	99.4			

Most of the sample participants did not take supplements. Most subjects in this study stated that they never consumed coffee; tea and dairy products were ingested every day, while the frequency for the consumption of cocoa products was twice per week. These foods reduce iron absorption.

Table 11. Frequency (%) of consumption of whole grain, soft drink (decrease iron absorption) and legumes, green vegetables (help iron absorption)

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
31	Whole grain consumption	Twice per day	1	0.6	1.70665	169	1
		Every day	55	32.4			
		Twice per week	40	23.5			
		Once per week	39	22.9			
		Twice per month	13	7.6			
		Once per month	7	4.1			
		Once per Year	2	1.2			
		Never	12	7.1			
		Total	169	99.4			
	Soft drink consumption	Twice per day	7	4.1	2.02240	169	1
		Every day	41	24.1			
		Twice per week	48	28.2			
		Once per week	22	12.9			
		Twice per month	17	10.0			
		Once per month	11	6.5			
		Once per Year	2	1.2			
		Never	21	12.4			
		Total	169	99.4			
	Legumes consumption	Twice per day	4	2.4	1.34196	169	1
		Every day	45	26.5			
		Twice per week	66	38.8			
		Once per week	31	18.2			
		Twice per month	13	7.6			
		Once per month	5	2.9			
		Once per Year	0	0.0			
		Never	5	2.9			
		Total	169	99.4			
	Green leady vegetables	Twice per day	3	1.8	1.11932	169	1
		Every day	45	26.5			
		Twice per week	79	46.5			
		Once per week	27	15.9			
		Twice per month	11	6.5			
		Once per month	1	0.6			
		Once per Year	0	0.0			
		Never	3	1.8			
		Total	169	99.4			

Most of the participants consumed whole grains every day and soft drink twice per week. Legumes and green leafy vegetables, which help iron absorption, were consumed twice per week. Of the entire sample for this question, one was left unanswered.

Table 12. Frequency (%) of fruit and vitamin C consumption (helps iron absorption), risk assessment and subjects thoughts about their diet

Questions		Options	Frequency	Percent	Standard deviation	Valid	Missing.
31	Fruit	Twice per day	8	4.7	1.20795	169	1
		Every day	70	41.2			
		Twice per week	48	28.2			
		Once per week	33	19.4			
		Twice per month	5	2.9			
		Once per month	2	1.2			
		Once per Year	0	0.0			
		Never	3	1.8			
		Total	169	99.4			
	Vitamin C supplement	Twice per day	8	4.7	1.99119	169	1
		Every day	82	48.2			
		Twice per week	20	11.8			
		Once per week	24	14.1			
		Twice per month	7	4.1			
		Once per month	9	5.3			
		Once per Year	4	2.4			
		Never	15	8.8			
		Total	169	99.4			
32	3 day record risk assessment	>8	53	31.2	1.38368	152	18
		<8	23	13.5			
		>18	2	1.2			
		<18	74	43.5			
		Total	152	89.4			
33	Think you consume enough iron	Yes	34	20.0	.76378	170	1
		No	62	36.5			
		I don't know	74	43.5			
		Total	170	100.0			

Most of the subjects in this study consumed fruits and took Vitamin C supplements every day. There was one missing answer for this question. Males were mostly not at risk for the development of iron deficiency as iron levels from their foods were high. Only 14% were at risk. Females were at more risk as their diet was low in high iron foods. Only 1% of the females were not at risk. There were 18 missing data for this question. Most of the sample participants did not know if they consumed enough iron from their diet.

ANOVA analyses revealed statistically significant differences ($p<0.05$) between genders, ethnicity, vegetarian status and risk in relation to awareness of iron deficiency anaemia and dietary practices. These statistical differences are presented in Tables 13 to 34 below.

Table 13. Mean comparison between genders and awareness of the term, function, worldwide relation, having the deficiency, family relation and symptoms of the deficiency

Questions			Options	Sum of Squares	d.f.	Mean Square	F	Sig.
4	Heard of the term for the deficiency		Between groups	1.506	1	1.506	10.905	.001
			Within Groups	23.200	168	.138		
			Total	24.706	169			
5	Iron helps store and use oxygen		Between groups	1.906	1	1.906	2.556	.112
			Within Groups	125.271	168	.746		
			Total	127.176	169			
6	Heard of the deficiency as being worldwide		Between groups	.024	1	.024	.107	.744
			Within Groups	36.824	168	.219		
			Total	36.847	169			
7	Have the deficiency		Between groups	1.153	1	1.153	3.258	.073
			Within Groups	59.459	168	.354		
			Total	60.612	169			
8	Family members have the deficiency		Between groups	.147	1	.147	.287	.593
			Within Groups	85.976	168	.512		
			Total	86.124	169			
9	Symptoms	Tiredness	Between Groups	.094	1	.094	.501	.480
			Within Groups	31.529	168	.188		
			Total	31.624	169			
		Light skin	Between Groups	.994	1	.994	4.812	.030
			Within Groups	34.706	168	.207		
			Total	35.700	169			
		Weakness	Between Groups	.376	1	.376	1.771	.185
			Within Groups	35.718	168	.213		
			Total	36.094	169			
		Loss of breath	Between Groups	.847	1	.847	3.456	.065
			Within Groups	41.176	168	.245		
			Total	42.024	169			
		Headache	Between Groups	.476	1	.476	1.976	.162
			Within Groups	40.518	168	.241		
			Total	40.994	169			
		Light headedness	Between Groups	2.847	1	2.847	12.078	.001
			Within Groups	39.600	168	.236		
			Total	42.447	169			
		Chilly hands and feet	Between Groups	1.324	1	1.324	6.081	.015
			Within Groups	36.565	168	.218		
			Total	37.888	169			
		Belly pain	Between Groups	.212	1	.212	1.744	.188
			Within Groups	20.400	168	.121		
			Total	20.612	169			

There was significance between gender and hearing of the deficiency, symptom of having light skin, light headedness and chilly hands and feet. A relationship was shown with these four factors and gender.

Table 14. Mean comparison between genders and awareness of symptoms, diet effect, diet risk, iron foods and awareness of high iron foods

Questions			Options	Sum of Squares	d.f.	Mean Square	F	Sig.
9	Symptom	Irritability	Between Groups	.712	1	.712	3.933	.049
			Within Groups	30.400	168	.181		
			Total	31.112	169			
		Soreness of tongue	Between Groups	.006	1	.006	.041	.840
			Within Groups	24.047	168	.143		
			Total	24.053	169			
		Weak nails	Between Groups	.024	1	.024	.125	.724
			Within Groups	31.600	168	.188		
			Total	31.624	169			
		Fast heartbeat	Between Groups	.212	1	.212	1.039	.309
			Within Groups	34.235	168	.204		
			Total	34.447	169			
		Deprived appetite	Between Groups	.212	1	.212	1.171	.281
			Within Groups	30.376	168	.181		
			Total	30.588	169			
		Strange craving	Between Groups	.588	1	.588	3.294	.071
			Within Groups	30.000	168	.179		
			Total	30.588	169			
		All of the above	Between Groups	.212	1	.212	2.040	.155
			Within Groups	17.435	168	.104		
			Total	17.647	169			
		None of the above	Between Groups	.006	1	.006	.336	.563
			Within Groups	2.941	168	.018		
			Total	2.947	169			
		I don’t know	Between Groups	.288	1	.288	2.038	.155
			Within Groups	23.765	168	.141		
			Total	24.053	169			
10	Diet can affect deficiency		Between Groups	.053	1	.053	1.336	.249
			Within Groups	6.659	168	.040		
			Total	6.712	169			
11	Well balanced diet reduce the risk		Between Groups	.006	1	.006	.024	.878
			Within Groups	42.047	168	.250		
			Total	42.053	169			
12	Know that there is iron in food		Between Groups	.006	1	.006	.204	.652
			Within Groups	4.847	168	.029		
			Total	4.853	169			
13	Aware of high iron containing foods		Between Groups	.094	1	.094	.642	.424
			Within Groups	24.612	168	.146		
			Total	24.706	169			

There was significance with gender and the symptom irritability. This means that there is a relationship with gender and this symptom.

Table 15. Mean comparison between genders and awareness of decrease in uptake, vegetarian risk, testing and confidence in the meaning, effect, risk, treatment, foods to reduce risk, function of iron, consequences, haemoglobin relation, women and children risk for the deficiency

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
14	Aware of foods that reduce iron absorption	Between Groups	.094	1	.094	.408	.524
		Within Groups	38.729	168	.231		
		Total	38.824	169			
15	Vegetarians are at greater risk	Between Groups	.376	1	.376	1.527	.218
		Within Groups	41.412	168	.246		
		Total	41.788	169			
16	Aware of how the deficiency is tested	Between Groups	.094	1	.094	.583	.446
		Within Groups	27.106	168	.161		
		Total	27.200	169			
17	Meaning of the term	Between Groups	.376	1	.376	.294	.588
		Within Groups	215.176	168	1.281		
		Total	215.553	169			
18	Effects on the body	Between Groups	.212	1	.212	.190	.663
		Within Groups	186.988	168	1.113		
		Total	187.200	169			
19	What increases the risk	Between Groups	2.124	1	2.124	1.850	.176
		Within Groups	192.824	168	1.148		
		Total	194.947	169			
20	What to do when iron levels are low	Between Groups	.006	1	.006	.005	.945
		Within Groups	204.871	168	1.219		
		Total	204.876	169			
21	What foods can help reduce your risk	Between Groups	.376	1	.376	.278	.599
		Within Groups	227.247	168	1.353		
		Total	227.624	169			
22	Job of iron in the body	Between Groups	.376	1	.376	.298	.586
		Within Groups	212.118	168	1.263		
		Total	212.494	169			
23	Dangers that come with anaemia	Between Groups	.476	1	.476	.356	.551
		Within Groups	224.635	168	1.337		
		Total	225.112	169			
24	Haemoglobin and iron relationship	Between Groups	1.700	1	1.700	1.087	.299
		Within Groups	262.706	168	1.564		
		Total	264.406	169			
25	Risk is greater for women	Between Groups	6.800	1	6.800	4.039	.046
		Within Groups	282.824	168	1.683		
		Total	289.624	169			
26	Children are at greater risk due to poor diet	Between Groups	.376	1	.376	.327	.568
		Within Groups	193.176	168	1.150		
		Total	193.553	169			

There was significance between gender and female's risks for development of iron deficiency.

Table 16. Mean comparison between genders and awareness of social, heart impact and consumption of beef, chicken, liver, turkey, fish, cereal, lentil, soybean, broccoli, spinach, clam

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
27	Low social like and risk for the deficiency	Between Groups	6.406	1	6.406	4.635	.033
		Within Groups	232.188	168	1.382		
		Total	238.594	169			
28	Anaemia can lead to heart problems	Between Groups	3.676	1	3.676	2.548	.112
		Within Groups	242.447	168	1.443		
		Total	246.124	169			
29	Beef	Between Groups	2.130	1	2.130	.617	.433
		Within Groups	576.723	167	3.453		
		Total	578.852	168			
	Chicken	Between Groups	.062	1	.062	.033	.857
		Within Groups	315.938	167	1.892		
		Total	316.000	168			
	Liver	Between Groups	10.758	1	10.758	4.026	.046
		Within Groups	446.224	167	2.672		
		Total	456.982	168			
	Turkey	Between Groups	.271	1	.271	.141	.708
		Within Groups	321.729	167	1.927		
		Total	322.000	168			
	Fish	Between Groups	1.965	1	1.965	.913	.341
		Within Groups	359.490	167	2.153		
		Total	361.456	168			
	Fortified cereal	Between Groups	.133	1	.133	.034	.854
		Within Groups	651.926	167	3.904		
		Total	652.059	168			
	Lentils	Between Groups	1.409	1	1.409	.680	.411
		Within Groups	346.058	167	2.072		
		Total	347.467	168			
	Soybeans	Between Groups	6.912	1	6.912	2.107	.148
		Within Groups	547.762	167	3.280		
		Total	554.675	168			
	Broccoli	Between Groups	12.521	1	12.521	4.531	.035
		Within Groups	461.479	167	2.763		
		Total	474.000	168			
	Spinach	Between Groups	.153	1	.153	.057	.811
		Within Groups	445.847	167	2.670		
		Total	446.000	168			
	Clams	Between Groups	3.568	1	3.568	4.313	.039
		Within Groups	138.148	167	.827		
		Total	141.716	168			

There was only statistical significance with awareness of the impact of low socio-economic status on the deficiency. Consuming liver, broccoli and clams also showed significance among the sample participants with gender.

Table 17. Mean comparison between genders and consumption of oysters, pumpkin seed, raisin (high iron food), iron supplement, coffee, tea, dairy, cocoa, whole grain, soft drink (foods that reduce iron absorption), legume, vegetable, fruit (foods that increase iron absorption)

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
29	Oysters	Between Groups	7.355	1	7.355	4.571	.034
		Within Groups	268.705	167	1.609		
		Total	276.059	168			
	Pumpkin seeds	Between Groups	4.335	1	4.335	2.069	.152
		Within Groups	349.949	167	2.096		
		Total	354.284	168			
	Raisins	Between Groups	12.252	1	12.252	4.159	.043
		Within Groups	491.996	167	2.946		
		Total	504.249	168			
30	Iron supplement	Between Groups	.376	1	.376	2.358	.127
		Within Groups	26.824	168	.160		
		Total	27.200	169			
31	Coffee	Between Groups	4.073	1	4.073	.719	.398
		Within Groups	946.459	167	5.667		
		Total	950.533	168			
	Tea	Between Groups	5.807	1	5.807	1.634	.203
		Within Groups	593.294	167	3.553		
		Total	599.101	168			
	Dairy products	Between Groups	5.089	1	5.089	2.992	.086
		Within Groups	284.012	167	1.701		
		Total	289.101	168			
	Cocoa products	Between Groups	1.506	1	1.506	.484	.488
		Within Groups	520.115	167	3.114		
		Total	521.621	168			
	Whole grain	Between Groups	2.469	1	2.469	.847	.359
		Within Groups	486.857	167	2.915		
		Total	489.325	168			
	Soft drink	Between Groups	3.960	1	3.960	.968	.327
		Within Groups	683.176	167	4.091		
		Total	687.136	168			
	Legumes	Between Groups	2.306	1	2.306	1.282	.259
		Within Groups	300.239	167	1.798		
		Total	302.544	168			
	Green leafy vegetables	Between Groups	1.176	1	1.176	.938	.334
		Within Groups	209.310	167	1.253		
		Total	210.485	168			
	Fruit	Between Groups	.366	1	.366	.250	.618
		Within Groups	244.770	167	1.466		
		Total	245.136	168			

Significance was seen for consumption of oysters and raisins with gender since the significance value was below 0.05 (sig.).

Table 18. Mean comparison between genders and consumption of vitamin C (increase iron absorption), risk assessment and thoughts about own diet

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
31	Vitamin C supplement	Between Groups	7.523	1	7.523	1.908	.169
		Within Groups	658.571	167	3.944		
		Total	666.095	168			
32	3 day record	Between Groups	262.477	1	262.477	1478.909	.000
		Within Groups	26.622	150	.177		
		Total	289.099	151			
33	Think you consume enough iron	Between Groups	.212	1	.212	.362	.548
		Within Groups	98.376	168	.586		
		Total	98.588	169			

There was a statistically significant differences ($P<0.05$) between gender in relation to the development of iron deficiency through dietary habits.

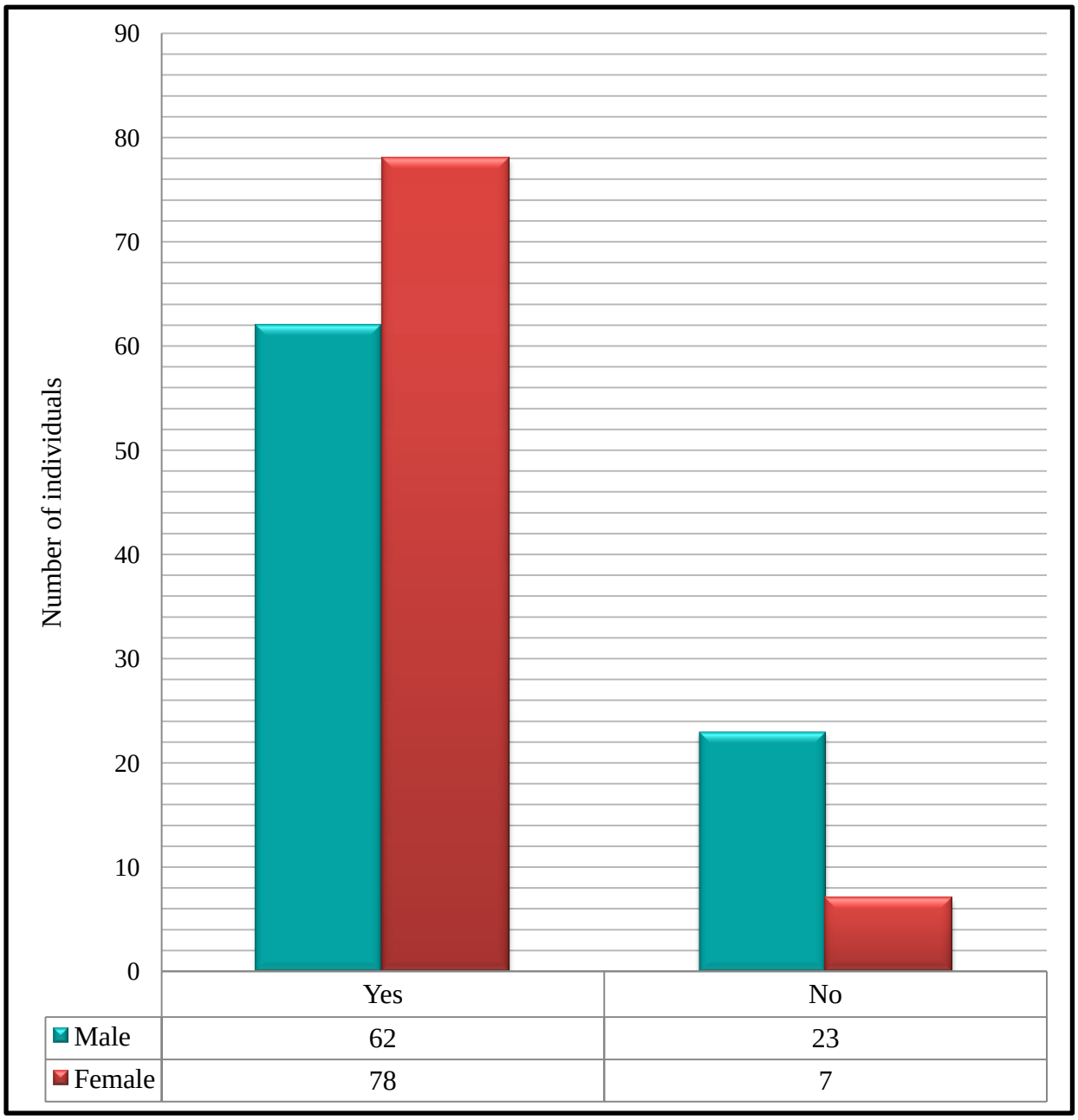


Figure 1. Significant difference between genders pertaining to “hearing of the term for the deficiency”

This graph showed that both the males and females have heard of the term “iron deficiency”. It was shown that more females have heard of the term than the male participants. There were no missing data for this question; therefore one hundred and seventy individuals answered the question making the results more valid.

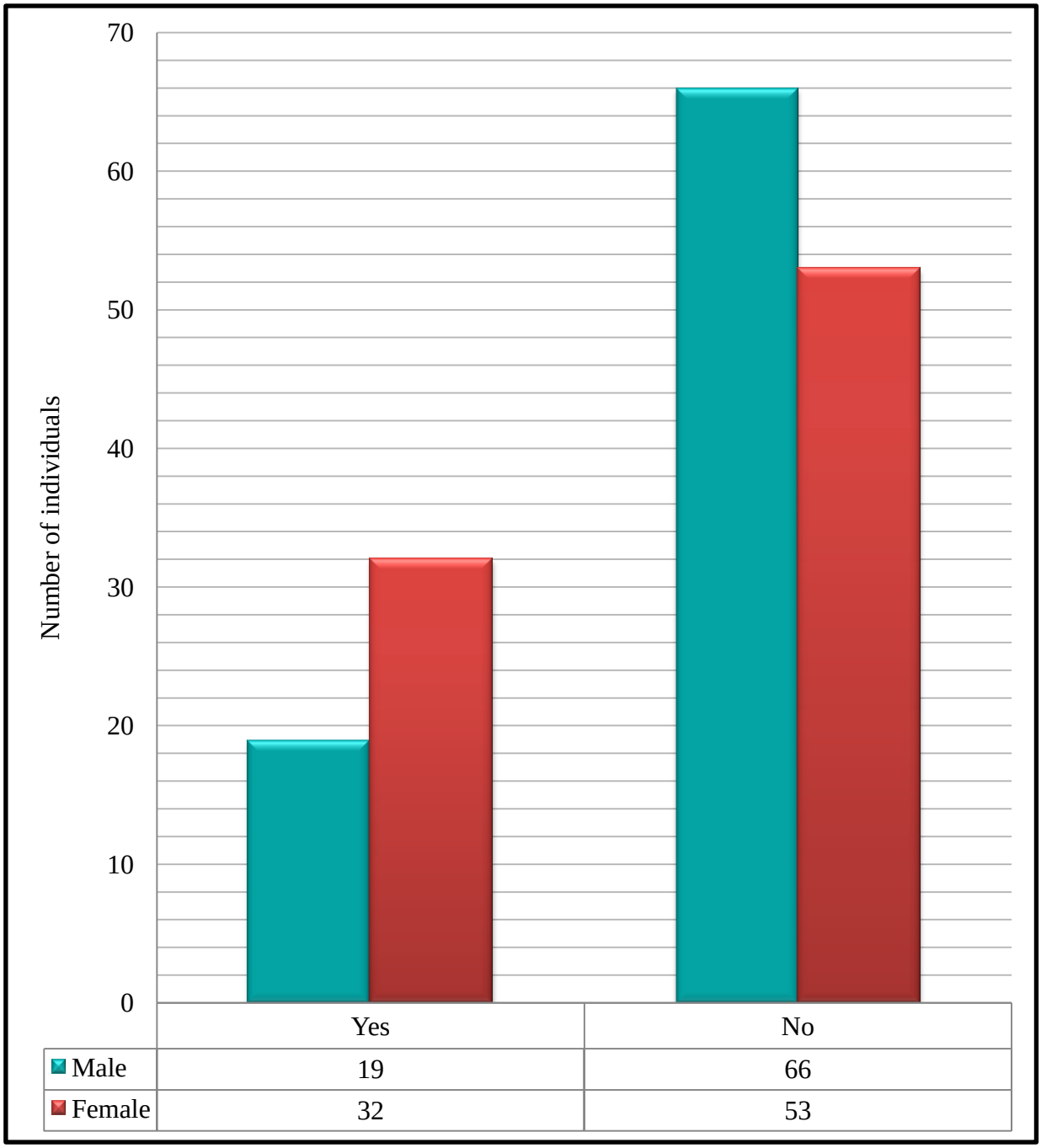


Figure 2. Significant difference between genders pertaining to awareness of the symptom “light skin” and its relation to the deficiency

This graph showed that both males and females in this study did not relate this symptom to iron deficiency. It was shown that a large number of the male subjects did not know that the symptom was linked to iron deficiency.

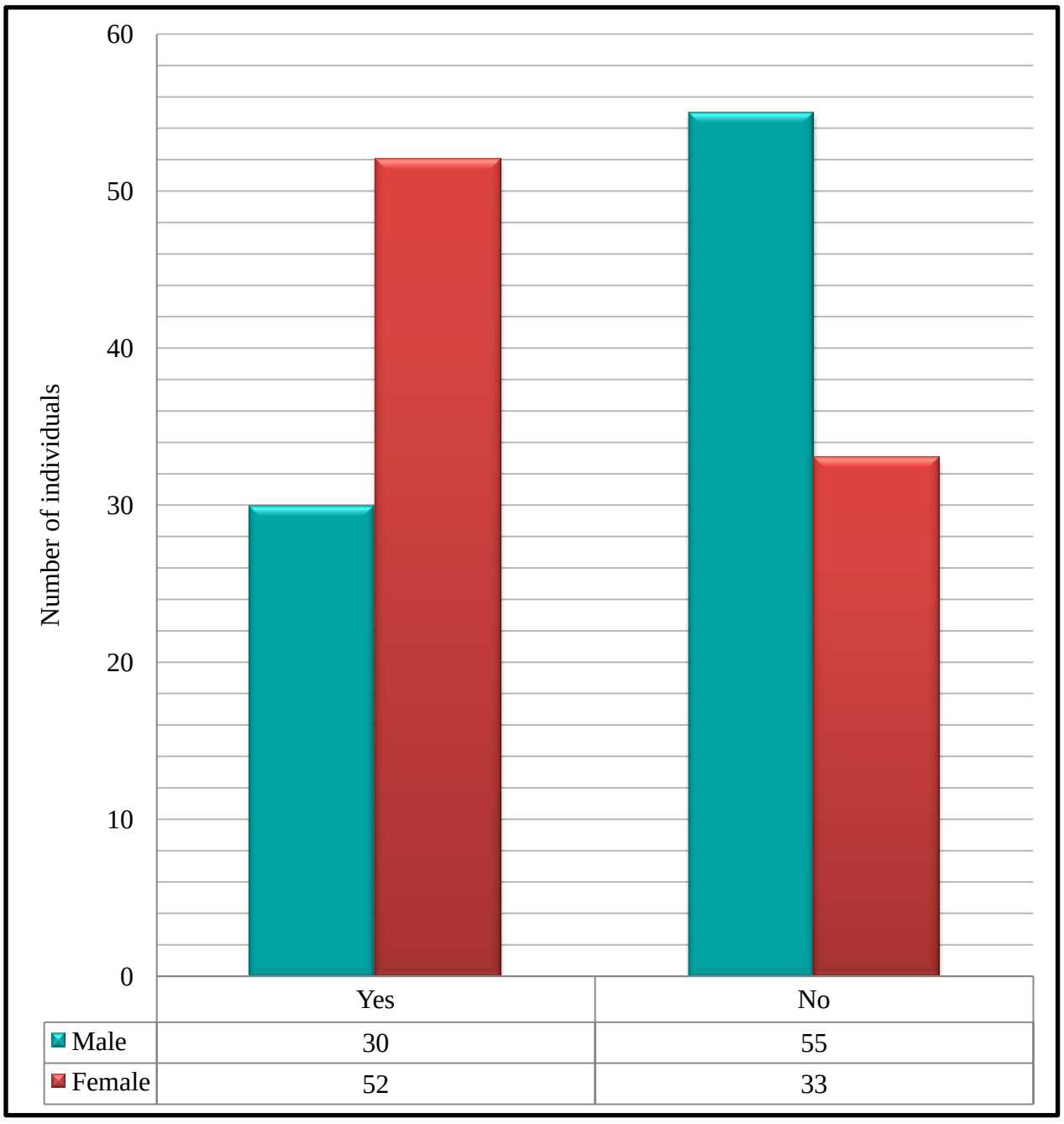


Figure 3. Significant difference between genders pertaining to awareness of the symptom “light headedness” and its relation to the deficiency

The female participants related light headedness to a symptom of the deficiency more than the male participants. There was no missing data for this question; therefore one hundred and seventy individuals answered the question making the results more valid.

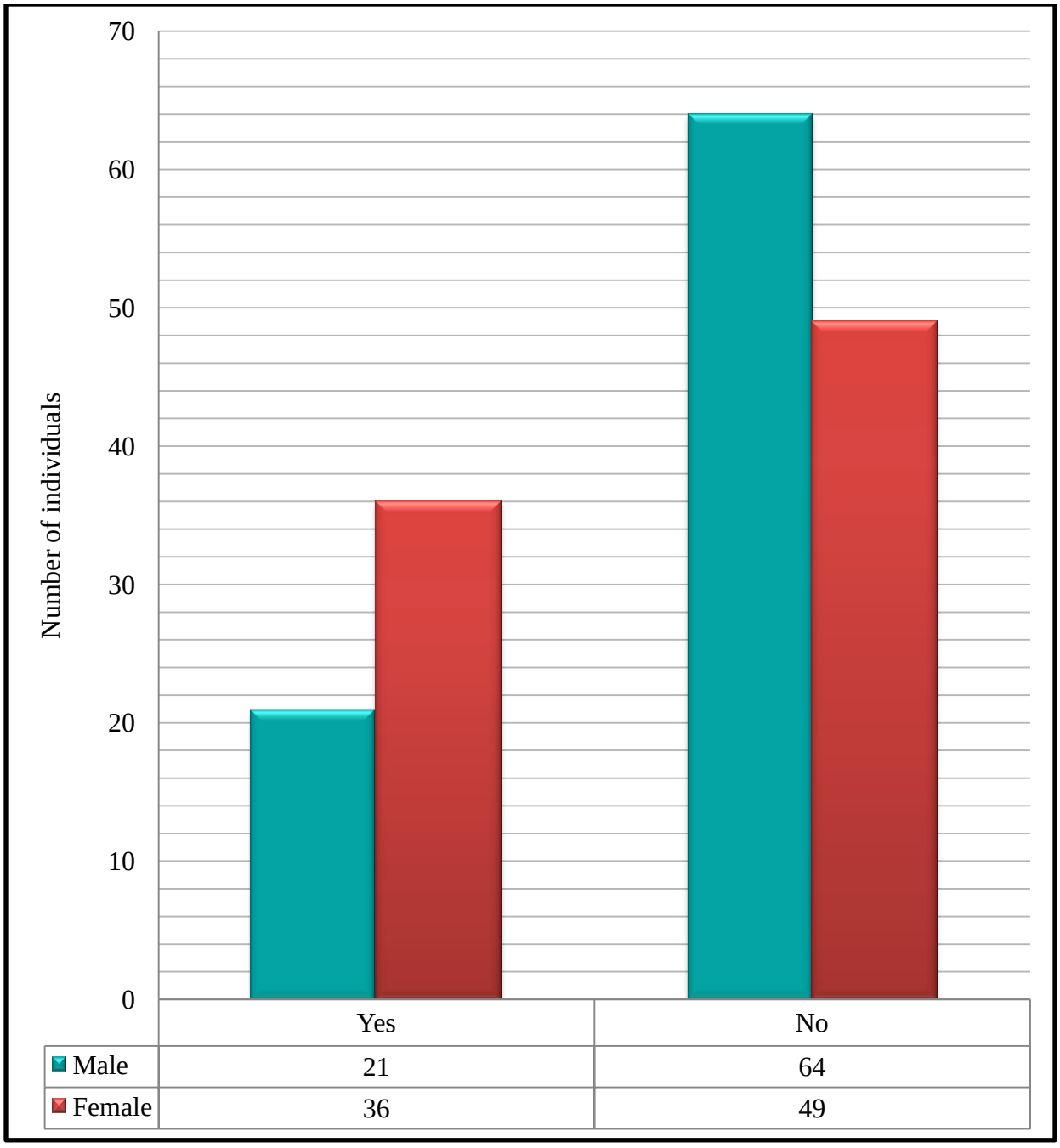


Figure 4. Significant difference between genders pertaining to awareness of the symptom “chilly hands and feet” and its relation to the deficiency

The male and female participants both did not relate chilly hands and feet with the deficiency. However, more females related the symptom to the deficiency than males. There was no missing data for this question; therefore one hundred and seventy individuals answered the question making the results more valid

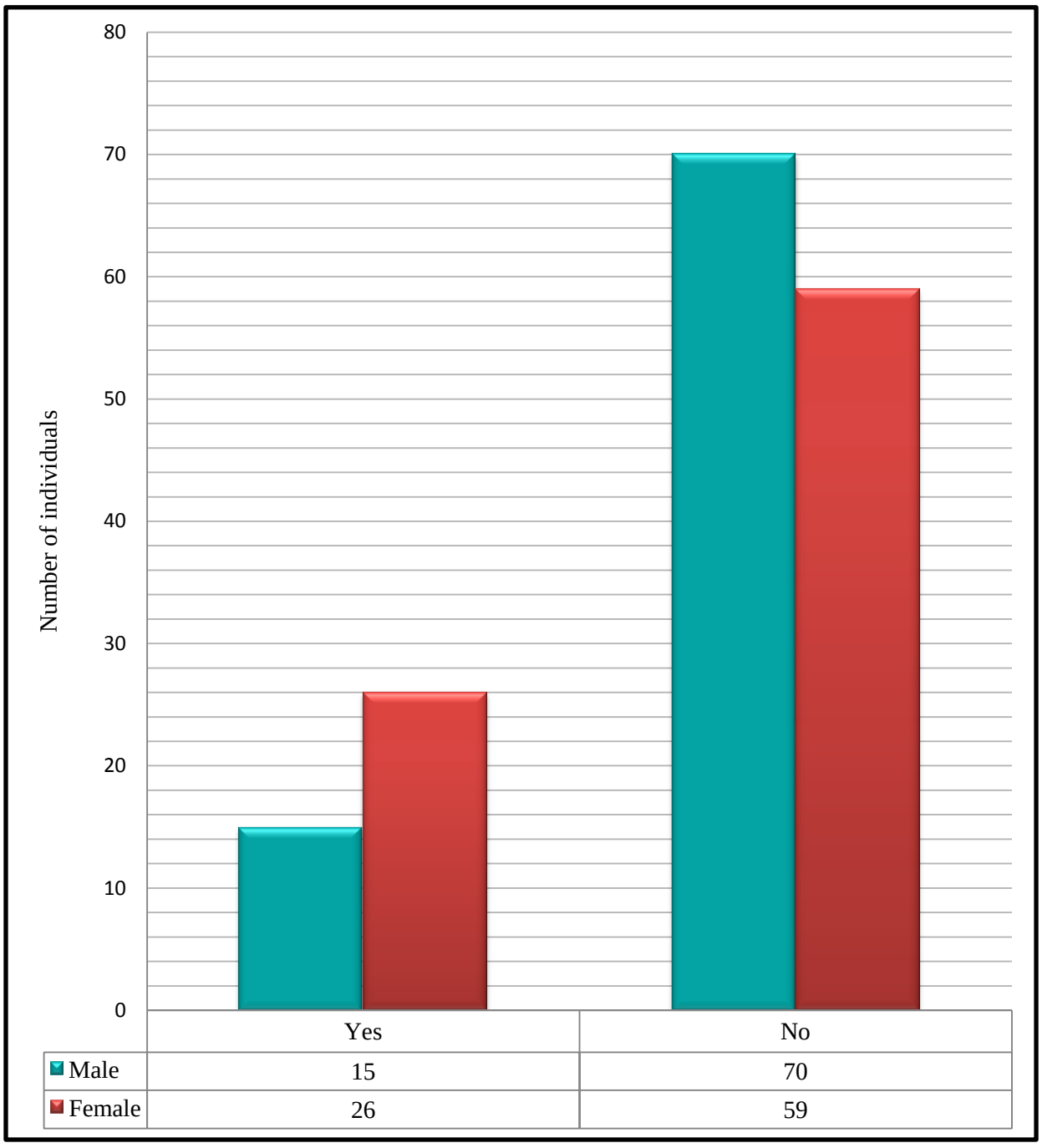


Figure 5. Significant difference between genders pertaining to awareness of the symptom "irritability" and its relation to the deficiency

The male and female sampled participants both did not link irritability with iron deficiency. However, more females related the symptom to this disorder than males. There were no missing data for this question.

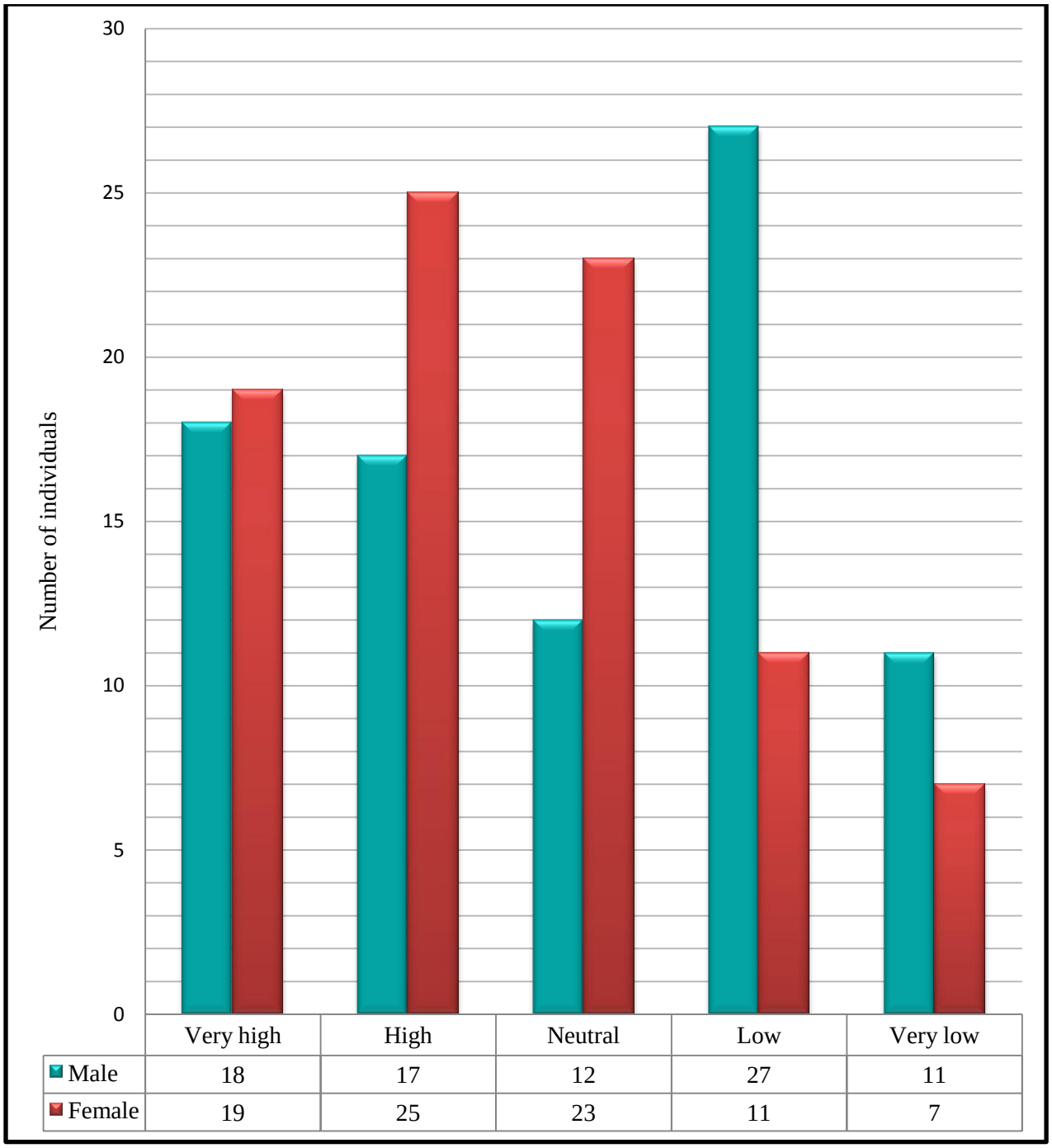
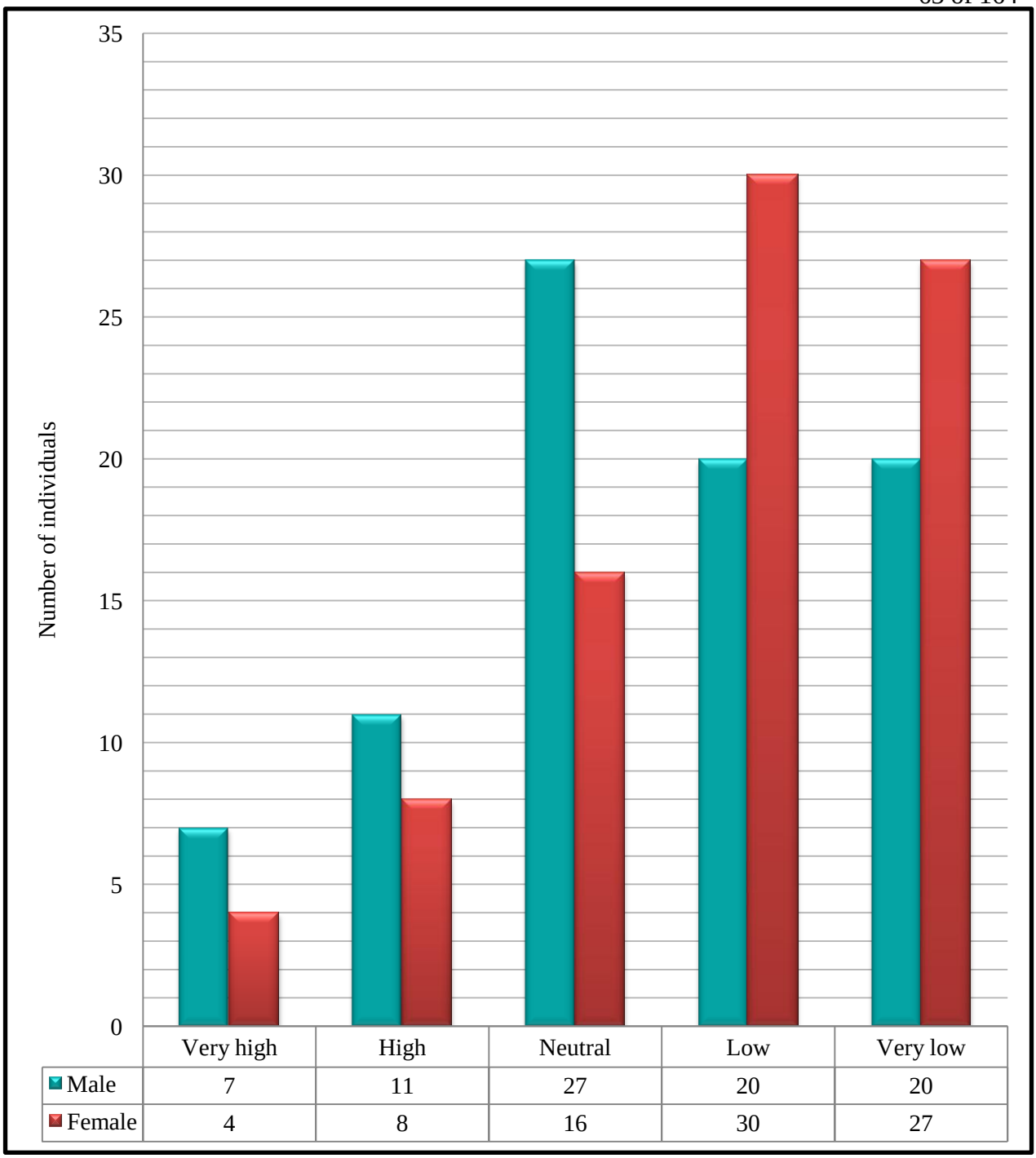


Figure 6. Significant difference between genders pertaining to the confidence of "knowing women are at greater risk for the deficiency"

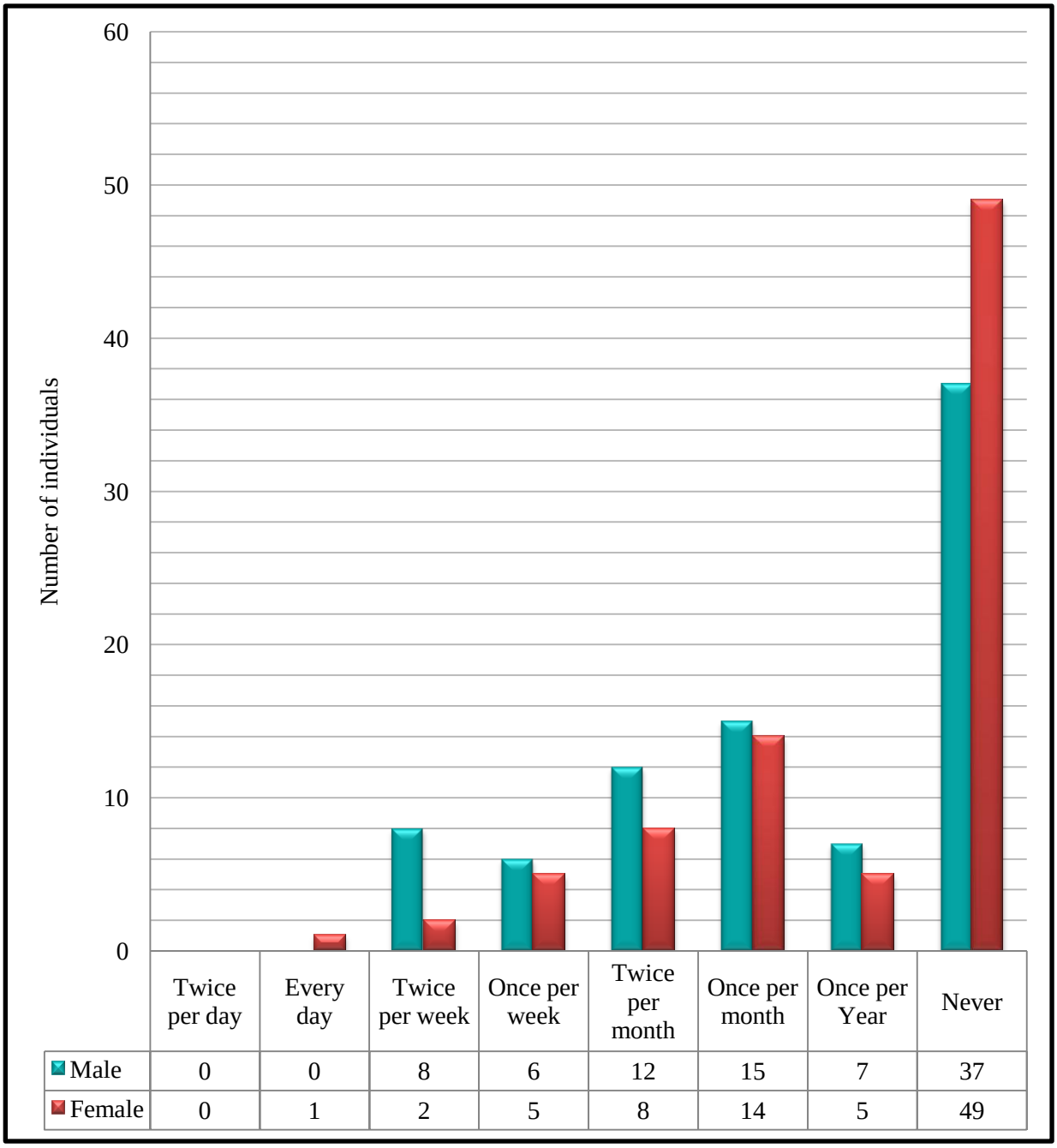
Most of the female participants felt high confidence towards knowing the risk associated with women when more or the male participants felt low confidence. There were no missing data for this question.



	Very high	High	Neutral	Low	Very low
Male	7	11	27	20	20
Female	4	8	16	30	27

Figure 7. Significant difference between genders pertaining to the confidence of "knowing that a low social life affects anaemia"

A large number of the female participants felt low confidence towards knowing how a social life affects the deficiency when a large number of the males felt neutral confidence. There were no missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per Year	Never
Male	0	0	8	6	12	15	7	37
Female	0	1	2	5	8	14	5	49

Figure 8. Significant difference between genders pertaining to frequency of consumption of "liver" as a high iron containing food

Just a few of the participants consumed liver on a frequent basis. The larger portion of the subjects never consumed this high iron containing food. More females than males never consumed this food item. There was only one missing piece of data for this question as one individual of the sample did not answer.

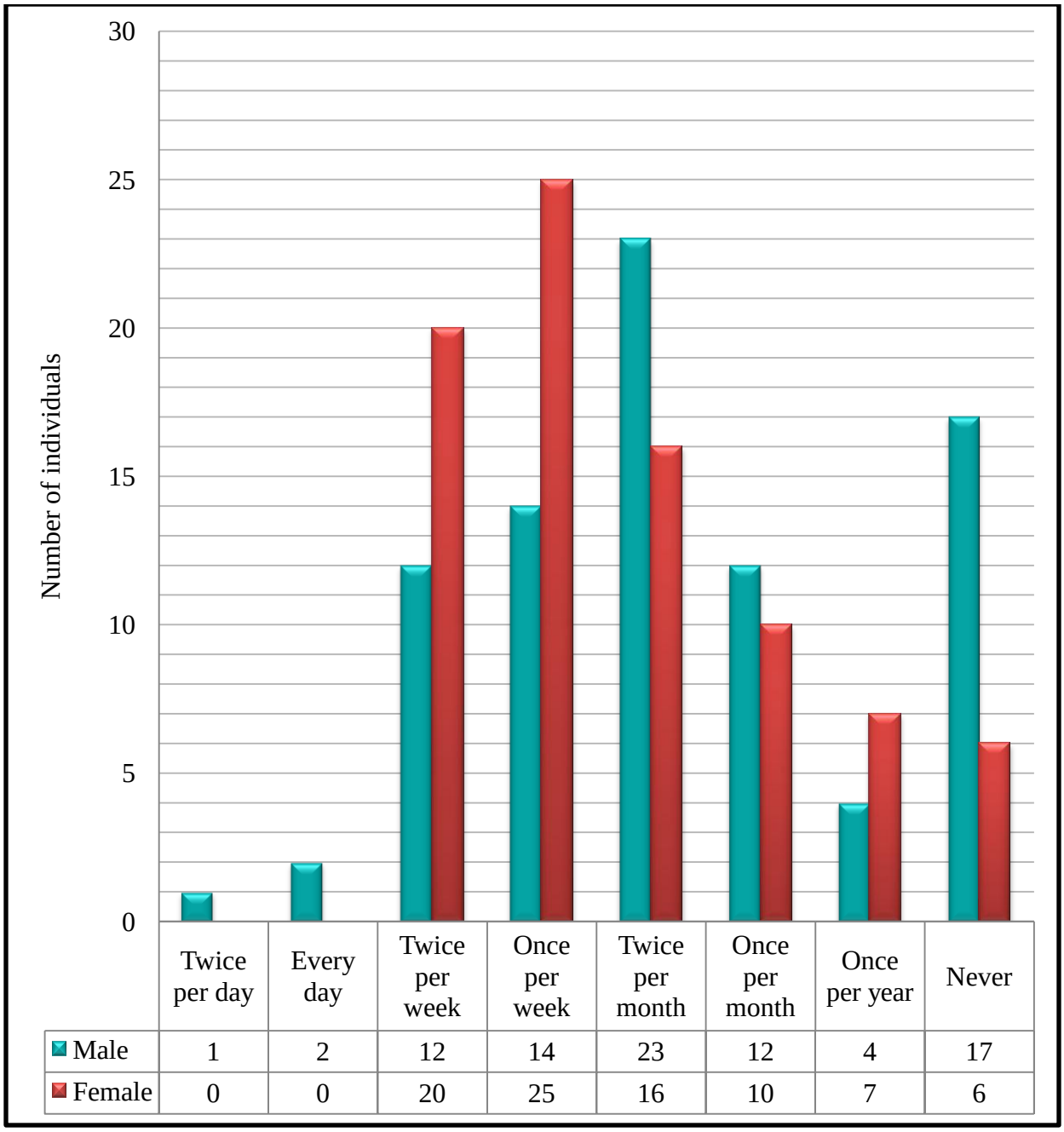
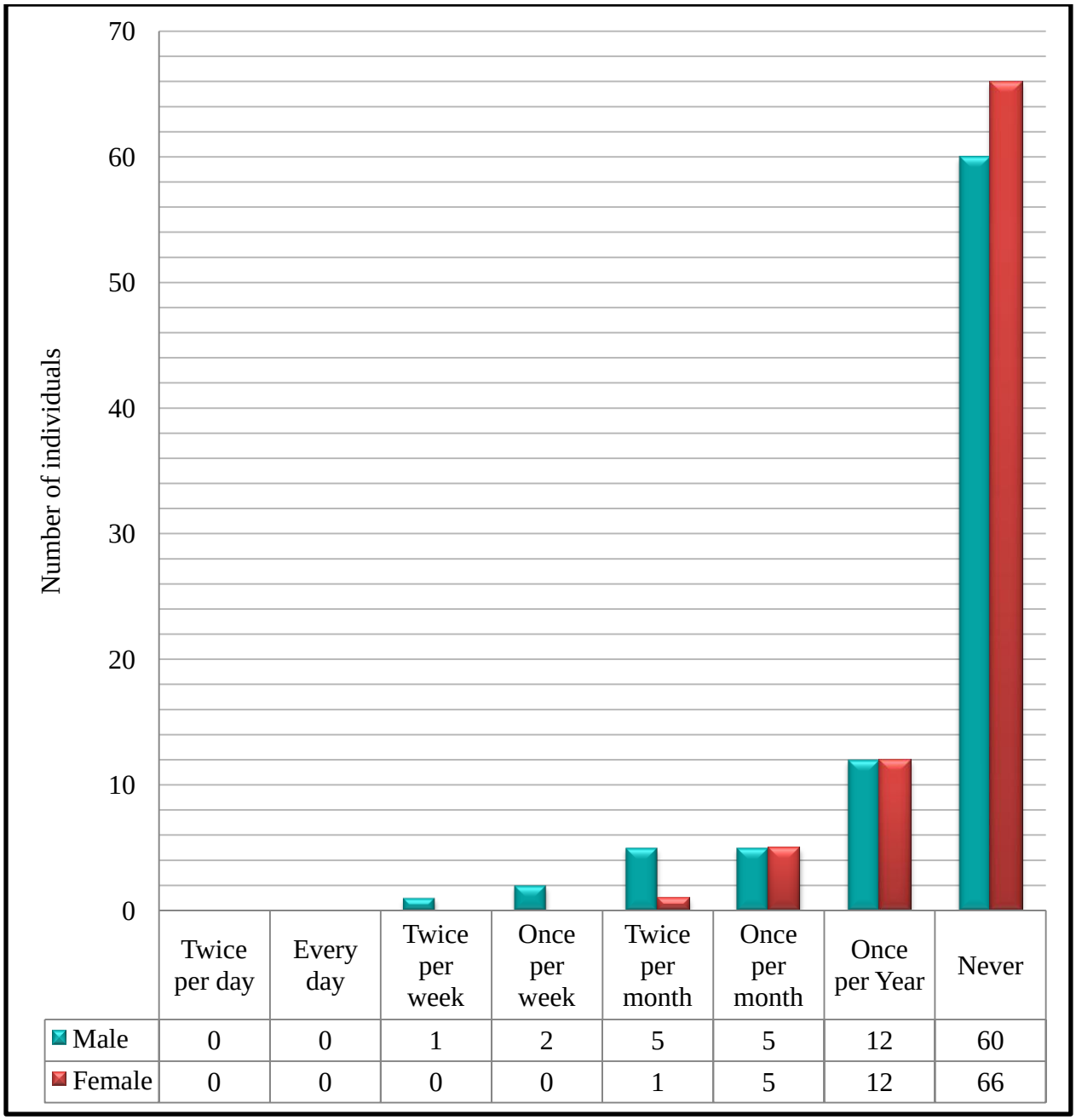


Figure 9. Significant difference between genders pertaining to frequency of the consumption of "broccoli" (high iron food)

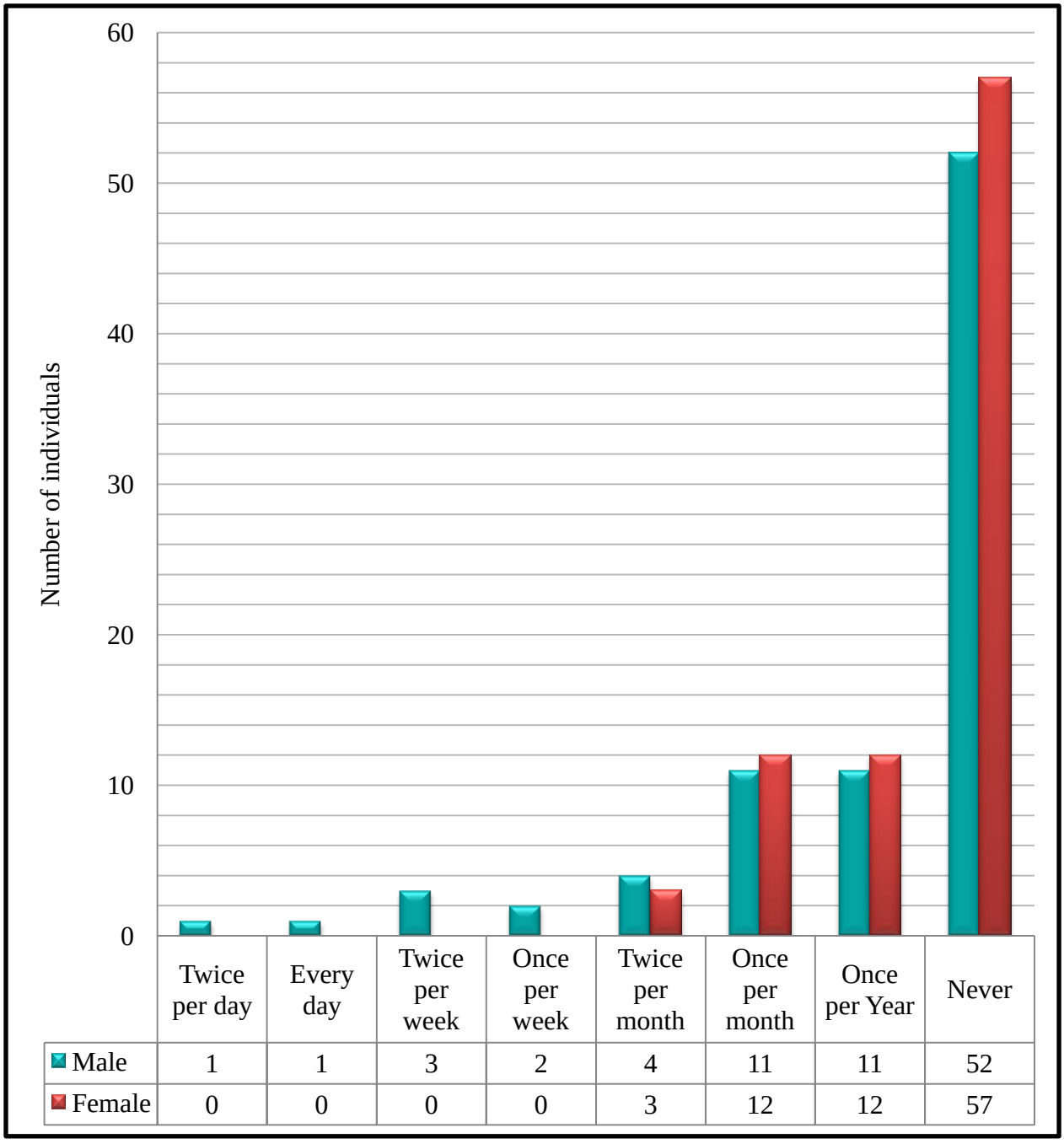
A small number of the participants consumed broccoli on a frequent basis. Most of the sample participants consumed this high iron containing food twice per month. More females consumed it once per week. More males consumed it twice per month. There was only one missing individual for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per Year	Never
Male	0	0	1	2	5	5	12	60
Female	0	0	0	0	1	5	12	66

Figure 10. Significant difference between genders pertaining to frequency of consumption of "clams", a high iron containing food

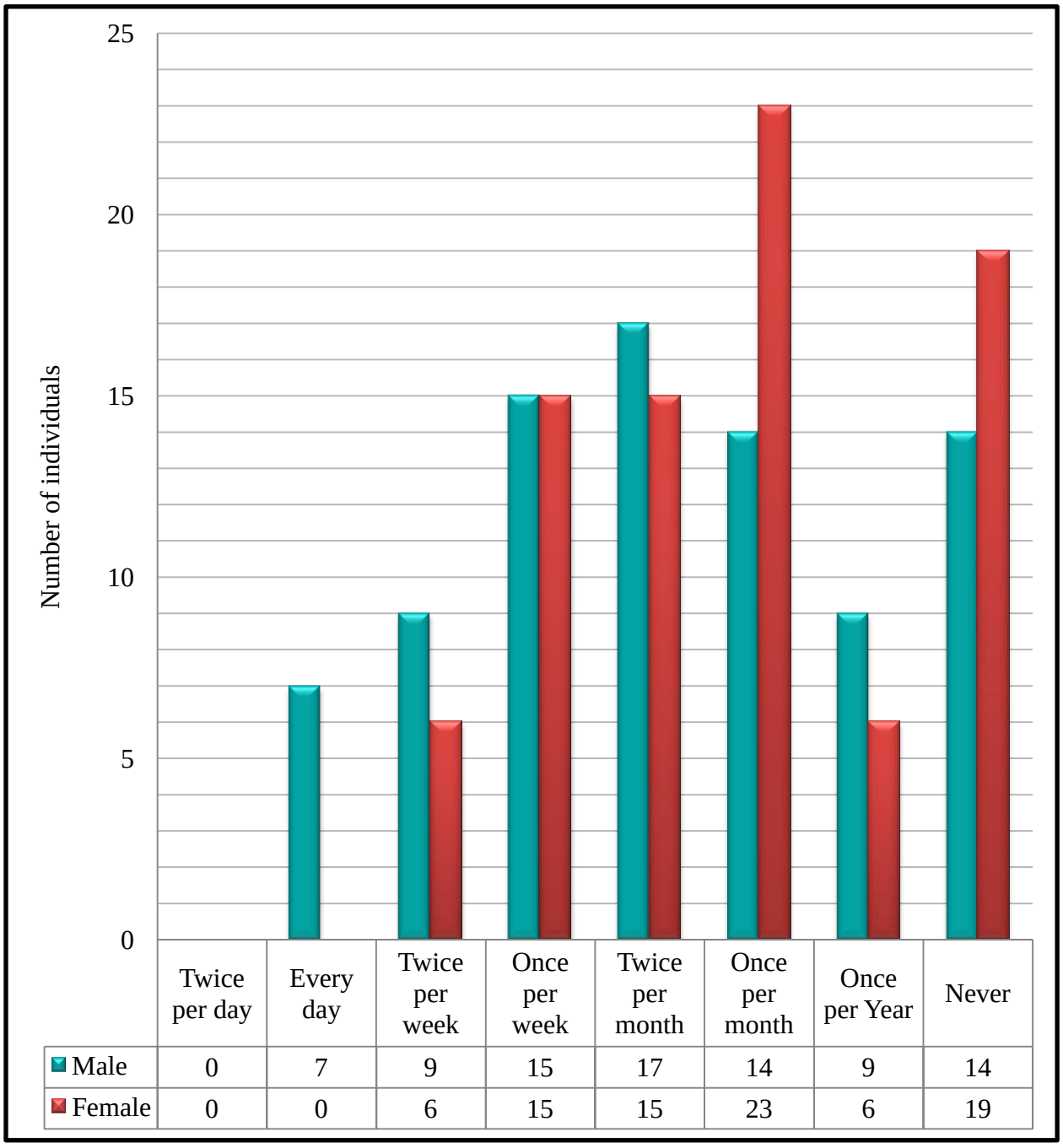
A small number of the participants consumed this item on a frequent basis. Most of the sample never consumed this high iron containing item. More females than males never consumed this item and the same amount of males to females consumed it once per year. There was only one missing individual for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per Year	Never
Male	1	1	3	2	4	11	11	52
Female	0	0	0	0	3	12	12	57

Figure 11. Significant difference between genders pertaining to frequency of consumption of "oysters", a high iron containing food

This graph showed that less of the participants consumed oysters on a frequent basis. Most of the sample never consumed this high iron containing item. More females than males never consumed this item and the same ratio of males to females consumed it once per month and year. There was only one missing individual for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per Year	Never
Male	0	7	9	15	17	14	9	14
Female	0	0	6	15	15	23	6	19

Figure 12. Significant difference between genders pertaining to frequency of consumption of "raisins", a high iron containing food

A small number of the participants consumed raisins on a frequent basis. Most consumed this high iron containing item once per month. More females than males never consumed this item and the same amount of males to females consumed it once per week. More males consumed this item twice per month. There was only one missing individual for this question.

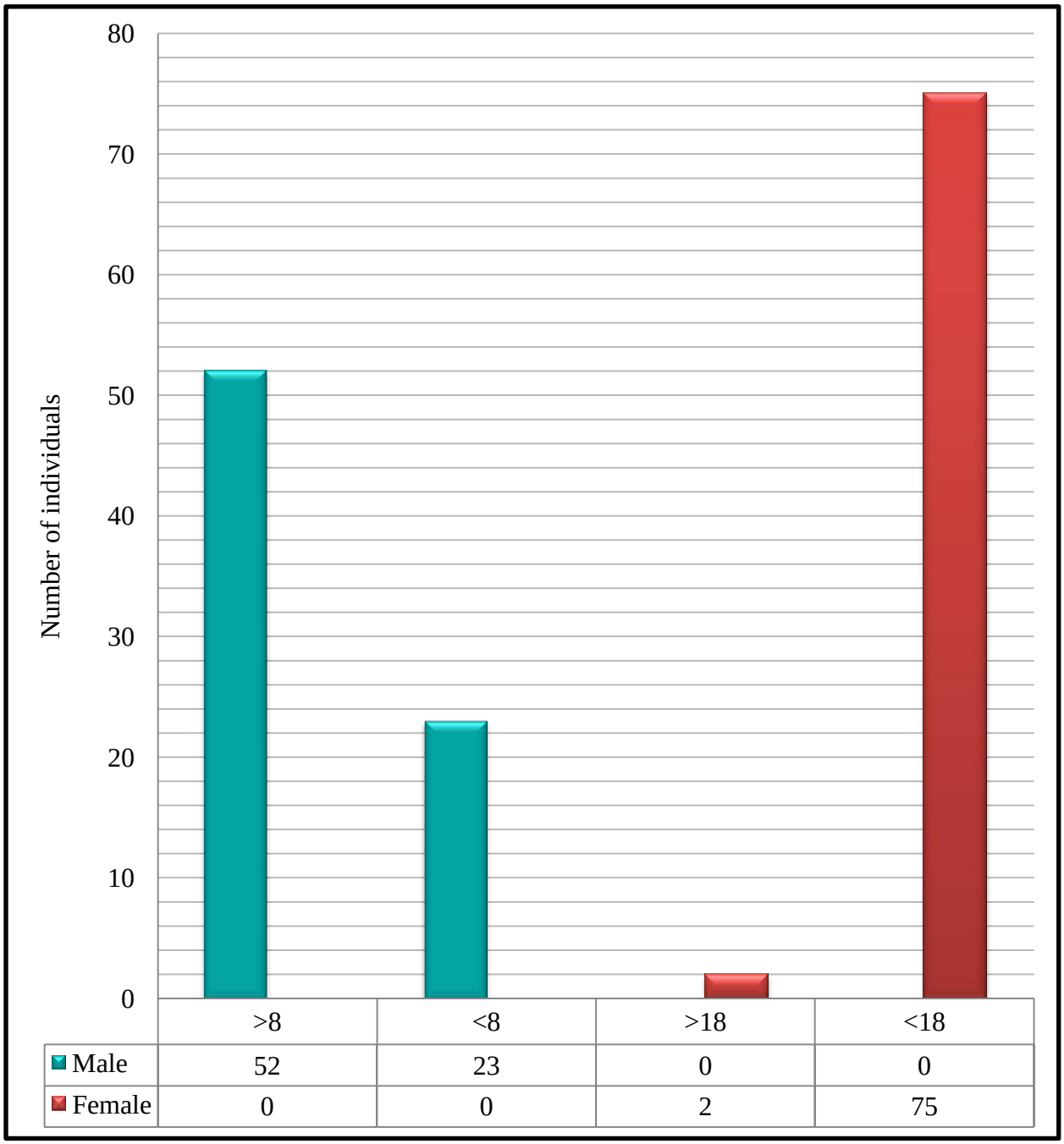


Figure 13. Significant difference between genders pertaining to the "risk" assessment from diet record

This graph showed that there were a small number of males at risk for the deficiency. Females were at greatest risk as 97 % of the female sample participants who filled in the diet record were at risk for the deficiency. Only 31 % of the male participants were at risk. There were 18 missing cases for this question.

Table 19. Mean comparison between ethnicity and awareness the term, function, worldwide relation, having the deficiency, family relation and symptoms of iron deficiency

Questions			Options	Sum of Squares	d.f.	Mean Square	F	Sig.
4	Heard of the term for the deficiency		Between groups	.411	2	.206	1.413	.246
			Within Groups	24.295	167	.145		
			Total	24.706	169			
5	Iron helps store and use oxygen		Between groups	1.508	2	.754	1.002	.369
			Within Groups	125.669	167	.753		
			Total	127.176	169			
6	Deficiency is worldwide		Between groups	.083	2	.042	.189	.828
			Within Groups	36.764	167	.220		
			Total	36.847	169			
7	Have the deficiency		Between groups	.168	2	.084	.232	.793
			Within Groups	60.444	167	.362		
			Total	60.612	169			
8	Family members have the deficiency		Between groups	1.813	2	.906	1.796	.169
			Within Groups	84.311	167	.505		
			Total	86.124	169			
9	Symptoms	Tiredness	Between Groups	.451	2	.226	1.209	.301
			Within Groups	31.172	167	.187		
			Total	31.624	169			
		Light skin	Between Groups	.184	2	.092	.433	.649
			Within Groups	35.516	167	.213		
			Total	35.700	169			
		Weakness	Between Groups	.476	2	.238	1.117	.330
			Within Groups	35.618	167	.213		
			Total	36.094	169			
		Loss of breath	Between Groups	.431	2	.215	.865	.423
			Within Groups	41.593	167	.249		
			Total	42.024	169			
		Headache	Between Groups	.061	2	.030	.124	.883
			Within Groups	40.933	167	.245		
			Total	40.994	169			
		Light headedness	Between Groups	.977	2	.489	1.968	.143
			Within Groups	41.470	167	.248		
			Total	42.447	169			
		Chilly hands and feet	Between Groups	.595	2	.297	1.332	.267
			Within Groups	37.293	167	.223		
			Total	37.888	169			
		Belly pain	Between Groups	.273	2	.137	1.122	.328
			Within Groups	20.338	167	.122		
			Total	20.612	169			

There was no significance with any of the awareness questions in this table as values were above 0.05.

Table 20. Mean comparison between ethnicity and awareness of symptoms of iron deficiency, diet effect, diet risk, iron in food, iron foods and foods that reduce iron absorption

Questions			Options	Sum of Squares	d.f.	Mean Square	F	Sig.
9	Symptoms	Irritability	Between Groups	.523	2	.262	1.428	.243
			Within Groups	30.589	167	.183		
			Total	31.112	169			
		Soreness of tongue	Between Groups	.124	2	.062	.432	.650
			Within Groups	23.929	167	.143		
			Total	24.053	169			
		Weak nails	Between Groups	.337	2	.168	.824	.440
			Within Groups	34.110	167	.204		
			Total	34.447	169			
		Heartbeat	Between Groups	.441	2	.220	1.180	.310
			Within Groups	31.183	167	.187		
			Total	31.624	169			
		Deprived appetite	Between Groups	.444	2	.222	1.231	.295
			Within Groups	30.144	167	.181		
			Total	30.588	169			
		Strange craving	Between Groups	.262	2	.131	.723	.487
			Within Groups	30.326	167	.182		
			Total	30.588	169			
		All of the above	Between Groups	.175	2	.087	.836	.435
			Within Groups	17.472	167	.105		
			Total	17.647	169			
		None of the above	Between Groups	.026	2	.013	.736	.480
			Within Groups	2.921	167	.017		
			Total	2.947	169			
		I don’t know	Between Groups	.124	2	.062	.432	.650
			Within Groups	23.929	167	.143		
			Total	24.053	169			
10	Deficiency affected by the diet		Between Groups	.017	2	.008	.211	.810
			Within Groups	6.695	167	.040		
			Total	6.712	169			
11	Well balanced diet reduce the risk		Between Groups	.570	2	.285	1.146	.320
			Within Groups	41.483	167	.248		
			Total	42.053	169			
12	Know that there is iron in food		Between Groups	.120	2	.060	2.111	.124
			Within Groups	4.733	167	.028		
			Total	4.853	169			
13	Aware of high iron containing foods		Between Groups	.887	2	.444	3.110	.047
			Within Groups	23.819	167	.143		
			Total	24.706	169			
14	Aware of foods that reduce iron absorption		Between Groups	.061	2	.031	.132	.877
			Within Groups	38.762	167	.232		
			Total	38.824	169			

There was significance with ethnicity and being aware of foods that have iron as the value was above 0.05 (sig.).

Table 21. Mean comparison between ethnicity and awareness of vegetarian risk, test and confidence in the meaning, effect, risk, treatment, foods to reduce risk, function of iron, consequences, haemoglobin relation, women risk, children risk and social impact

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
15	Vegetarians are at greater risk	Between Groups	2.404	2	1.202	5.096	.007
		Within Groups	39.385	167	.236		
		Total	41.788	169			
16	Aware of how the deficiency is tested	Between Groups	.082	2	.041	.252	.778
		Within Groups	27.118	167	.162		
		Total	27.200	169			
17	Meaning of the term	Between Groups	.382	2	.191	.148	.862
		Within Groups	215.171	167	1.288		
		Total	215.553	169			
18	Effects of the deficiency	Between Groups	1.300	2	.650	.584	.559
		Within Groups	185.900	167	1.113		
		Total	187.200	169			
19	What increases risk	Between Groups	1.569	2	.785	.678	.509
		Within Groups	193.378	167	1.158		
		Total	194.947	169			
20	What to do it iron levels are low	Between Groups	.459	2	.230	.188	.829
		Within Groups	204.417	167	1.224		
		Total	204.876	169			
21	What foods can reduce risk	Between Groups	1.127	2	.563	.415	.661
		Within Groups	226.497	167	1.356		
		Total	227.624	169			
22	Job of iron	Between Groups	.135	2	.067	.053	.948
		Within Groups	212.359	167	1.272		
		Total	212.494	169			
23	Dangers of anaemia	Between Groups	1.102	2	.551	.411	.664
		Within Groups	224.010	167	1.341		
		Total	225.112	169			
24	Haemoglobin and iron relationship	Between Groups	.311	2	.156	.098	.906
		Within Groups	264.094	167	1.581		
		Total	264.406	169			
25	Women at greater risk	Between Groups	3.649	2	1.824	1.065	.347
		Within Groups	285.975	167	1.712		
		Total	289.624	169			
26	Children at risk due to poor diet	Between Groups	1.857	2	.928	.809	.447
		Within Groups	191.696	167	1.148		
		Total	193.553	169			
27	Social life affecting risk	Between Groups	.422	2	.211	.148	.862
		Within Groups	238.172	167	1.426		
		Total	238.594	169			

There was significance with ethnicity and confidence knowing that vegetarians have greater risk.

Table 22. Mean comparison between ethnicity and confidence in knowing heart risk; consumption of beef, chicken, liver, turkey, fish, cereal, lentil, soybean, broccoli, clam, oysters

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
28	Heart problems	Between Groups	4.978	2	2.489	1.724	.182
		Within Groups	241.146	167	1.444		
		Total	246.124	169			
29	Beef	Between Groups	121.362	2	60.681	22.018	.000
		Within Groups	457.490	166	2.756		
		Total	578.852	168			
	Chicken	Between Groups	.894	2	.447	.236	.790
		Within Groups	315.106	166	1.898		
		Total	316.000	168			
	Liver	Between Groups	12.088	2	6.044	2.255	.108
		Within Groups	444.895	166	2.680		
		Total	456.982	168			
	Turkey	Between Groups	1.553	2	.777	.402	.669
		Within Groups	320.447	166	1.930		
		Total	322.000	168			
	Fish	Between Groups	.899	2	.449	.207	.813
		Within Groups	360.557	166	2.172		
		Total	361.456	168			
	Fortified cereal	Between Groups	3.525	2	1.762	.451	.638
		Within Groups	648.534	166	3.907		
		Total	652.059	168			
	Lentils	Between Groups	1.091	2	.546	.261	.770
		Within Groups	346.376	166	2.087		
		Total	347.467	168			
	Soybeans	Between Groups	29.515	2	14.757	4.665	.011
		Within Groups	525.160	166	3.164		
		Total	554.675	168			
	Broccoli	Between Groups	11.759	2	5.880	2.111	.124
		Within Groups	462.241	166	2.785		
		Total	474.000	168			
	Spinach	Between Groups	10.970	2	5.485	2.093	.127
		Within Groups	435.030	166	2.621		
		Total	446.000	168			
	Clams	Between Groups	3.338	2	1.669	2.002	.138
		Within Groups	138.378	166	.834		
		Total	141.716	168			
	Oysters	Between Groups	13.187	2	6.594	4.164	.017
		Within Groups	262.872	166	1.584		
		Total	276.059	168			

There was significance with beef, soybean and oyster consumption as values were below 0.05 in relation to ethnicity

Table 23. Mean comparison between ethnicity and consumption of pumpkin seeds, raisin and iron supplement, coffee, tea, dairy, cocoa, whole grain, soft drink, legumes, vegetables, fruit and vitamin C

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
29	Pumpkin seeds	Between Groups	5.325	2	2.663	1.267	.284
		Within Groups	348.959	166	2.102		
		Total	354.284	168			
	Raisins	Between Groups	6.448	2	3.224	1.075	.344
		Within Groups	497.801	166	2.999		
		Total	504.249	168			
30	Iron Supplement	Between Groups	.681	2	.341	2.146	.120
		Within Groups	26.519	167	.159		
		Total	27.200	169			
31	Coffee	Between Groups	35.781	2	17.891	3.247	.041
		Within Groups	914.751	166	5.511		
		Total	950.533	168			
	Tea	Between Groups	4.201	2	2.101	.586	.558
		Within Groups	594.900	166	3.584		
		Total	599.101	168			
	Dairy products	Between Groups	1.108	2	.554	.319	.727
		Within Groups	287.993	166	1.735		
		Total	289.101	168			
	Cocoa products	Between Groups	.227	2	.113	.036	.965
		Within Groups	521.395	166	3.141		
		Total	521.621	168			
	Whole grain	Between Groups	1.119	2	.559	.190	.827
		Within Groups	488.207	166	2.941		
		Total	489.325	168			
	Soft drink	Between Groups	1.679	2	.839	.203	.816
		Within Groups	685.457	166	4.129		
		Total	687.136	168			
	Legumes	Between Groups	1.347	2	.674	.371	.690
		Within Groups	301.197	166	1.814		
		Total	302.544	168			
	Green leafy vegetables	Between Groups	7.373	2	3.687	3.013	.052
		Within Groups	203.112	166	1.224		
		Total	210.485	168			
	Fruit	Between Groups	5.616	2	2.808	1.946	.146
		Within Groups	239.520	166	1.443		
		Total	245.136	168			
	Vitamin C supplement	Between Groups	7.869	2	3.935	.992	.373
		Within Groups	658.226	166	3.965		
		Total	666.095	168			

There was significance with coffee consumption and ethnicity as the value was below 0.05. No other significant relationships were found between the diet and ethnicity assessment.

Table 24. Mean comparison between ethnicity and assessment of diet and thoughts about own diet

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
32	3 day recall	Between Groups	.212	2	.106	.055	.947
		Within Groups	288.887	149	1.939		
		Total	289.099	151			
33	Think you consume enough iron	Between Groups	.807	2	.403	.689	.503
		Within Groups	97.781	167	.586		
		Total	98.588	169			

No significant relationships were found as values were not below 0.05 (sig.)

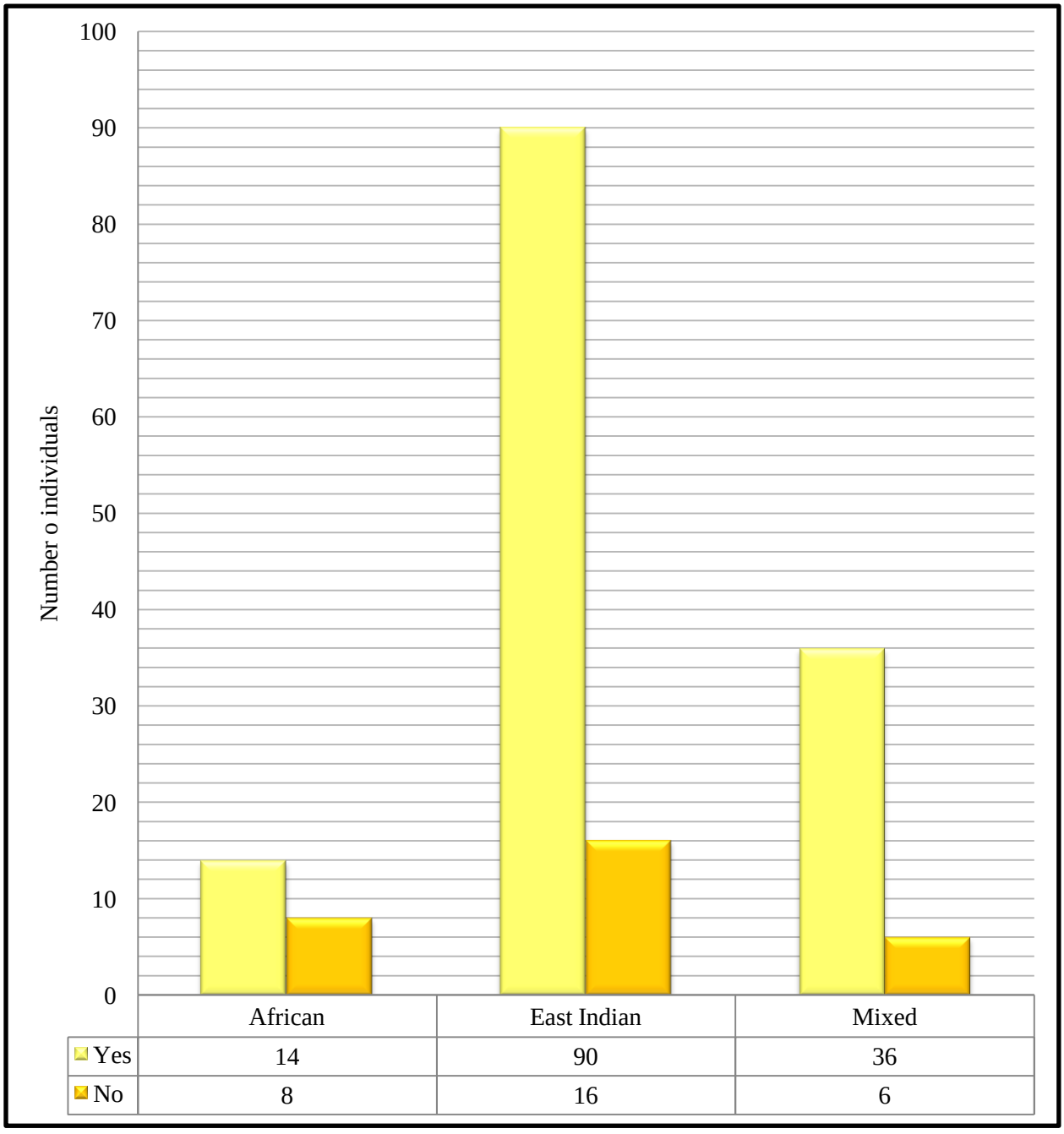


Figure 14. Significant difference between ethnicity pertaining to “awareness of high iron foods”

The East Indian sampled participants was more aware of iron containing foods than the other ethnicities. Only a few of the sample participants were unaware. There was no missing data for this question; therefore one hundred and seventy individuals answered the question making the results more valid.

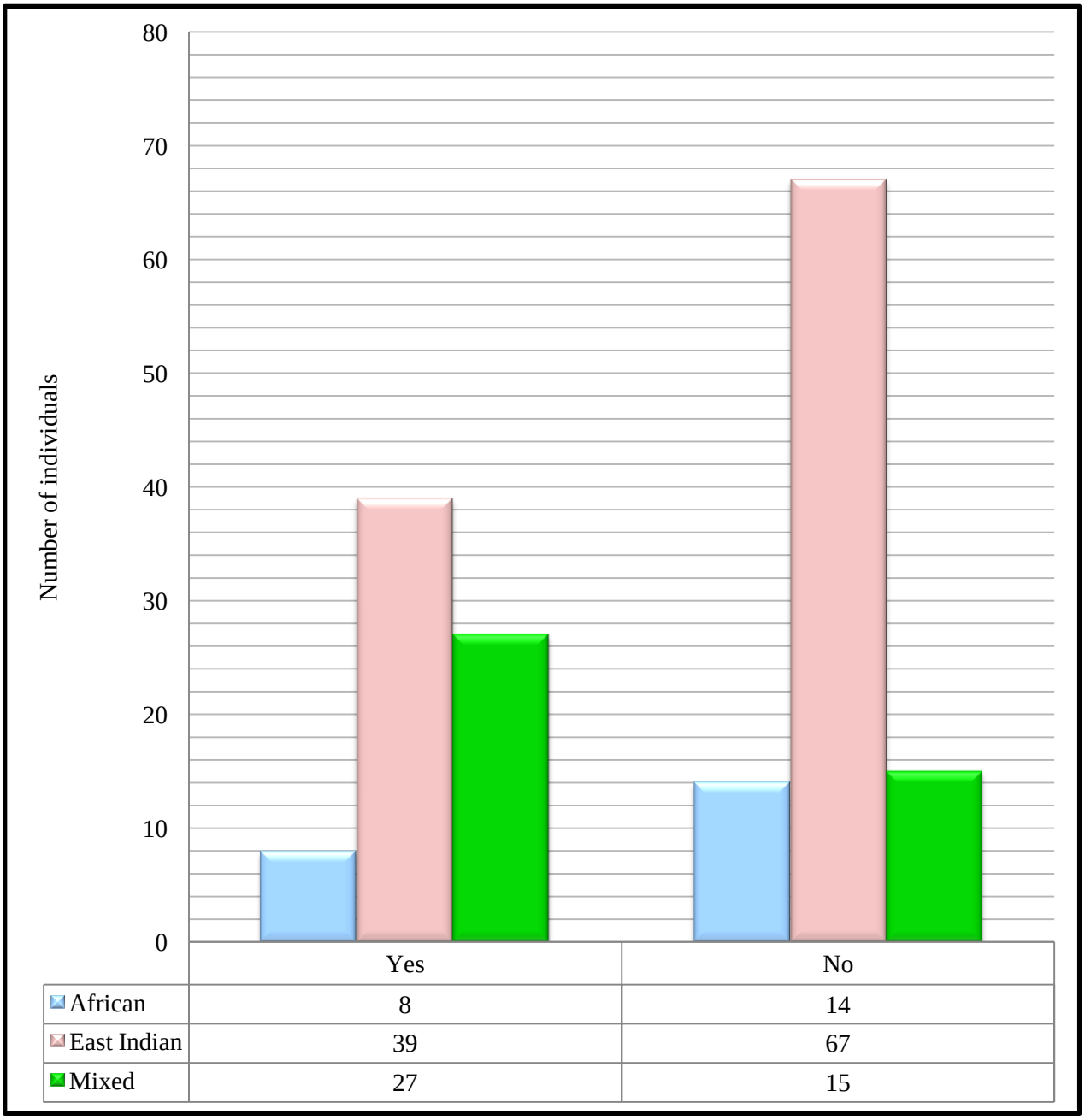
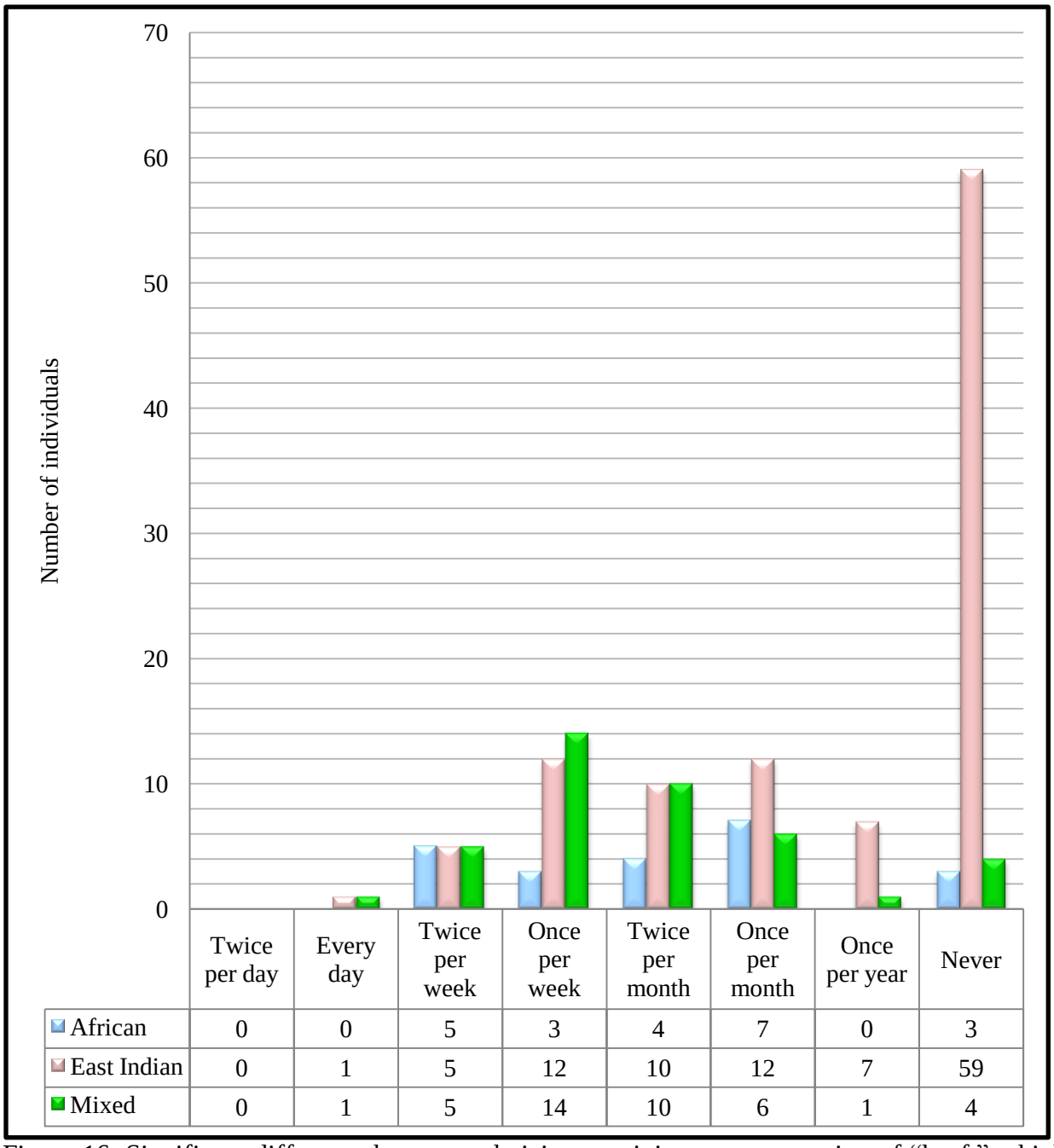


Figure 15. Significant difference between ethnicity pertaining to awareness that "vegetarians are at greater risk for the deficiency"

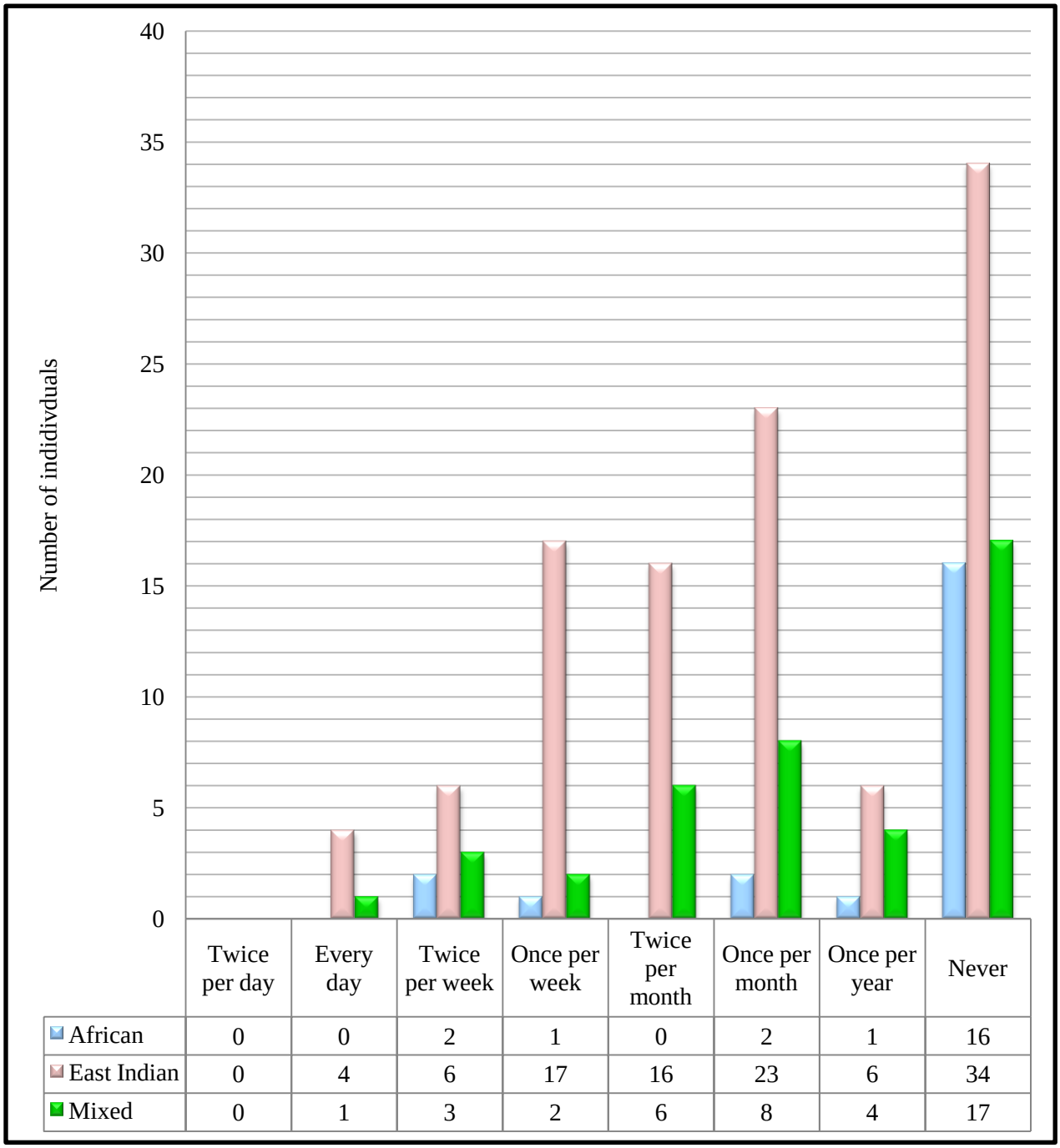
The East Indian participants were less aware that vegetarians were at greater risk for this anaemia. Most of the individuals from the ethnicities were unaware of this information. Only a few of the sample participants were aware. There was no missing data for this question; therefore one hundred and seventy individuals answered the question making the results more valid.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
African	0	0	5	3	4	7	0	3
East Indian	0	1	5	12	10	12	7	59
Mixed	0	1	5	14	10	6	1	4

Figure 16. Significant difference between ethnicity pertaining to consumption of “beef,” a high iron containing food

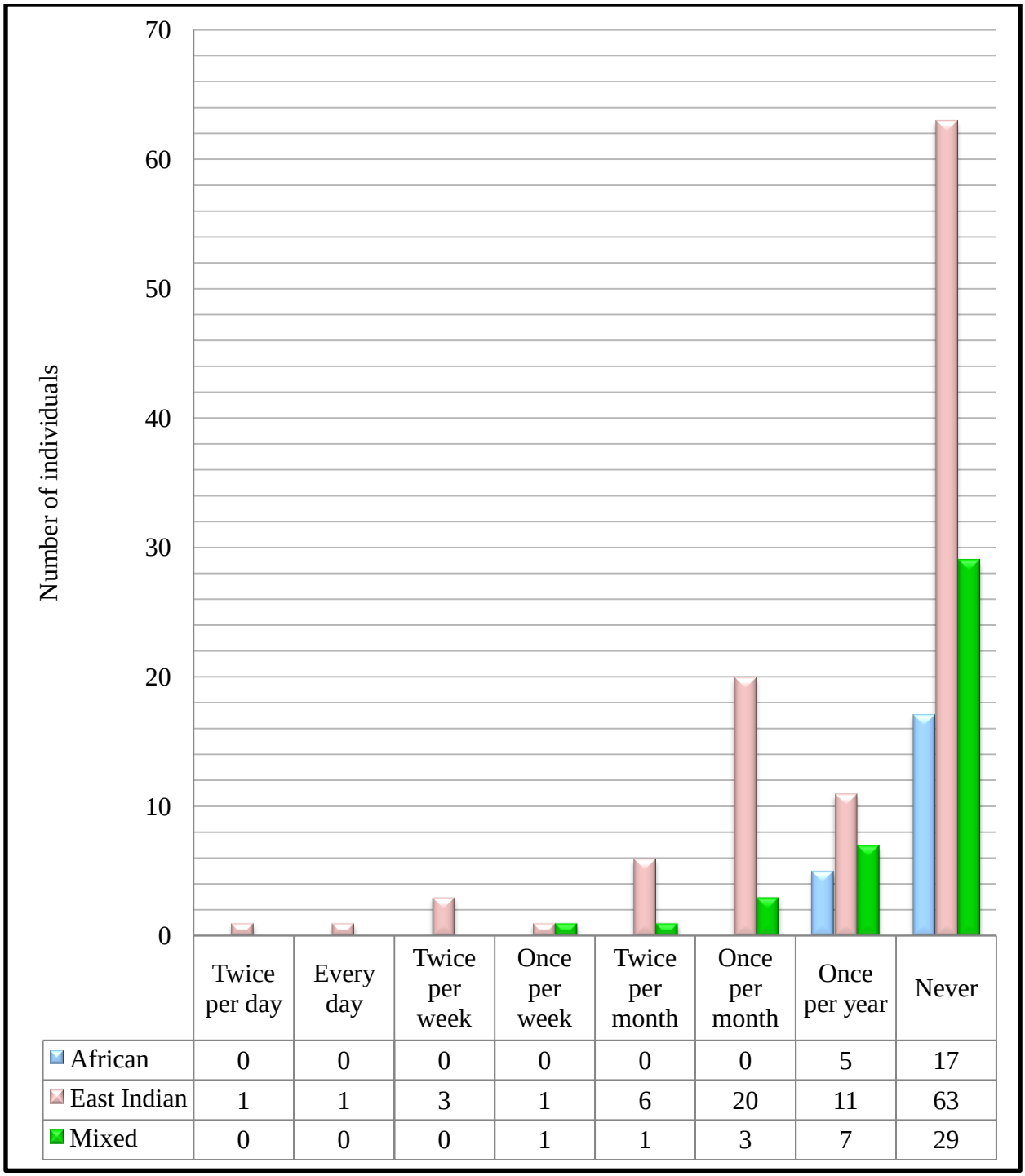
A large number of the East Indian sampled participants never consumed beef. A large number of the mixed participants consumed beef once per week and a large number of the African sampled participants consumed beef once per month. There was only one missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
African	0	0	2	1	0	2	1	16
East Indian	0	4	6	17	16	23	6	34
Mixed	0	1	3	2	6	8	4	17

Figure 17. Significant difference between ethnicity pertaining to consumption of "soybean," a high iron containing food

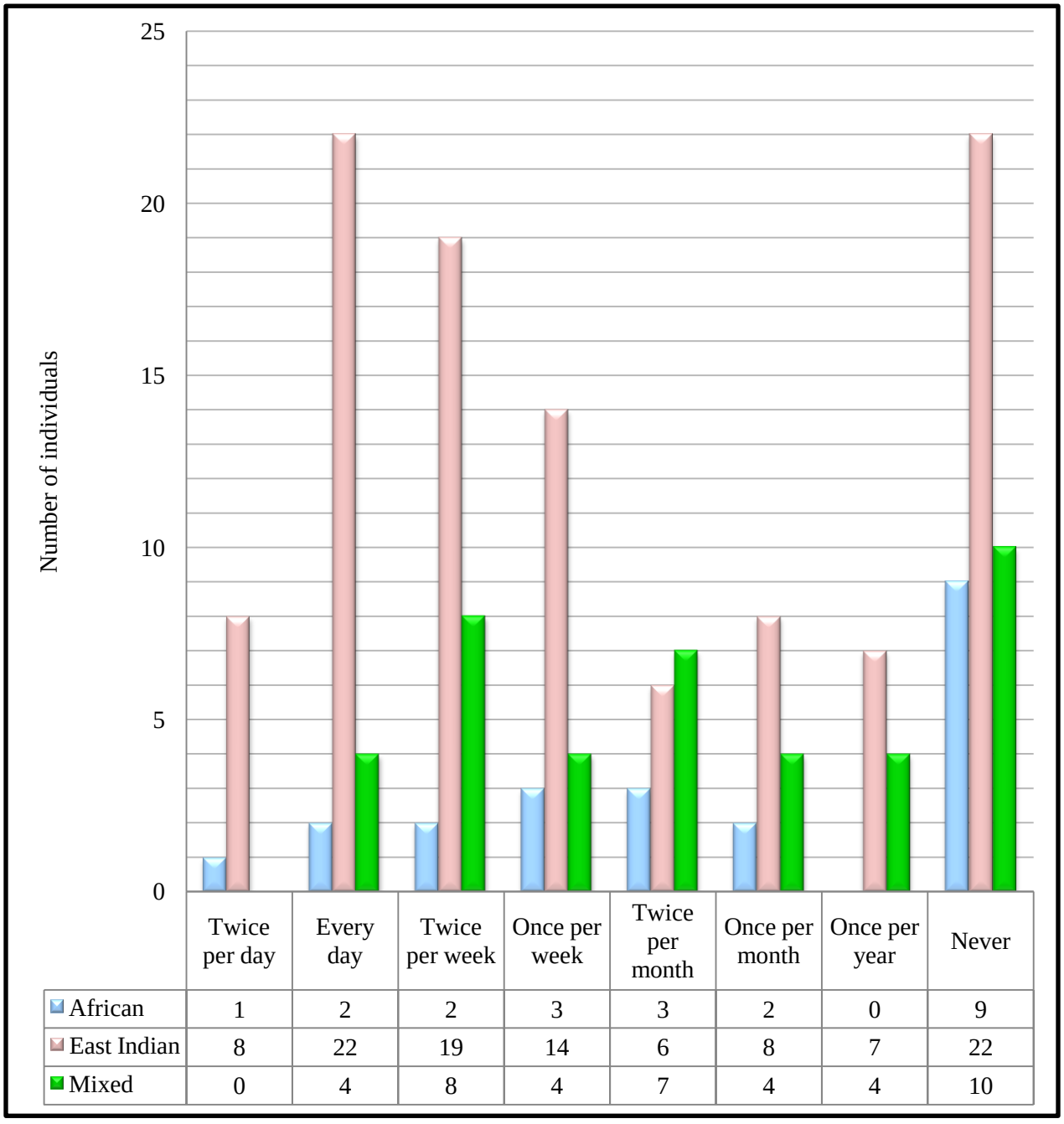
All of the ethnic groups never consumed soybean. Some of the East Indian and mixed sampled participants consumed soybean twice per month. There was only one missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
African	0	0	0	0	0	0	5	17
East Indian	1	1	3	1	6	20	11	63
Mixed	0	0	0	1	1	3	7	29

Figure 18. Significant difference between ethnicity pertaining to consumption of "oysters," a high iron containing food

Most of the ethnic groups never consumed oysters. Most of the East Indian participants consumed oysters up to once per month. There was only one missing data.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
African	1	2	2	3	3	2	0	9
East Indian	8	22	19	14	6	8	7	22
Mixed	0	4	8	4	7	4	4	10

Figure 19. Significant difference between ethnicity pertaining to consumption of "coffee," an iron absorption inhibiting food

The same number of East Indian sampled participants consumed coffee every day as well as never. Most of the mixed and African participants never consumed coffee. Only a few mixed and Africans consumed coffee twice per week. There was only one missing data for this question.

Table 25. Mean comparison between vegetarian status and awareness of the term, function, worldwide relation, having the deficiency, family relation and symptoms of iron deficiency

Questions			Options	Sum of Squares	d.f.	Mean Square	F	Sig.
4	Heard of the term for the deficiency		Between groups	.775	3	.258	1.793	.150
			Within Groups	23.930	166	.144		
			Total	24.706	169			
5	Iron helps store and use oxygen		Between groups	2.430	3	.810	1.078	.360
			Within Groups	124.746	166	.751		
			Total	127.176	169			
6	Deficiency is worldwide		Between groups	.175	3	.058	.265	.851
			Within Groups	36.672	166	.221		
			Total	36.847	169			
7	Have the deficiency		Between groups	2.186	3	.729	2.070	.106
			Within Groups	58.426	166	.352		
			Total	60.612	169			
8	Family members anaemia		Between groups	.861	3	.287	.559	.643
			Within Groups	85.262	166	.514		
			Total	86.124	169			
9	Symptoms	Tiredness	Between Groups	.761	3	.254	1.365	.255
			Within Groups	30.862	166	.186		
			Total	31.624	169			
		Light skin	Between Groups	.146	3	.049	.228	.877
			Within Groups	35.554	166	.214		
			Total	35.700	169			
		Weakness	Between Groups	.540	3	.180	.841	.473
			Within Groups	35.554	166	.214		
			Total	36.094	169			
		Loss of breath	Between Groups	.569	3	.190	.760	.518
			Within Groups	41.454	166	.250		
			Total	42.024	169			
		Headache	Between Groups	.183	3	.061	.249	.862
			Within Groups	40.811	166	.246		
			Total	40.994	169			
		Light headedness	Between Groups	.406	3	.135	.535	.659
			Within Groups	42.041	166	.253		
			Total	42.447	169			
		Chilly hands and feet	Between Groups	.210	3	.070	.309	.819
			Within Groups	37.678	166	.227		
			Total	37.888	169			
		Belly pain	Between Groups	.097	3	.032	.263	.852
			Within Groups	20.514	166	.124		
			Total	20.612	169			
		Irritability	Between Groups	.553	3	.184	1.001	.394
			Within Groups	30.559	166	.184		
			Total	31.112	169			

There was no significance between vegetarian status and awareness in this table. ANOVA values were above 0.05 showing no significance.

Table 26. Mean comparison between vegetarian status and awareness of symptoms, diet effect, diet risk, iron in food, iron foods, foods that reduce absorption and vegetarian risk

Questions			Options	Sum of Squares	d.f.	Mean Square	F	Sig.
9	Symptoms	Soreness of tongue	Between Groups	.277	3	.092	.644	.588
			Within Groups	23.776	166	.143		
			Total	24.053	169			
		Weak nails	Between Groups	.580	3	.193	1.034	.379
			Within Groups	31.043	166	.187		
			Total	31.624	169			
		Fast heartbeat	Between Groups	.368	3	.123	.597	.618
			Within Groups	34.080	166	.205		
			Total	34.447	169			
		Deprived appetite	Between Groups	.235	3	.078	.429	.732
			Within Groups	30.353	166	.183		
			Total	30.588	169			
		Strange craving	Between Groups	.891	3	.297	1.659	.178
			Within Groups	29.698	166	.179		
			Total	30.588	169			
		All of the above	Between Groups	.132	3	.044	.416	.742
			Within Groups	17.516	166	.106		
			Total	17.647	169			
		None of the above	Between Groups	.003	3	.001	.056	.983
			Within Groups	2.944	166	.018		
			Total	2.947	169			
		I don’t know	Between Groups	.781	3	.260	1.857	.139
			Within Groups	23.272	166	.140		
			Total	24.053	169			
10	Deficiency affected by the diet		Between Groups	.016	3	.005	.133	.940
			Within Groups	6.696	166	.040		
			Total	6.712	169			
11	Well balanced diet reduce the risk		Between Groups	.123	3	.041	.162	.922
			Within Groups	41.930	166	.253		
			Total	42.053	169			
12	Know that there is iron in food		Between Groups	.008	3	.003	.094	.963
			Within Groups	4.845	166	.029		
			Total	4.853	169			
13	Aware of high iron foods		Between Groups	.263	3	.088	.595	.619
			Within Groups	24.443	166	.147		
			Total	24.706	169			
14	Foods can reduce iron absorption		Between Groups	1.804	3	.601	2.697	.048
			Within Groups	37.019	166	.223		
			Total	38.824	169			
15	Vegetarians are at greater risk		Between Groups	.642	3	.214	.863	.461
			Within Groups	41.146	166	.248		
			Total	41.788	169			

Significance was found with vegetarian status and knowing that foods reduce iron absorption.

Table 27. Mean comparison between vegetarian status and awareness of test and confidence in the meaning, effect, risk, treatment, foods to reduce risk, function of iron, consequences, haemoglobin relation, women risk, children risk, social impact, heart risk and beef consumption

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
16	Aware of how the deficiency is tested	Between Groups	.702	3	.234	1.467	.226
		Within Groups	26.498	166	.160		
		Total	27.200	169			
17	Meaning of the deficiency	Between Groups	7.589	3	2.530	2.019	.113
		Within Groups	207.964	166	1.253		
		Total	215.553	169			
18	Effects of the deficiency	Between Groups	7.957	3	2.652	2.456	.065
		Within Groups	179.243	166	1.080		
		Total	187.200	169			
19	What increases the risk	Between Groups	6.983	3	2.328	2.056	.108
		Within Groups	187.964	166	1.132		
		Total	194.947	169			
20	What to do if levels are low	Between Groups	6.451	3	2.150	1.799	.149
		Within Groups	198.426	166	1.195		
		Total	204.876	169			
21	What foods can reduce your risk	Between Groups	7.317	3	2.439	1.838	.142
		Within Groups	220.306	166	1.327		
		Total	227.624	169			
22	Job of iron in the body	Between Groups	2.454	3	.818	.646	.586
		Within Groups	210.041	166	1.265		
		Total	212.494	169			
23	Dangers of anaemia	Between Groups	5.414	3	1.805	1.364	.256
		Within Groups	219.698	166	1.323		
		Total	225.112	169			
24	Haemoglobin and iron relationship	Between Groups	2.957	3	.986	.626	.599
		Within Groups	261.448	166	1.575		
		Total	264.406	169			
25	Women at more risk	Between Groups	6.766	3	2.255	1.323	.269
		Within Groups	282.858	166	1.704		
		Total	289.624	169			
26	Children at risk due to poor diet	Between Groups	4.807	3	1.602	1.409	.242
		Within Groups	188.746	166	1.137		
		Total	193.553	169			
27	Social life affecting risk	Between Groups	8.015	3	2.672	1.923	.128
		Within Groups	230.579	166	1.389		
		Total	238.594	169			
28	Heart problems can be caused	Between Groups	3.904	3	1.301	.892	.447
		Within Groups	242.219	166	1.459		
		Total	246.124	169			
29	Beef	Between Groups	36.908	3	12.303	3.746	.012
		Within Groups	541.944	165	3.285		
		Total	578.852	168			

There was significance in this table with vegetarian status and beef consumption.

Table 28. Mean comparison between vegetarian status and consumption of chicken, liver, turkey, fish, cereal, lentils, soybean, broccoli, spinach, clams, oysters, pumpkin seeds and raisins

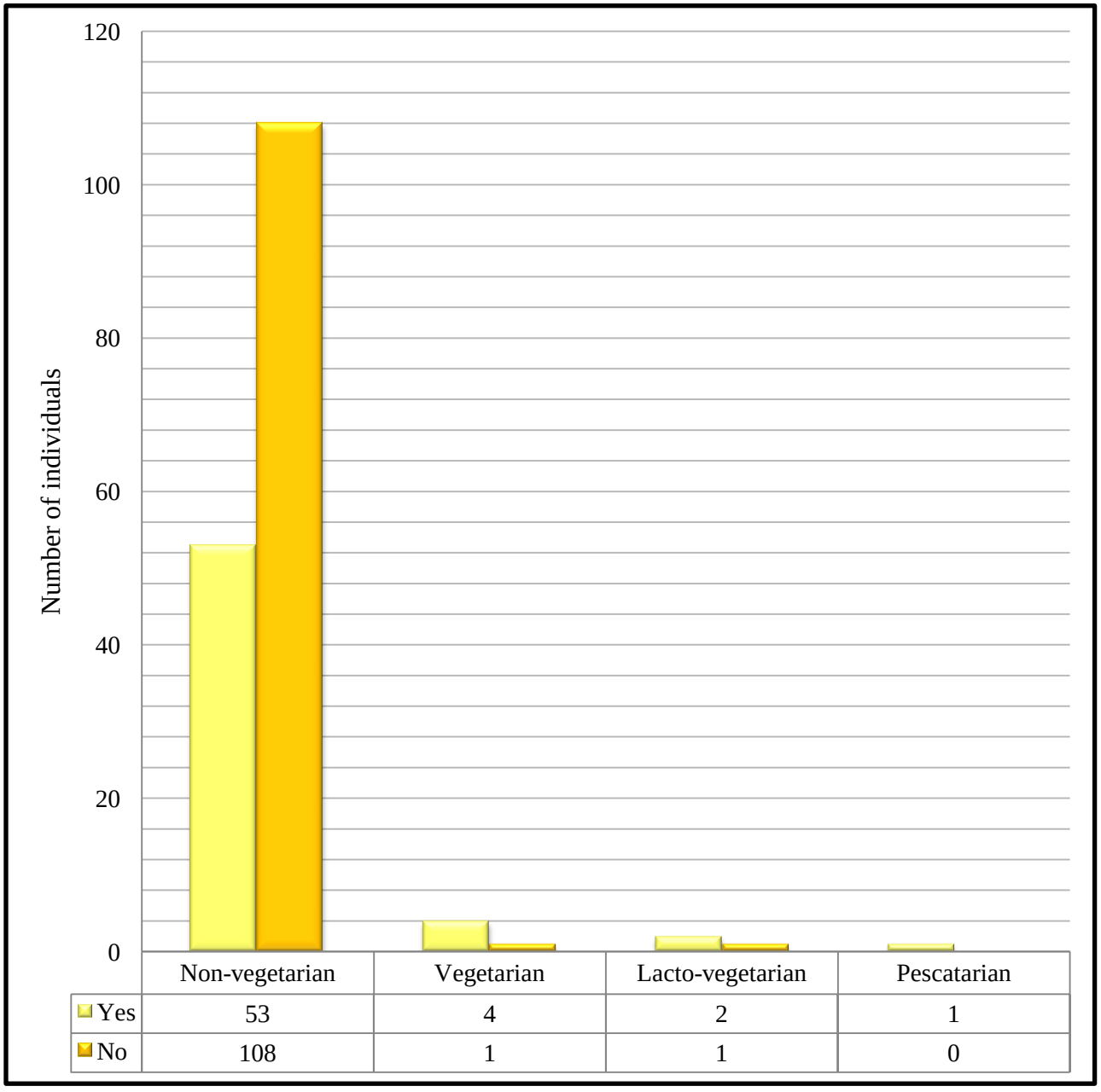
Question		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
29	Chicken	Between Groups	230.025	3	76.675	147.152	.000
		Within Groups	85.975	165	.521		
		Total	316.000	168			
	Liver	Between Groups	23.588	3	7.863	2.994	.032
		Within Groups	433.394	165	2.627		
		Total	456.982	168			
	Turkey	Between Groups	20.400	3	6.800	3.720	.013
		Within Groups	301.600	165	1.828		
		Total	322.000	168			
	Fish	Between Groups	59.056	3	19.685	10.741	.000
		Within Groups	302.400	165	1.833		
		Total	361.456	168			
	Fortified cereal	Between Groups	11.749	3	3.916	1.009	.390
		Within Groups	640.310	165	3.881		
		Total	652.059	168			
	Lentils	Between Groups	6.157	3	2.052	.992	.398
		Within Groups	341.310	165	2.069		
		Total	347.467	168			
	Soybeans	Between Groups	54.833	3	18.278	6.034	.001
		Within Groups	499.842	165	3.029		
		Total	554.675	168			
	Broccoli	Between Groups	10.533	3	3.511	1.250	.293
		Within Groups	463.467	165	2.809		
		Total	474.000	168			
	Spinach	Between Groups	8.158	3	2.719	1.025	.383
		Within Groups	437.842	165	2.654		
		Total	446.000	168			
	Clams	Between Groups	1.541	3	.514	.605	.613
		Within Groups	140.175	165	.850		
		Total	141.716	168			
	Oysters	Between Groups	19.815	3	6.605	4.253	.006
		Within Groups	256.244	165	1.553		
		Total	276.059	168			
	Pumpkin seeds	Between Groups	10.417	3	3.472	1.666	.176
		Within Groups	343.867	165	2.084		
		Total	354.284	168			
	Raisins	Between Groups	13.674	3	4.558	1.533	.208
		Within Groups	490.575	165	2.973		
		Total	504.249	168			

There was significance with vegetarian status and chicken, liver, turkey, fish, soybean and oyster consumption. Values were below 0.05 significance (sig.).

Table 29. Mean comparison between vegetarian status and consumption of iron supplement, coffee, tea, dairy, cocoa, whole grain, soft drink, legume, vegetable, fruit, vitamin C, risk based on diet record, thoughts on own diet

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
30	Iron supplement	Between Groups	.923	3	.308	1.944	.124
		Within Groups	26.277	166	.158		
		Total	27.200	169			
31	Coffee	Between Groups	14.922	3	4.974	.877	.454
		Within Groups	935.610	165	5.670		
		Total	950.533	168			
	Tea	Between Groups	13.234	3	4.411	1.242	.296
		Within Groups	585.867	165	3.551		
		Total	599.101	168			
	Dairy products	Between Groups	4.785	3	1.595	.402	.752
		Within Groups	654.967	165	3.969		
		Total	659.751	168			
	Cocoa products	Between Groups	10.180	3	3.393	1.095	.353
		Within Groups	511.442	165	3.100		
		Total	521.621	168			
	Whole grain	Between Groups	5.665	3	1.888	.644	.588
		Within Groups	483.660	165	2.931		
		Total	489.325	168			
	Soft drink	Between Groups	4.342	3	1.447	.350	.789
		Within Groups	682.794	165	4.138		
		Total	687.136	168			
	Legumes	Between Groups	7.478	3	2.493	1.394	.247
		Within Groups	295.067	165	1.788		
		Total	302.544	168			
	Green leafy vegetables	Between Groups	2.275	3	.758	.601	.615
		Within Groups	208.210	165	1.262		
		Total	210.485	168			
	Fruit	Between Groups	1.726	3	.575	.390	.760
		Within Groups	243.410	165	1.475		
		Total	245.136	168			
	Vitamin C supplement	Between Groups	7.128	3	2.376	.595	.619
		Within Groups	658.967	165	3.994		
		Total	666.095	168			
32	Dietary risk for the deficiency	Between Groups	2.011	3	.670	.345	.792
		Within Groups	287.088	148	1.940		
		Total	289.099	151			
33	Think you consume enough iron	Between Groups	.625	3	.208	.353	.787
		Within Groups	97.964	166	.590		
		Total	98.588	169			

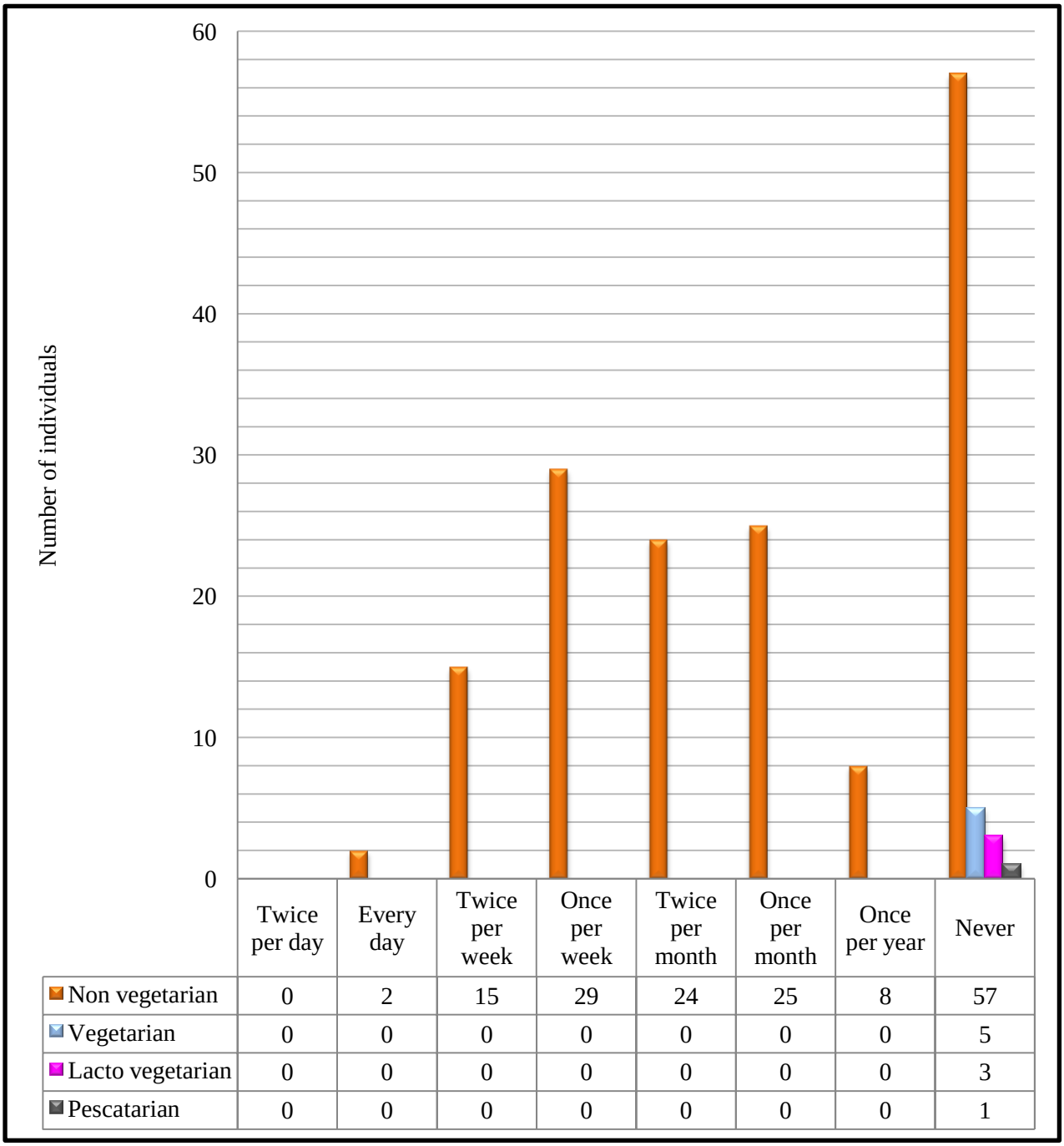
There was no significance with vegetarian status and the information in this table. No values were below 0.05.



	Non-vegetarian	Vegetarian	Lacto-vegetarian	Pescatarian
Yes	53	4	2	1
No	108	1	1	0

Figure 20. Significant difference between vegetarian status with “awareness that there are foods that can reduce iron absorption”

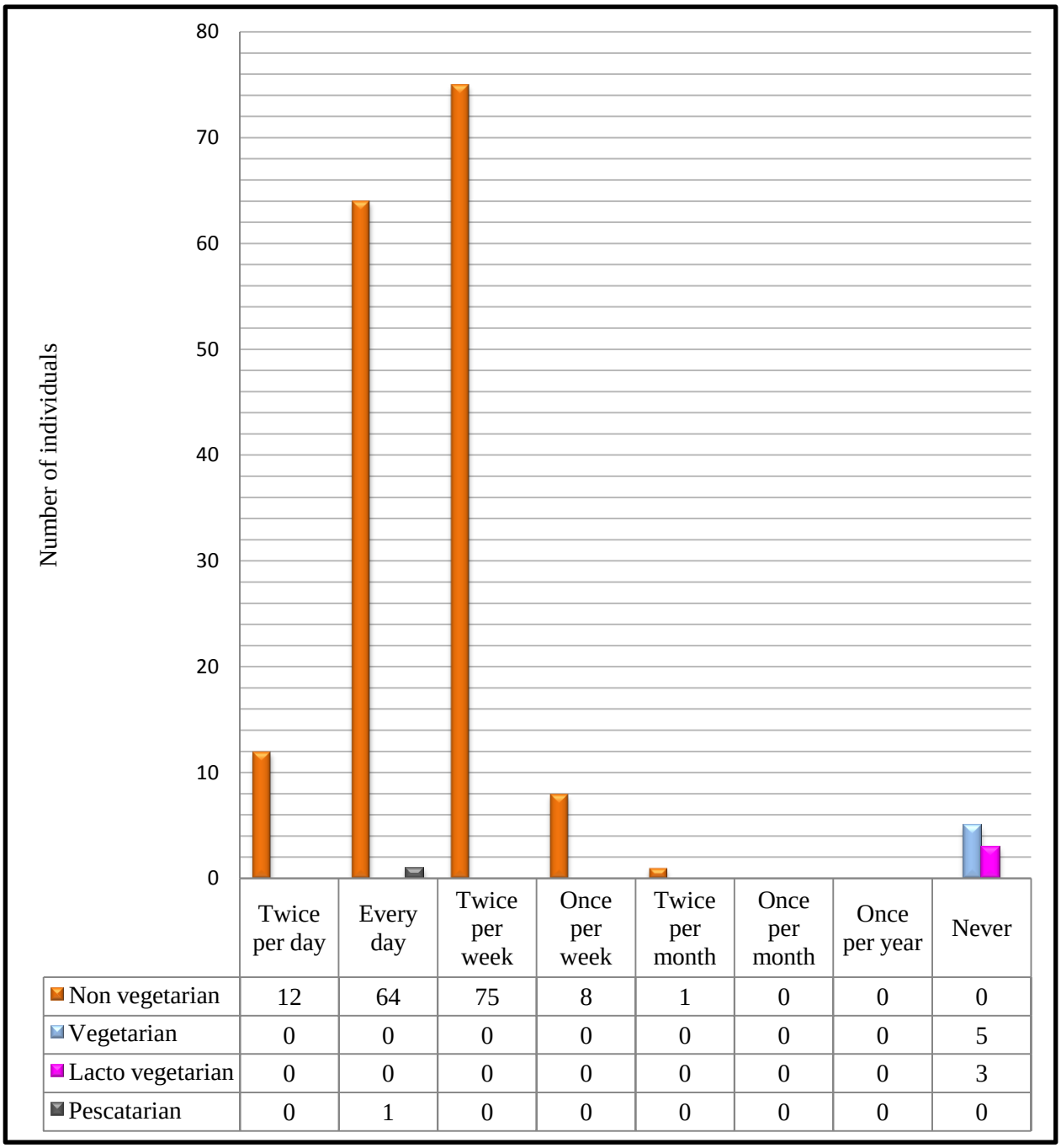
A large number of the non-vegetarian sampled participants were unaware of foods that increase iron absorption. A large number of the vegetarian and lacto-vegetarians were aware. The pescatarian was aware that foods reduce iron absorption. There was no missing data for this question; therefore one hundred and seventy individuals answered the question making the results more valid.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Non vegetarian	0	2	15	29	24	25	8	57
Vegetarian	0	0	0	0	0	0	0	5
Lacto vegetarian	0	0	0	0	0	0	0	3
Pescatarian	0	0	0	0	0	0	0	1

Figure 21. Significant difference between vegetarian status with consumption of “beef,” a high iron containing food

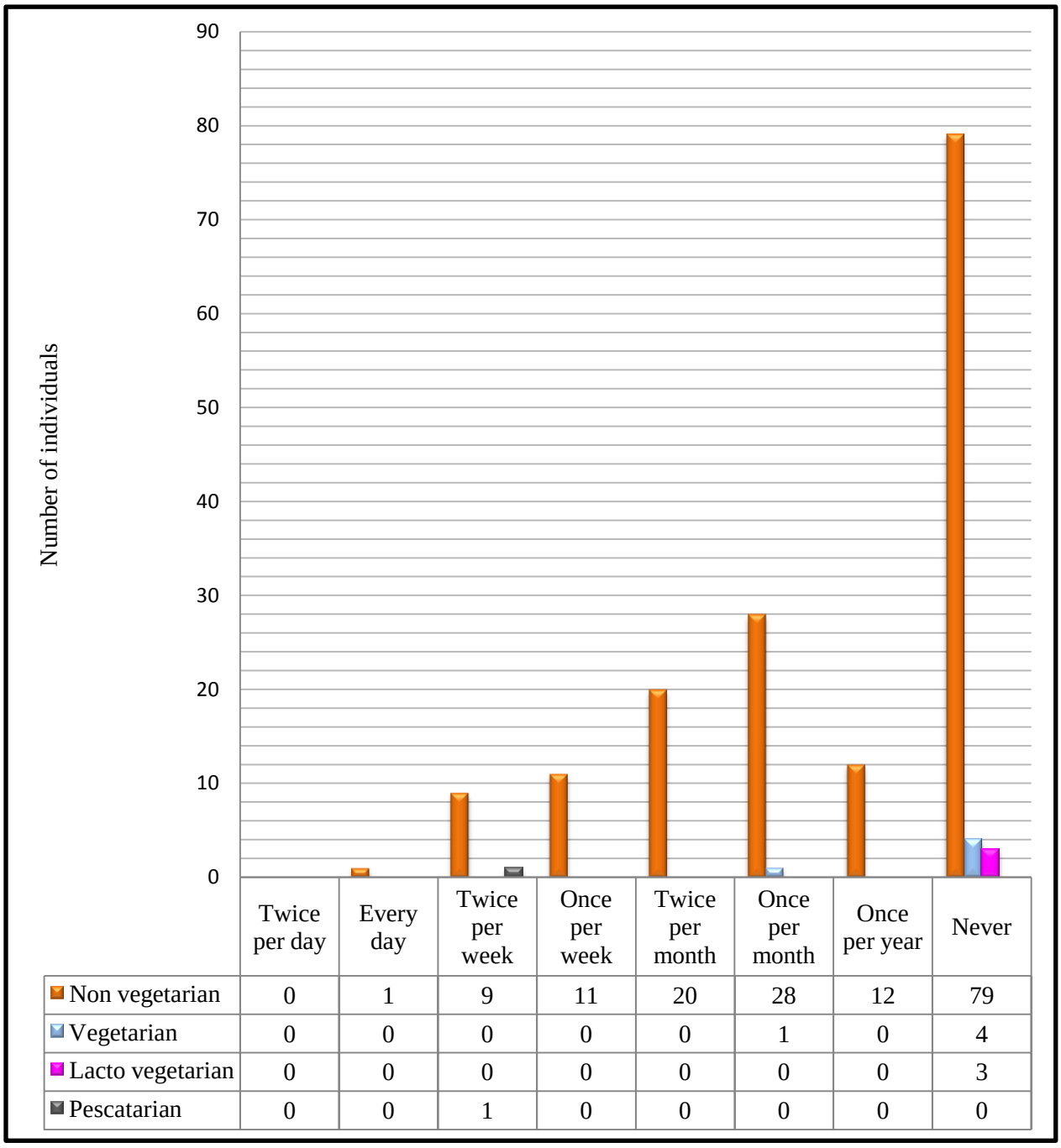
This graph showed that a large number of the non-vegetarian sampled participants never consumed beef. The vegetarians, lacto- vegetarians and pescatarian also never consumed beef. There was one missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Non vegetarian	12	64	75	8	1	0	0	0
Vegetarian	0	0	0	0	0	0	0	5
Lacto vegetarian	0	0	0	0	0	0	0	3
Pescatarian	0	1	0	0	0	0	0	0

Figure 22. Significant difference between vegetarian status pertaining to consumption of "chicken," a high iron containing food

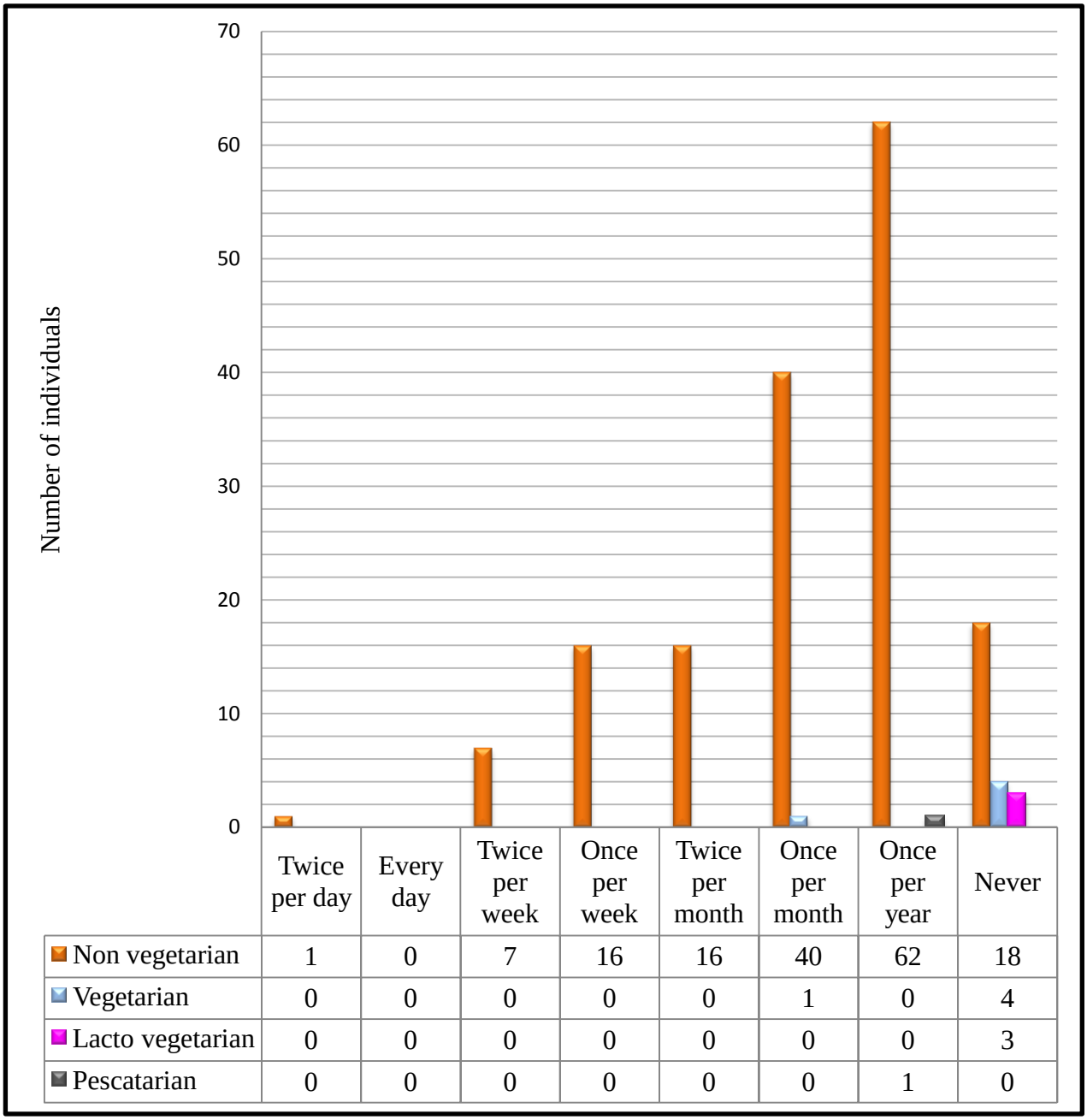
A large number of the non-vegetarian sampled participants consumed chicken twice per week. The vegetarians, lacto- vegetarians never consumed chicken. There was one missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Non vegetarian	0	1	9	11	20	28	12	79
Vegetarian	0	0	0	0	0	1	0	4
Lacto vegetarian	0	0	0	0	0	0	0	3
Pescatarian	0	0	1	0	0	0	0	0

Figure 23. Significant difference between vegetarian status pertaining to consumption of "liver," a high iron containing food

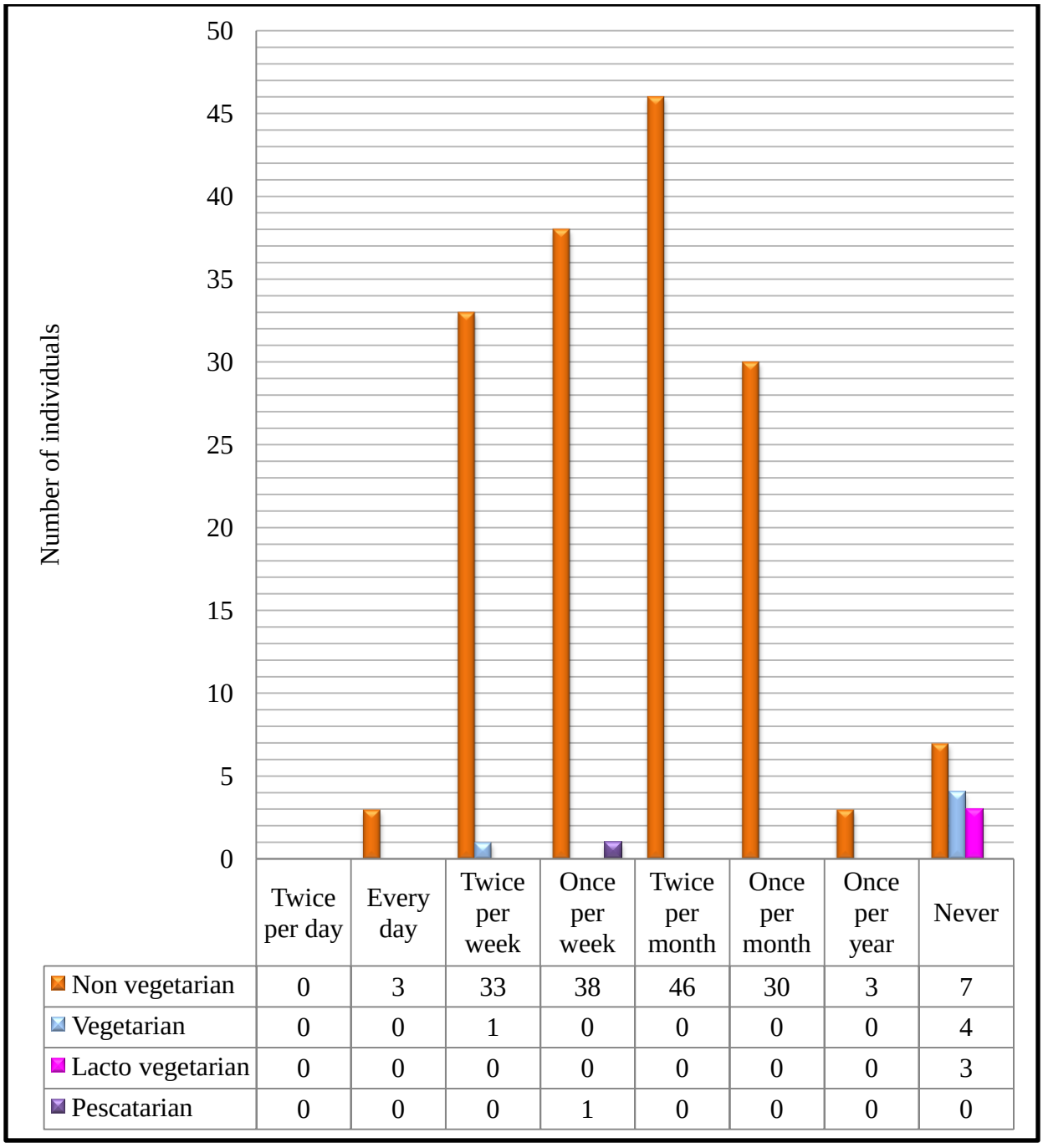
A large number of the non-vegetarian sampled participants never consumed liver. The vegetarians, lacto- vegetarians also never consumed chicken. The pescatarian consumed liver twice per week. There was one missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Non vegetarian	1	0	7	16	16	40	62	18
Vegetarian	0	0	0	0	0	1	0	4
Lacto vegetarian	0	0	0	0	0	0	0	3
Pescatarian	0	0	0	0	0	0	1	0

Figure 24. Significant difference between vegetarian status pertaining to consumption of "turkey," a high iron containing food

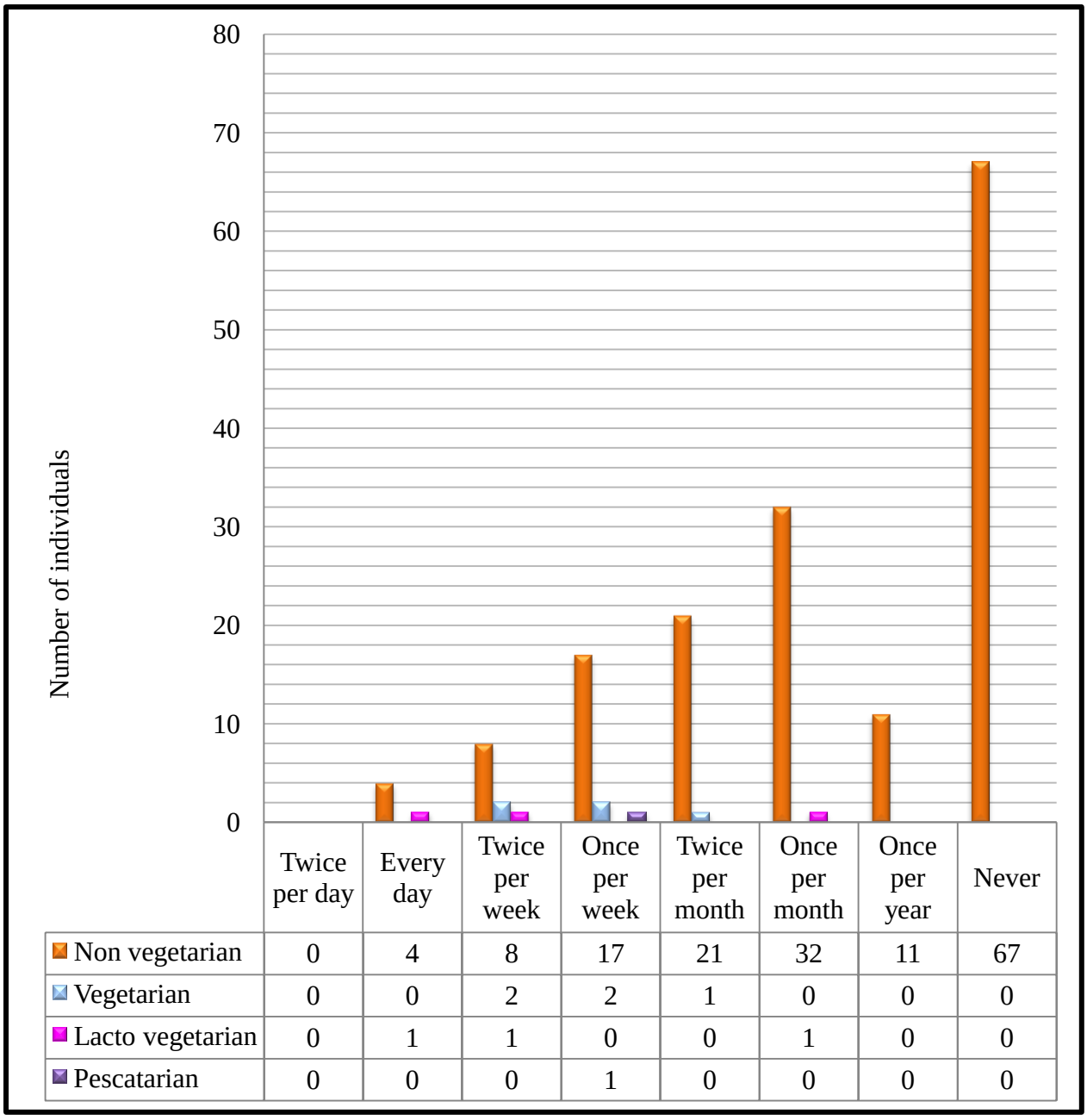
A large number of the non-vegetarian sampled participants consumed turkey once per year. The vegetarians, lacto- vegetarians never consumed turkey. The pescatarian consumed turkey once per year. There was one missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Non vegetarian	0	3	33	38	46	30	3	7
Vegetarian	0	0	1	0	0	0	0	4
Lacto vegetarian	0	0	0	0	0	0	0	3
Pescatarian	0	0	0	1	0	0	0	0

Figure 25. Significant difference between vegetarian status pertaining to consumption of “fish,” a high iron containing food

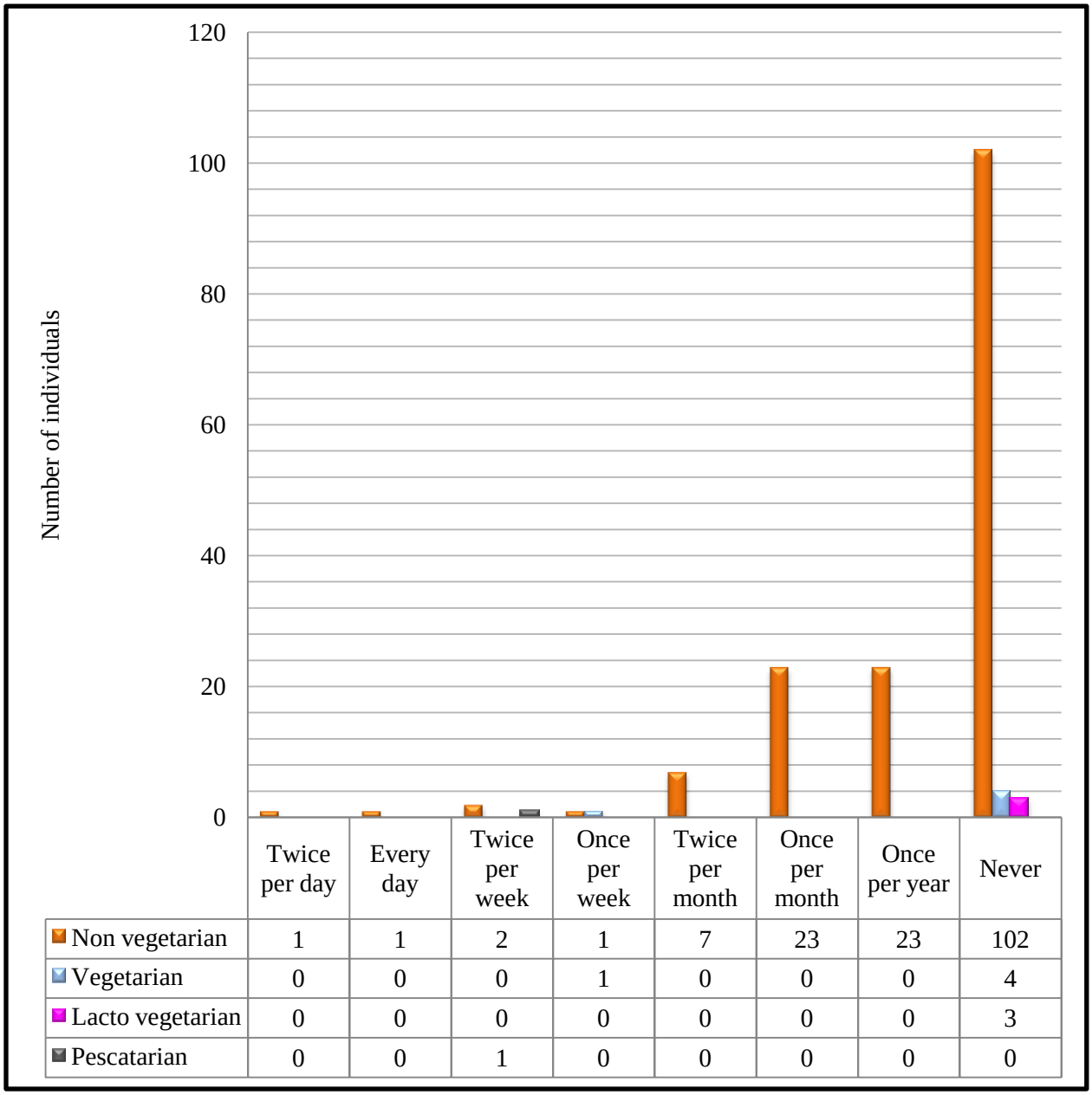
A large number of the non-vegetarian sampled participants consumed fish twice per month. The vegetarians, lacto-vegetarians never consumed fish. The pescatarian consumed fish once per week. There was one missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Non vegetarian	0	4	8	17	21	32	11	67
Vegetarian	0	0	2	2	1	0	0	0
Lacto vegetarian	0	1	1	0	0	1	0	0
Pescatarian	0	0	0	1	0	0	0	0

Figure 26. Significant difference between vegetarian status pertaining to consumption of "soybean," a high iron containing food

A large number of the non-vegetarian sampled participants never consumed soybean. The vegetarians consumed soybeans everyday and twice per week when lacto-vegetarians consumed soybean every day, twice per week and once per month evenly. The pescatarian consumed soybean twice per week. There was one missing data for this question.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Non vegetarian	1	1	2	1	7	23	23	102
Vegetarian	0	0	0	1	0	0	0	4
Lacto vegetarian	0	0	0	0	0	0	0	3
Pescatarian	0	0	1	0	0	0	0	0

Figure 27. Significant difference between vegetarian status pertaining to consumption of "oyster," a high iron containing food

A large number of the non-vegetarian sampled participants never consumed oysters. Most of the vegetarians, lacto- vegetarians also never consumed oysters. The pescatarian consumed oysters twice per week. There was one missing data for this question.

Table 30. Mean comparison between dietary risk and awareness of the term, function, worldwide relation, having the deficiency, family relation and symptoms of iron deficiency

Questions			Options	Sum of Squares	d.f.	Mean Square	F	Sig.
4	Heard of the term for the deficiency		Between Groups	4.036	3	1.345	9.570	.000
			Within Groups	20.806	148	.141		
			Total	24.842	151			
5	Iron helps store and use oxygen		Between Groups	4.383	3	1.461	2.060	.108
			Within Groups	104.960	148	.709		
			Total	109.342	151			
6	Deficiency is worldwide		Between Groups	.386	3	.129	.547	.651
			Within Groups	34.818	148	.235		
			Total	35.204	151			
7	Have the deficiency		Between Groups	1.918	3	.639	1.767	.156
			Within Groups	53.556	148	.362		
			Total	55.474	151			
8	Family members anaemia		Between Groups	.725	3	.242	.457	.713
			Within Groups	78.268	148	.529		
			Total	78.993	151			
9	Symptoms	Tiredness	Between Groups	2.008	3	.669	4.061	.008
			Within Groups	24.387	148	.165		
			Total	26.395	151			
		Light skin	Between Groups	1.846	3	.615	2.904	.037
			Within Groups	31.358	148	.212		
			Total	33.204	151			
		Weakness	Between Groups	1.967	3	.656	3.362	.020
			Within Groups	28.868	148	.195		
			Total	30.836	151			
		Loss of breath	Between Groups	2.539	3	.846	3.574	.016
			Within Groups	35.040	148	.237		
			Total	37.579	151			
		Headache	Between Groups	2.229	3	.743	3.188	.026
			Within Groups	34.482	148	.233		
			Total	36.711	151			
		Light headedness	Between Groups	4.014	3	1.338	5.830	.001
			Within Groups	33.960	148	.229		
			Total	37.974	151			
		Chilly hands and feet	Between Groups	2.078	3	.693	3.105	.028
			Within Groups	33.020	148	.223		
			Total	35.099	151			
		Belly pain	Between Groups	.336	3	.112	.863	.462
			Within Groups	19.184	148	.130		
			Total	19.520	151			

Significance was found with comparing diet risk with hearing of the term, the symptoms tiredness, light skin, weakness, loss of breath, headache, light headedness, chilly hands and feet.

Table 31. Mean comparison between dietary risk and awareness of symptoms, diet effect, diet risk, iron in food, iron foods and foods that reduce absorption

Questions			Options	Sum of Squares	d.f.	Mean Square	F	Sig.
9	Symptoms	Irritability	Between Groups	.899	3	.300	1.607	.190
			Within Groups	27.601	148	.186		
			Total	28.500	151			
		Soreness of tongue	Between Groups	.073	3	.024	.159	.924
			Within Groups	22.769	148	.154		
			Total	22.842	151			
		Weak nails	Between Groups	1.516	3	.505	2.674	.049
			Within Groups	27.958	148	.189		
			Total	29.474	151			
		Fast heartbeat	Between Groups	.793	3	.264	1.321	.270
			Within Groups	29.602	148	.200		
			Total	30.395	151			
		Deprived appetite	Between Groups	.622	3	.207	1.101	.351
			Within Groups	27.878	148	.188		
			Total	28.500	151			
		Strange craving	Between Groups	1.436	3	.479	2.617	.053
			Within Groups	27.064	148	.183		
			Total	28.500	151			
		All of the above	Between Groups	.345	3	.115	1.001	.394
			Within Groups	17.023	148	.115		
			Total	17.368	151			
		None of the above	Between Groups	.006	3	.002	.152	.928
			Within Groups	1.968	148	.013		
			Total	1.974	151			
		I don't know	Between Groups	2.843	3	.948	7.773	.000
			Within Groups	18.045	148	.122		
			Total	20.888	151			
10	Deficiency affected by the diet		Between Groups	.009	3	.003	.087	.967
			Within Groups	4.827	148	.033		
			Total	4.836	151			
11	Balanced diet reduce the risk		Between Groups	.114	3	.038	.150	.930
			Within Groups	37.439	148	.253		
			Total	37.553	151			
12	Know that there is iron in food		Between Groups	.062	3	.021	1.070	.364
			Within Groups	2.878	148	.019		
			Total	2.941	151			
13	Aware of high iron foods		Between Groups	.528	3	.176	1.238	.298
			Within Groups	21.025	148	.142		
			Total	21.553	151			
14	Foods that reduce iron absorption		Between Groups	1.323	3	.441	1.966	.122
			Within Groups	33.197	148	.224		
			Total	34.520	151			

There was significance with weak nails as well as with not knowing the symptoms of the deficiency.

Table 32. Mean comparison between dietary risk and awareness of vegetarian risk, test and confidence in the meaning, effect, risk, treatment, foods to reduce risk, function of iron, consequences, haemoglobin relation, women risk, children risk and social impact

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
15	Vegetarians are at greater risk	Between Groups	1.013	3	.338	1.372	.254
		Within Groups	36.454	148	.246		
		Total	37.467	151			
16	Aware of how the deficiency is tested	Between Groups	.459	3	.153	.935	.425
		Within Groups	24.218	148	.164		
		Total	24.678	151			
17	Meaning of the term	Between Groups	6.262	3	2.087	1.620	.187
		Within Groups	190.732	148	1.289		
		Total	196.993	151			
18	Effects of the deficiency	Between Groups	9.345	3	3.115	2.914	.036
		Within Groups	158.207	148	1.069		
		Total	167.553	151			
19	What increases risk	Between Groups	4.077	3	1.359	1.124	.341
		Within Groups	178.864	148	1.209		
		Total	182.941	151			
20	What to do it iron levels are low	Between Groups	1.395	3	.465	.367	.777
		Within Groups	187.598	148	1.268		
		Total	188.993	151			
21	What foods can reduce risk	Between Groups	2.623	3	.874	.639	.591
		Within Groups	202.371	148	1.367		
		Total	204.993	151			
22	Job of iron	Between Groups	3.457	3	1.152	.924	.431
		Within Groups	184.484	148	1.247		
		Total	187.941	151			
23	Dangers of anaemia	Between Groups	7.894	3	2.631	2.012	.115
		Within Groups	193.573	148	1.308		
		Total	201.467	151			
24	Haemoglobin and iron relationship	Between Groups	10.224	3	3.408	2.195	.091
		Within Groups	229.750	148	1.552		
		Total	239.974	151			
25	Women at greater risk	Between Groups	17.578	3	5.859	3.571	.016
		Within Groups	242.817	148	1.641		
		Total	260.395	151			
26	Children at risk due to poor diet	Between Groups	4.625	3	1.542	1.410	.242
		Within Groups	161.842	148	1.094		
		Total	166.467	151			
27	Social life affecting risk	Between Groups	2.893	3	.964	.647	.586
		Within Groups	220.732	148	1.491		
		Total	223.625	151			

There was significance found with confidence in knowing the effect of the deficiency on the body and confidence in knowing why women were at more risk for the deficiency.

Table 33. Mean comparison between dietary risk and awareness of heart risk, consumption of beef, liver, turkey, fish, cereal, lentils, soybean, broccoli, clams, oysters, pumpkin seeds, raisin and iron supplement

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
28	Heart problems from anaemia	Between Groups	12.404	3	4.135	2.922	.036
		Within Groups	209.432	148	1.415		
		Total	221.836	151			
29	Beef	Between Groups	2.436	3	.812	.230	.875
		Within Groups	519.074	147	3.531		
		Total	521.510	150			
	Chicken	Between Groups	.293	3	.098	.047	.987
		Within Groups	306.926	147	2.088		
		Total	307.219	150			
	Liver	Between Groups	9.735	3	3.245	1.208	.309
		Within Groups	394.953	147	2.687		
		Total	404.689	150			
	Turkey	Between Groups	1.541	3	.514	.253	.859
		Within Groups	298.393	147	2.030		
		Total	299.934	150			
	Fish	Between Groups	5.040	3	1.680	.732	.534
		Within Groups	337.146	147	2.294		
		Total	342.185	150			
	Fortified cereal	Between Groups	9.349	3	3.116	.806	.492
		Within Groups	568.439	147	3.867		
		Total	577.788	150			
	Lentils	Between Groups	2.879	3	.960	.472	.702
		Within Groups	299.068	147	2.034		
		Total	301.947	150			
	Soybeans	Between Groups	7.556	3	2.519	.740	.530
		Within Groups	500.616	147	3.406		
		Total	508.172	150			
	Broccoli	Between Groups	26.677	3	8.892	3.331	.021
		Within Groups	392.369	147	2.669		
		Total	419.046	150			
	Spinach	Between Groups	7.216	3	2.405	.964	.412
		Within Groups	366.982	147	2.496		
		Total	374.199	150			
	Clams	Between Groups	3.908	3	1.303	1.642	.182
		Within Groups	116.635	147	.793		
		Total	120.543	150			
	Oysters	Between Groups	7.655	3	2.552	2.099	.103
		Within Groups	178.742	147	1.216		
		Total	186.397	150			
	Pumpkin seeds	Between Groups	8.666	3	2.889	1.407	.243
		Within Groups	301.798	147	2.053		
		Total	310.464	150			
	Raisins	Between Groups	35.802	3	11.934	4.082	.008
		Within Groups	429.814	147	2.924		
		Total	465.616	150			

This table showed that there is significance with confidence in knowing that the deficiency leads to heart problems, as well as broccoli and raisin consumption when compared to dietary risk.

Table 34. Mean comparison between dietary risk and consumption of iron supplement, coffee, tea, dairy, cocoa, whole grain, soft drink, legume, vegetable, fruit, vitamin C, risk based on diet record, thoughts on own diet

Questions		Options	Sum of Squares	d.f.	Mean Square	F	Sig.
30	Iron supplement	Between Groups	.758	3	.253	1.564	.201
		Within Groups	23.919	148	.162		
		Total	24.678	151			
31	Coffee	Between Groups	12.816	3	4.272	.765	.515
		Within Groups	820.402	147	5.581		
		Total	833.219	150			
	Tea	Between Groups	12.732	3	4.244	1.156	.329
		Within Groups	539.586	147	3.671		
		Total	552.318	150			
	Dairy products	Between Groups	25.479	3	8.493	2.107	.102
		Within Groups	592.560	147	4.031		
		Total	618.040	150			
	Cocoa products	Between Groups	24.657	3	8.219	2.740	.045
		Within Groups	440.919	147	2.999		
		Total	465.576	150			
	Whole grain	Between Groups	16.534	3	5.511	1.906	.131
		Within Groups	425.016	147	2.891		
		Total	441.550	150			
	Soft drink	Between Groups	40.455	3	13.485	3.650	.014
		Within Groups	543.122	147	3.695		
		Total	583.576	150			
	Legumes	Between Groups	2.776	3	.925	.484	.694
		Within Groups	281.092	147	1.912		
		Total	283.868	150			
	Green leafy vegetables	Between Groups	.477	3	.159	.127	.944
		Within Groups	184.133	147	1.253		
		Total	184.609	150			
	Fruit	Between Groups	3.155	3	1.052	.785	.504
		Within Groups	197.017	147	1.340		
		Total	200.172	150			
	Vitamin C supplement	Between Groups	12.706	3	4.235	1.092	.354
		Within Groups	569.930	147	3.877		
		Total	582.636	150			
33	Think you consume enough iron	Between Groups	.654	3	.218	.370	.775
		Within Groups	87.182	148	.589		
		Total	87.836	151			

This table showed that there is significance between cocoa product and soft drink consumption with dietary risk.

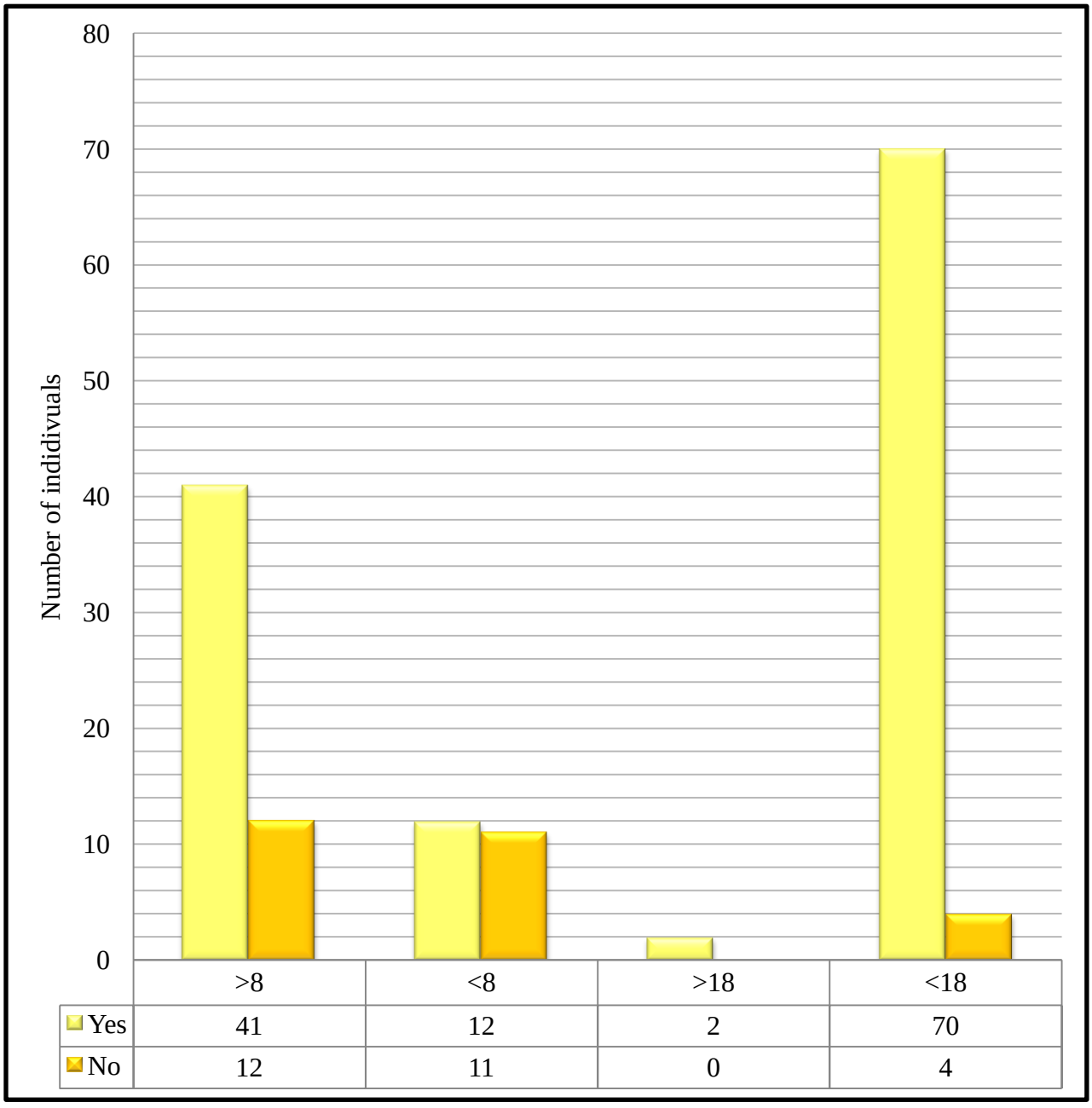


Figure 28. Significant difference between dietary risks with “awareness of the term for the deficiency”

A large number of the male sampled participants who were not at risk for the deficiency claimed to have heard about the term. The male sample participants who were at risk did not hear about the term. Most of the female sample participants heard of the term, but were at increased risk for the deficiency. Only 5% of the female sample participants were unaware of the term and had risk for the deficiency.

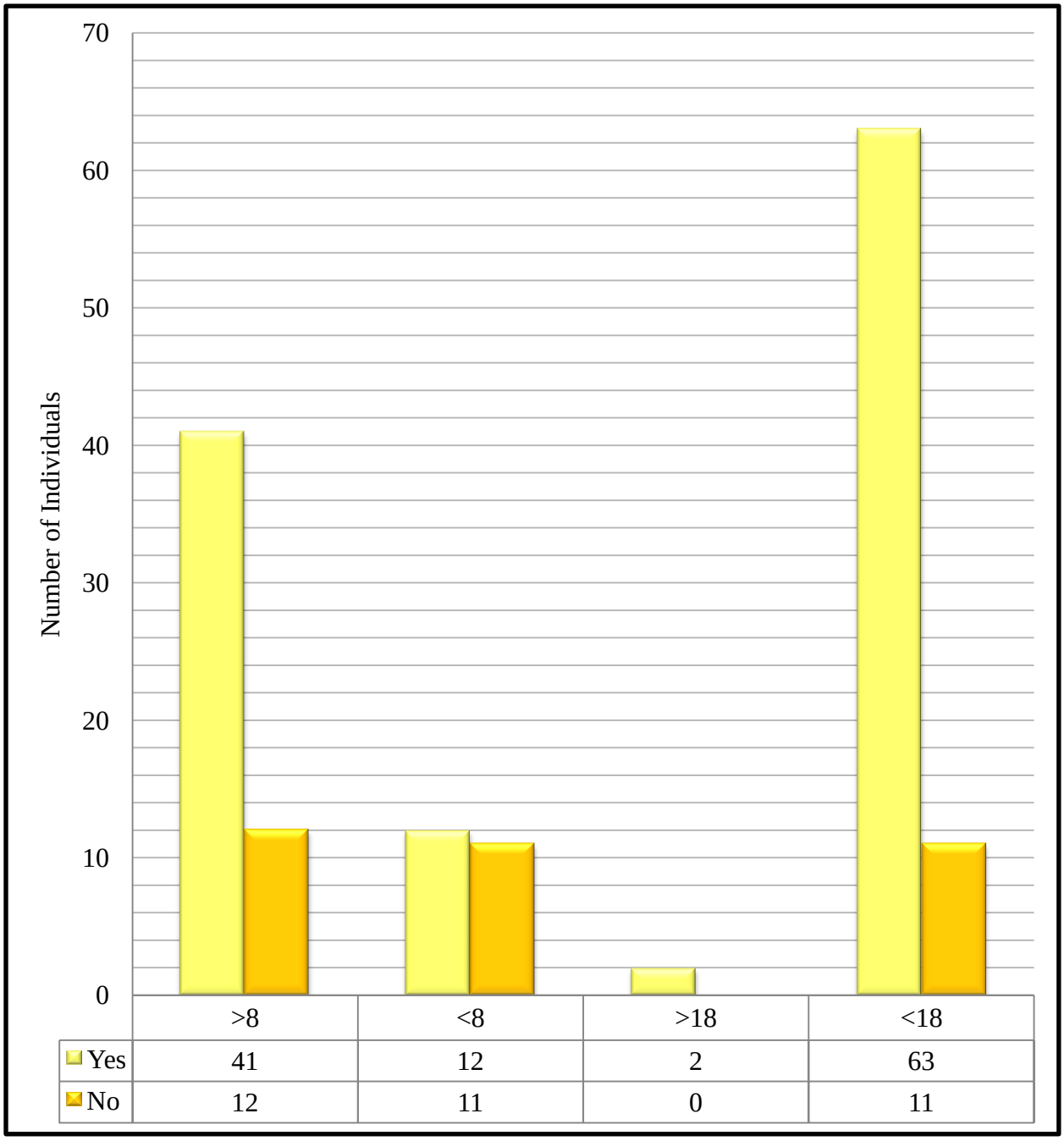


Figure 29. Significant difference between dietary risks with awareness of the symptom "tiredness" and its relation to the deficiency

Most of the female participants at risk related the symptom of tiredness to the deficiency. A large number of the male sample participants were not at risk related the deficiency to the symptom tiredness.

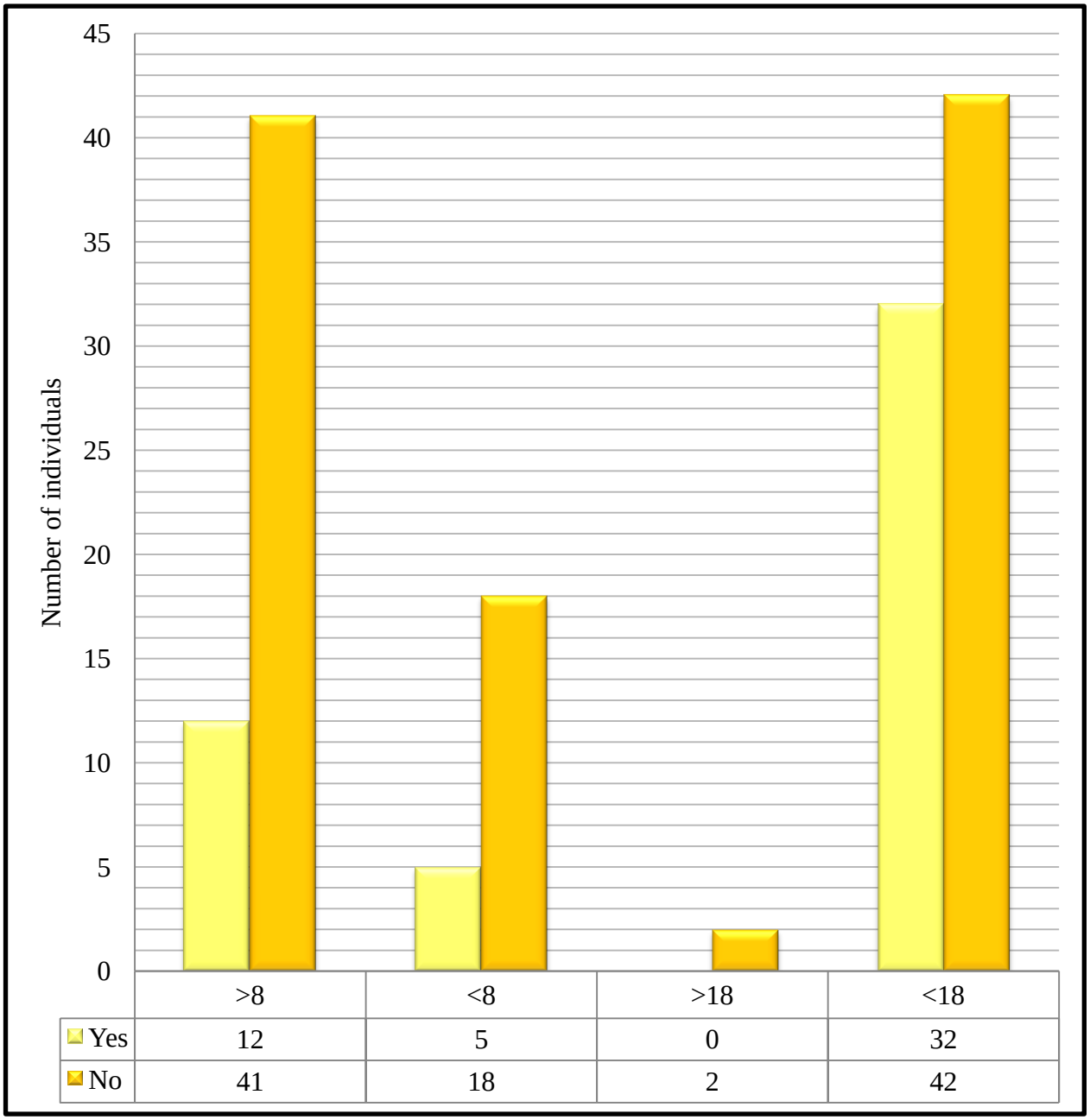


Figure 30. Significant difference between dietary risks with awareness that the symptom "light skin" is related to the deficiency

Most of the female sampled participants at risk did not relate the deficiency to the symptom of light skin. Most of the male sample participants not at risk also did not relate this symptom to the deficiency.

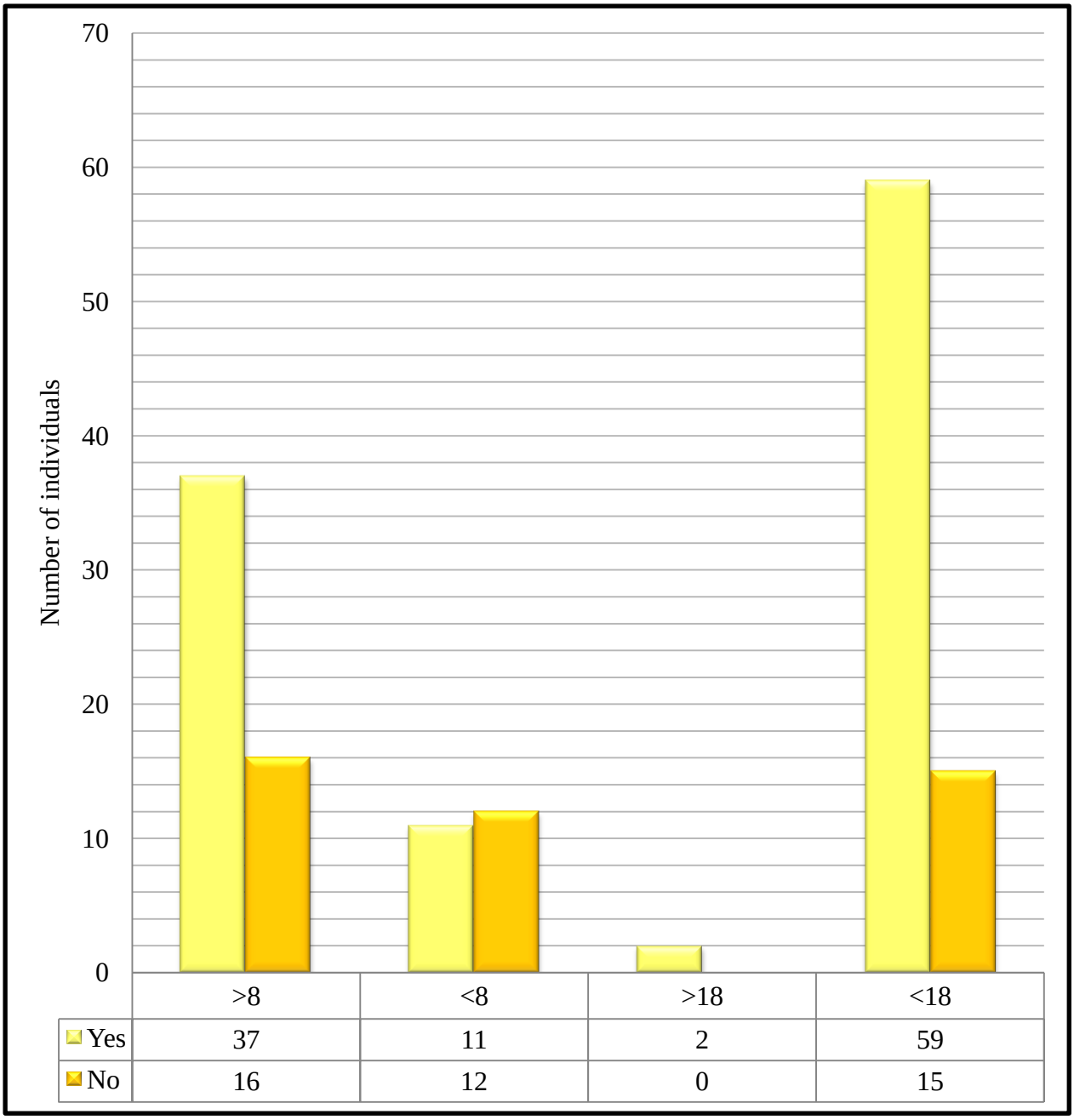


Figure 31. Significant difference between dietary risks with awareness that the symptom "weakness" is related to the deficiency

A large number of the female sampled participants who were at risk for the deficiency related this symptom to the deficiency. The male sampled participants who were not at risk also related this symptom to the deficiency.

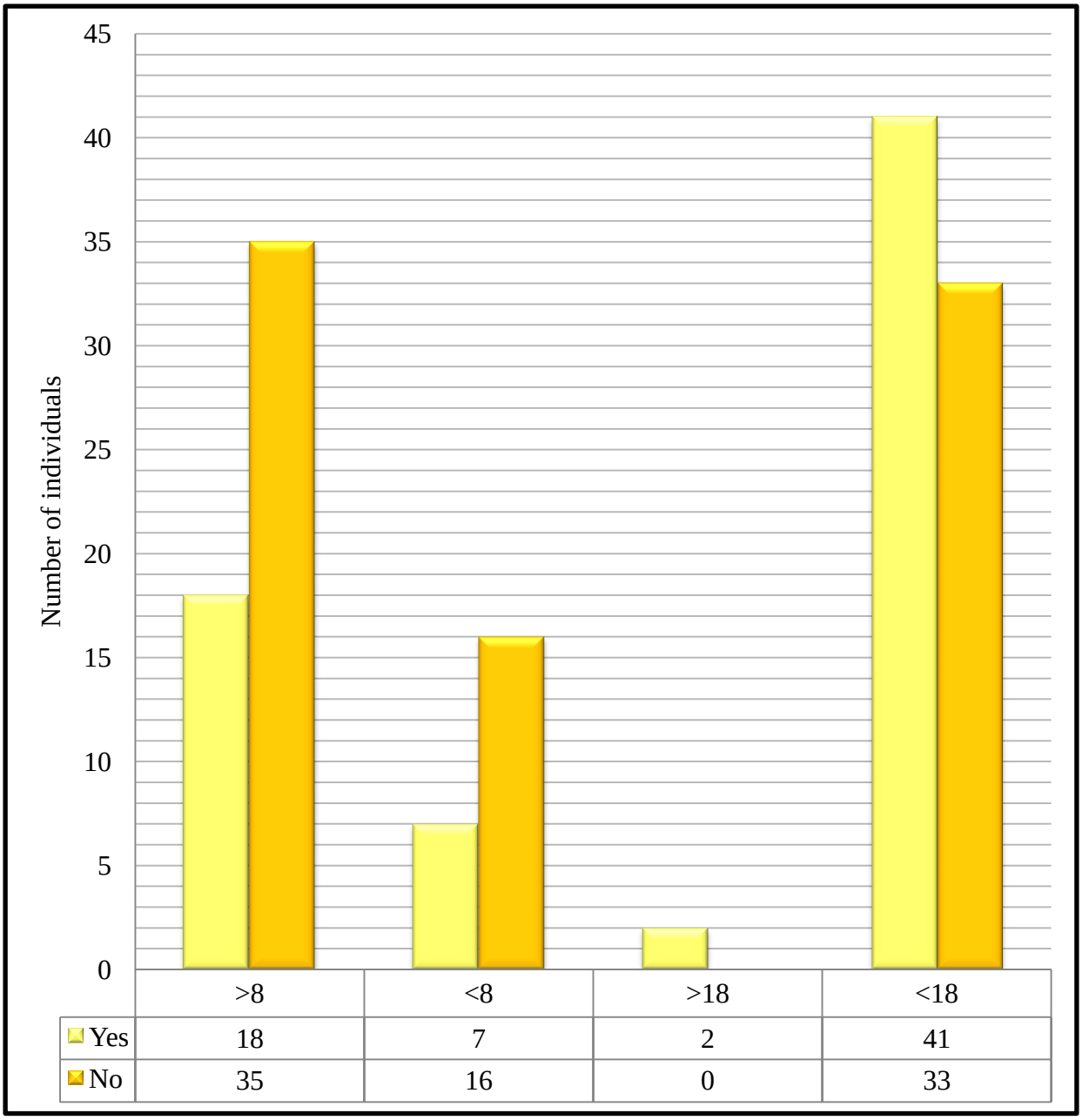


Figure 32. Significant difference between dietary risks with awareness that the symptom "loss of breath" is related to the deficiency

A large number of the female sampled participants at risk related this symptom to the deficiency. A large number of the male sampled participants not at risk did not relate this symptom of loss of breath to the deficiency.

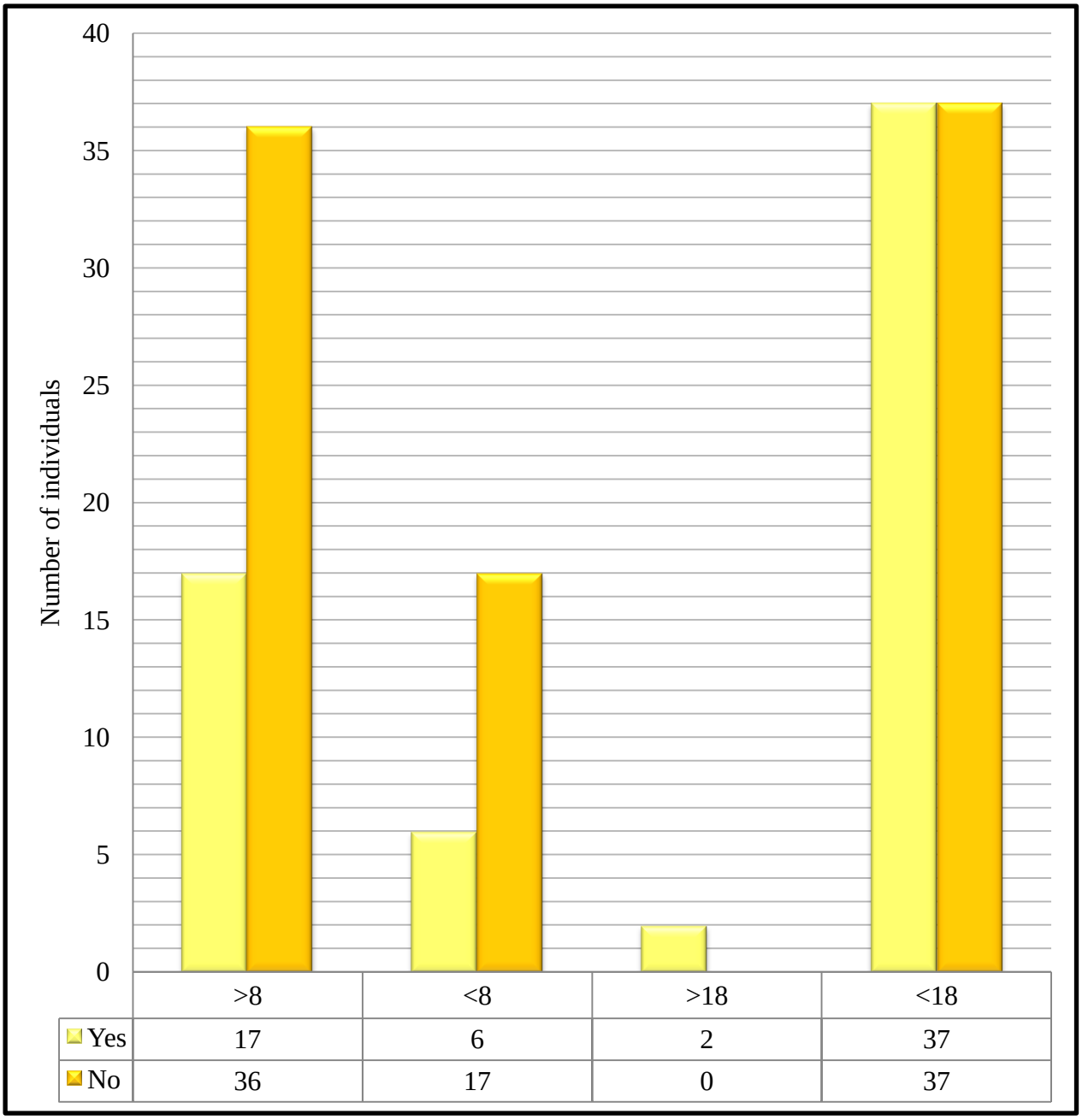


Figure 33. Significant difference between dietary risks with awareness that the symptom "headache" is related to the deficiency

An even amount of the female sampled participants at risk for the deficiency did not relate and related the symptom to the deficiency. A large number of the male sampled participants not at risk did not relate this symptom to the deficiency.

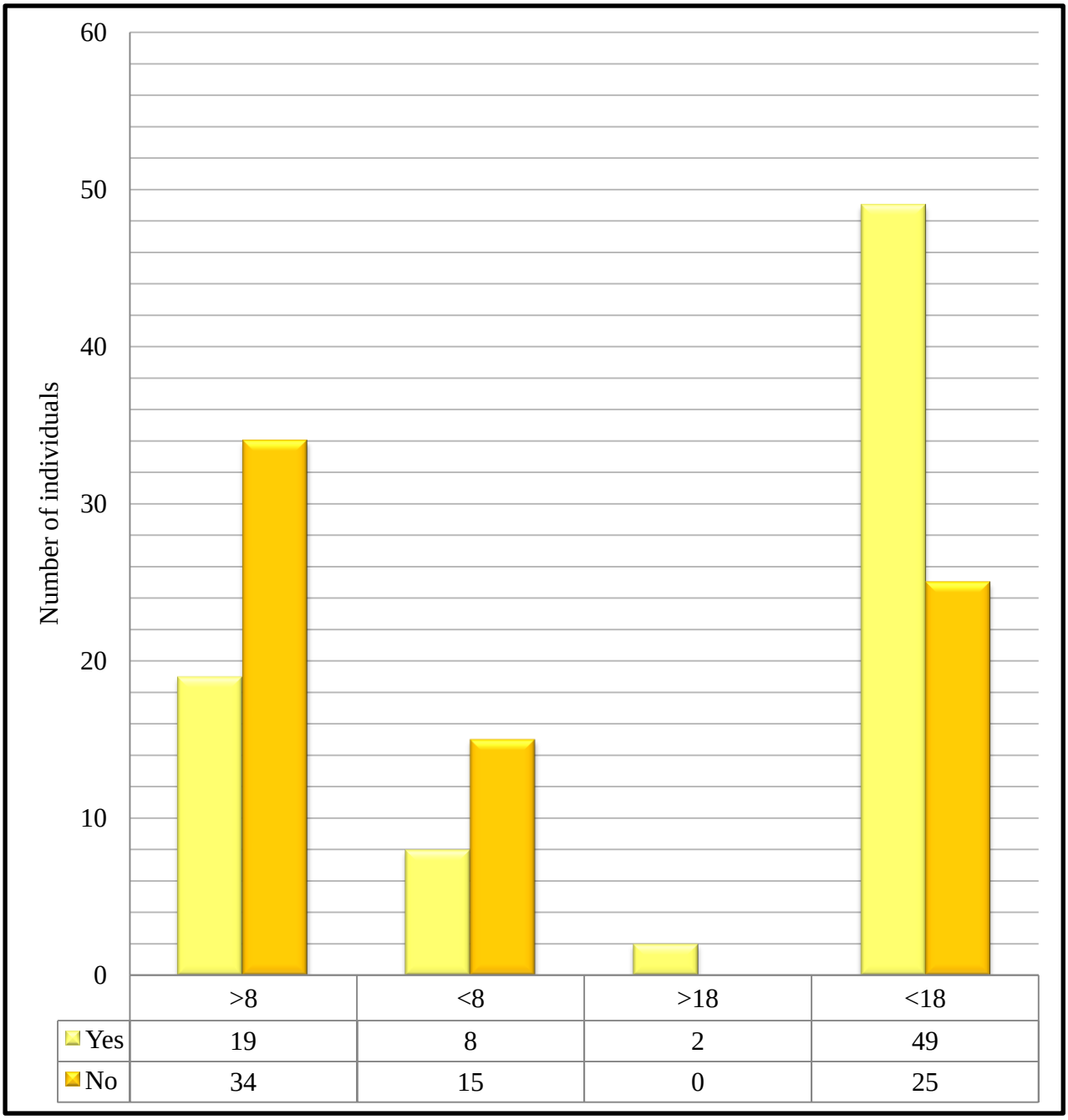


Figure 34. Significant difference between dietary risks with awareness that the symptom “light headedness” is related to the deficiency

A large number of the female sampled participants at risk related this anaemia to light headedness. A large number of the male sampled participants not at risk did not relate this anaemia to the symptom.

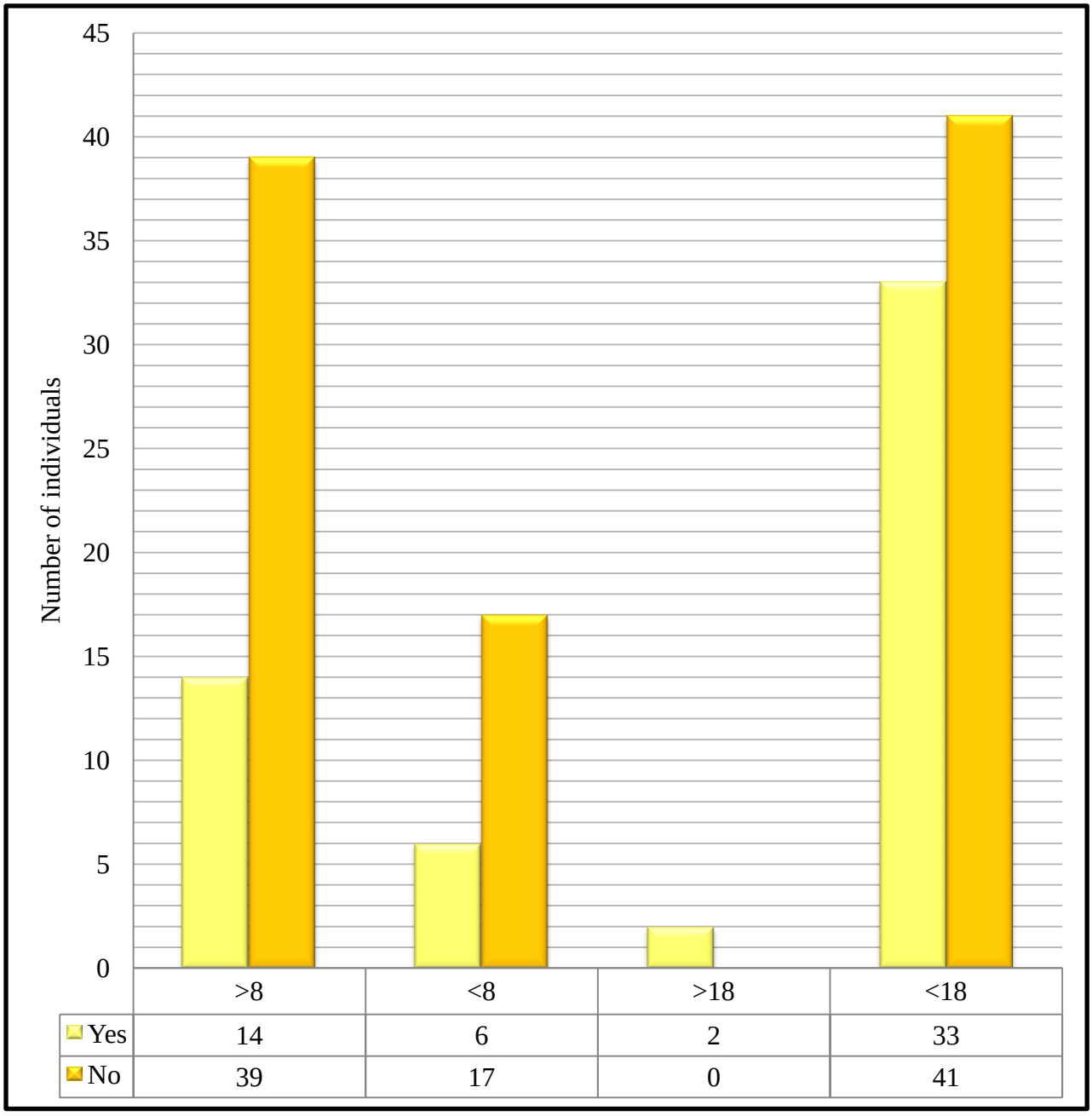


Figure 35. Significant difference between dietary risks with awareness that the symptom “chilly hands and feet” is related to the deficiency

A large number of the female sampled participants did not relate this symptom to the deficiency. A large number of the male sampled participants at risk and not at risk also did not relate the deficiency with the symptom chilly hands and feet.

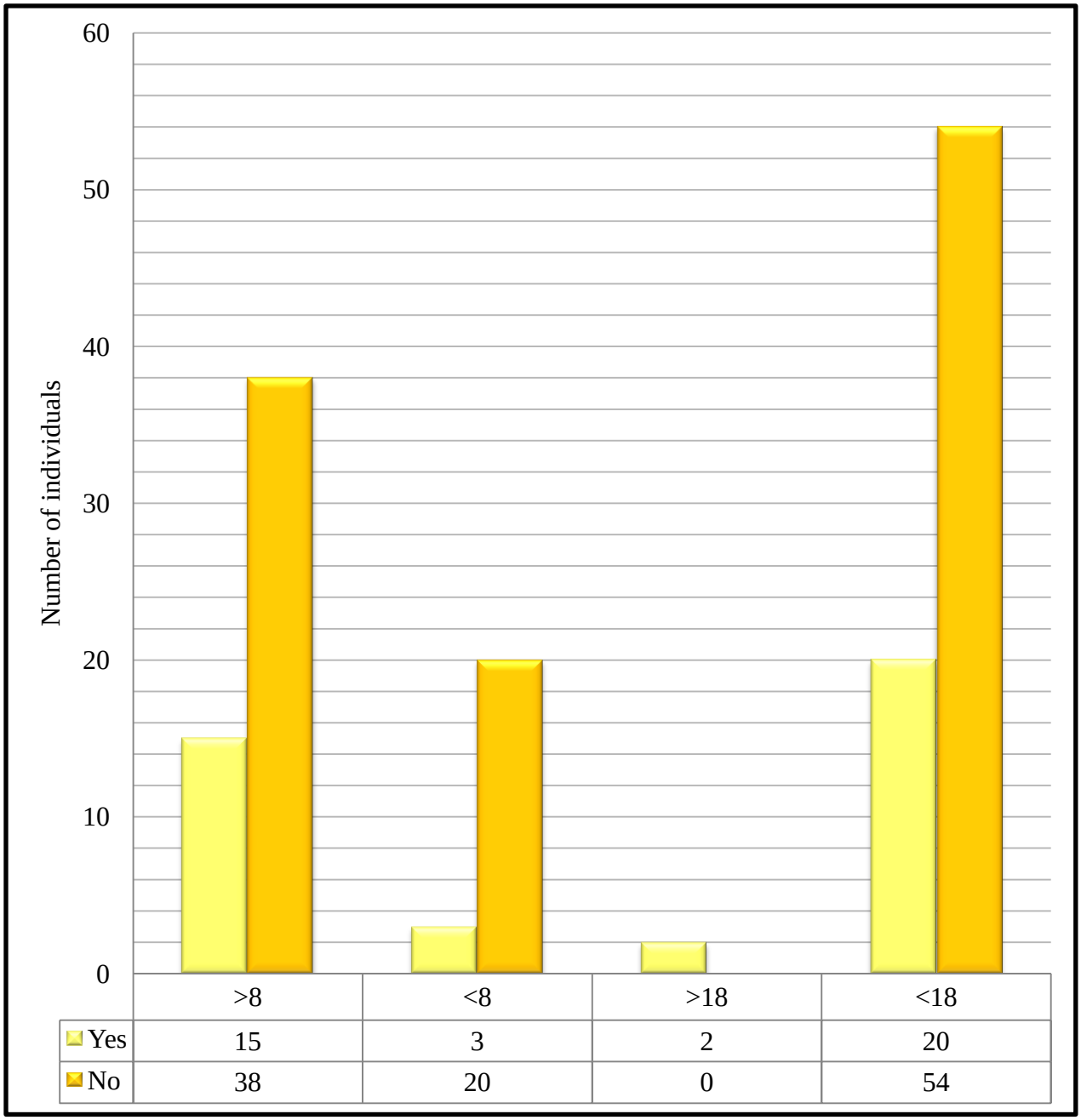
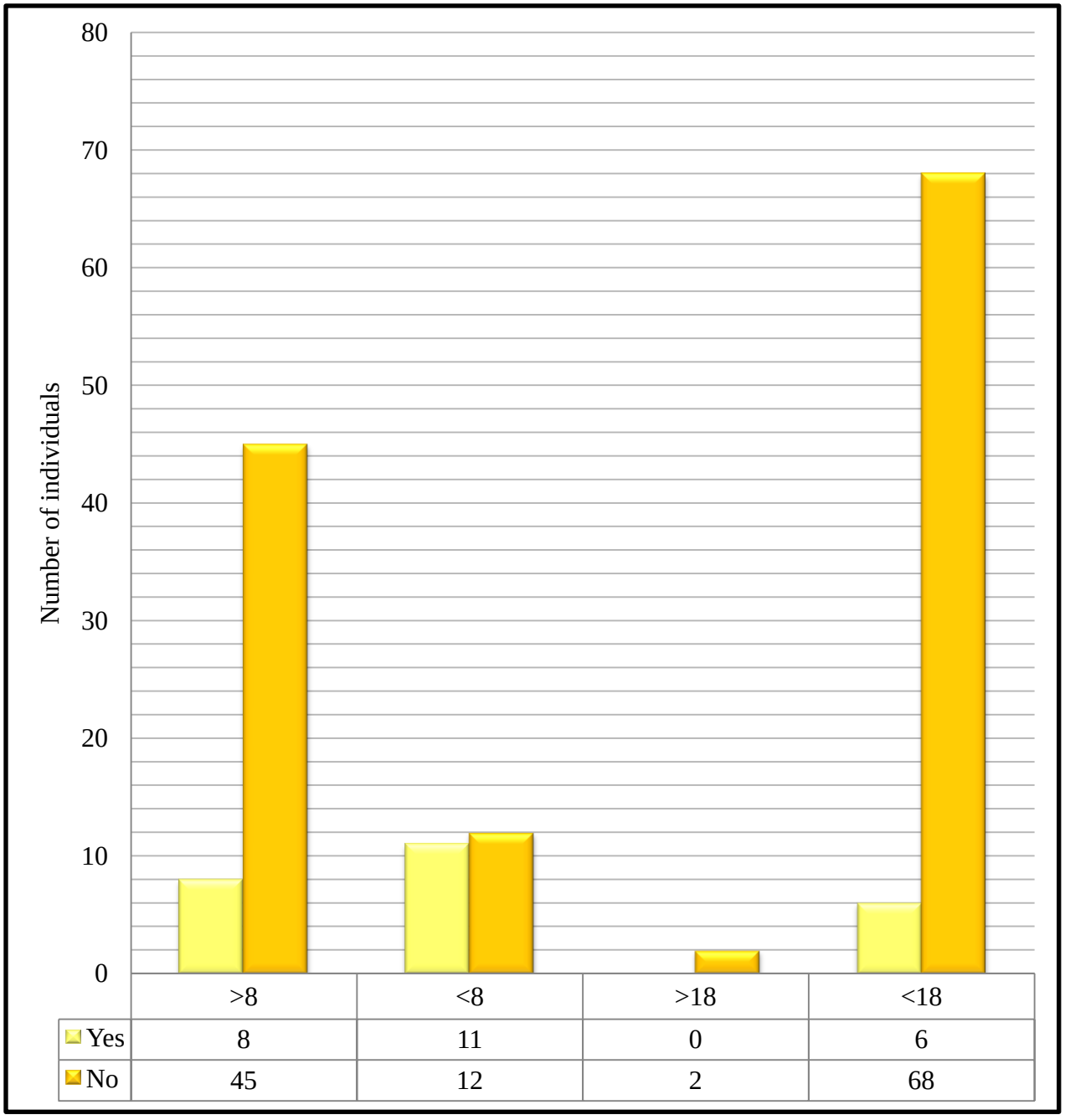


Figure 36. Significant difference between dietary risks with awareness that the symptom "weak nails" is related to the deficiency

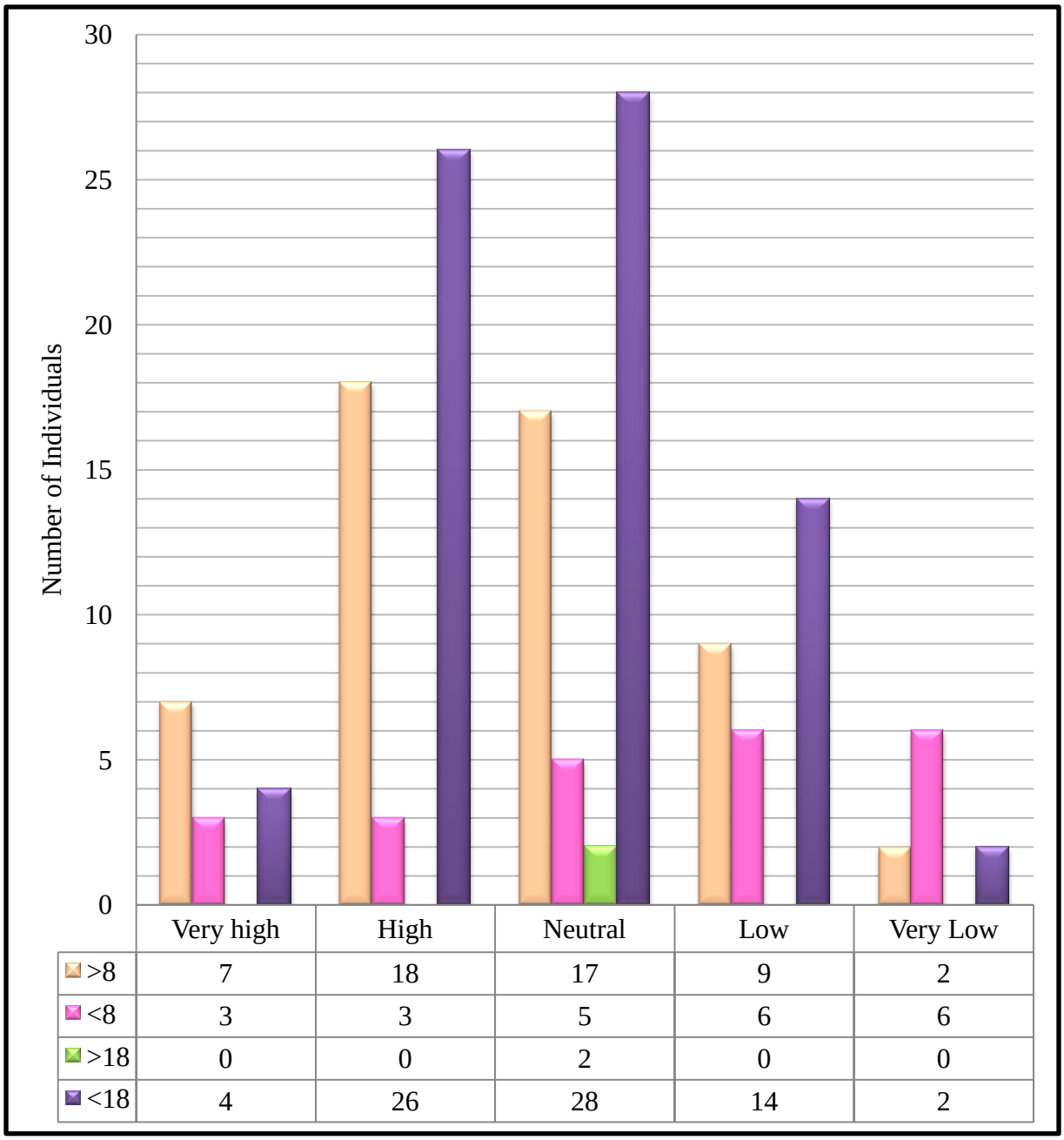
Most of the female sampled participants at risk for the deficiency did not relate this symptom to the deficiency. Most of the male sampled participants at risk also did not relate weak nails to the deficiency.



	>8	<8	>18	<18
Yes	8	11	0	6
No	45	12	2	68

Figure 37. Significant difference between dietary risks with awareness of “not knowing” that all the symptoms related to the deficiency

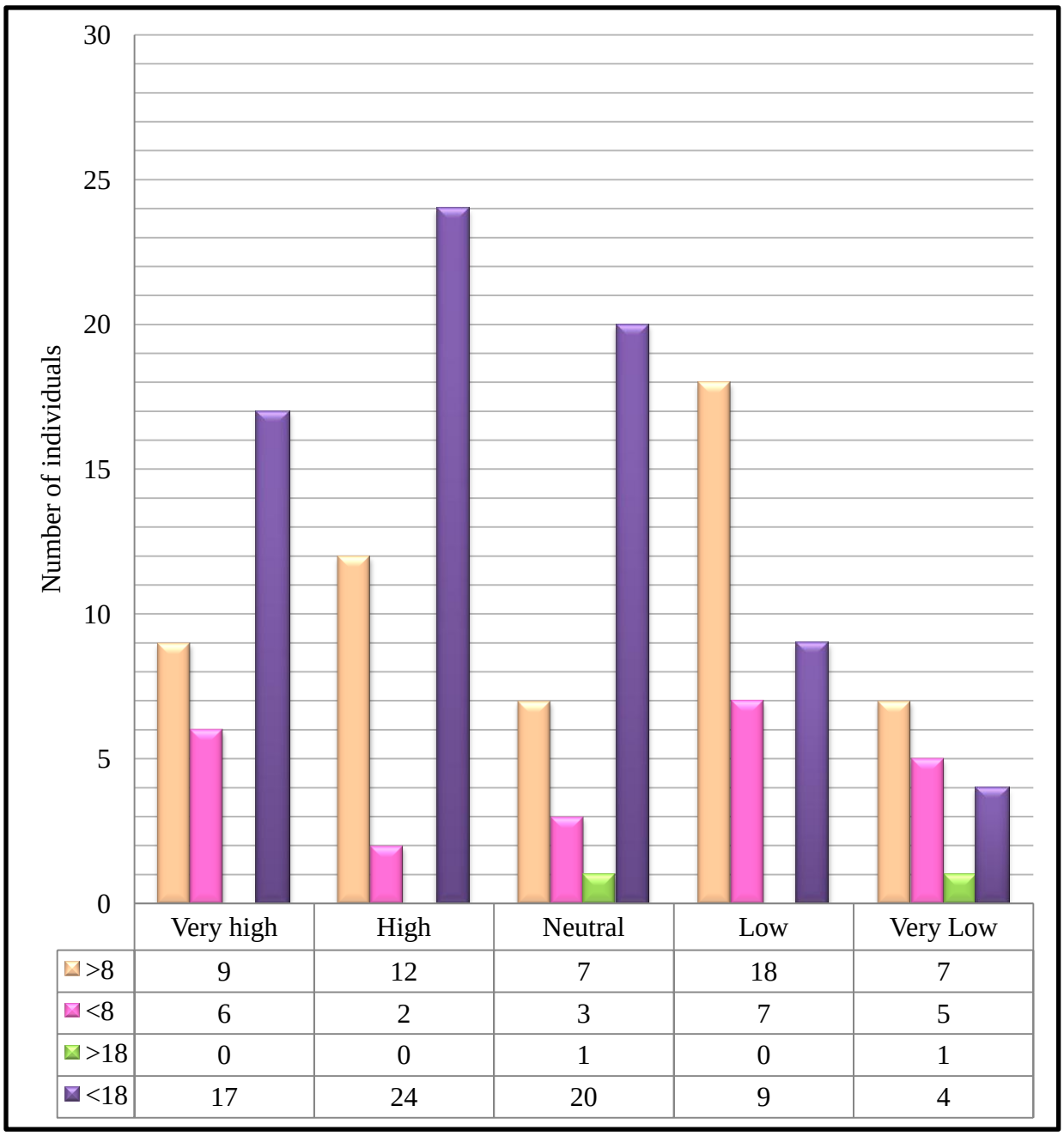
The overall female sampled participants at risk claimed to know the symptoms related to the deficiency. The male sampled participants not at risk were also seen to be more aware.



	Very high	High	Neutral	Low	Very Low
>8	7	18	17	9	2
<8	3	3	5	6	6
>18	0	0	2	0	0
<18	4	26	28	14	2

Figure 38. Significant difference between dietary risks with confidence of knowing the “effect of the deficiency on the body”

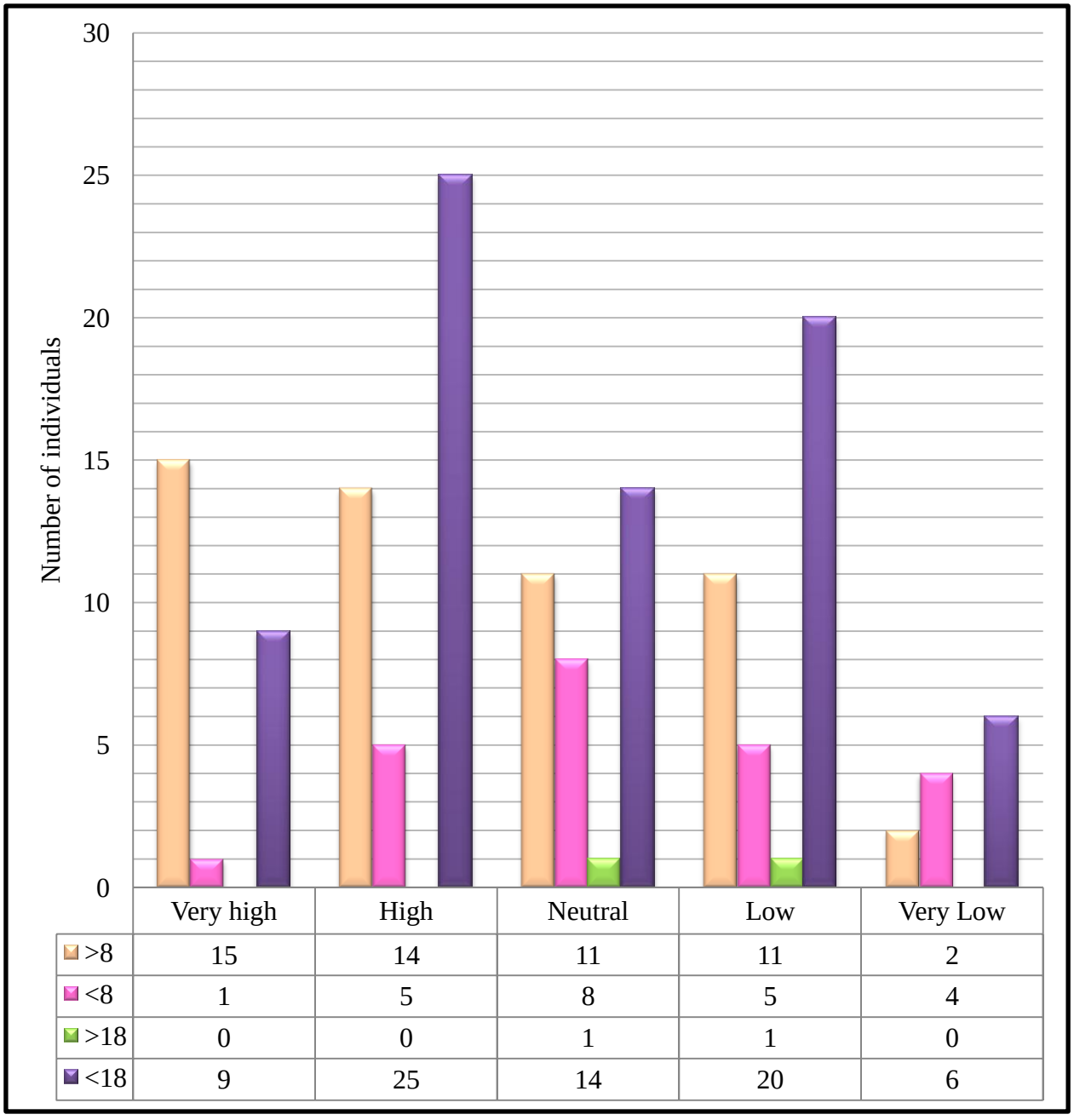
The female sampled participants at risk felt neutral in knowing the effect of the deficiency on the body. The male sampled participants who did not have the deficiency felt more high confidence in knowing the effect of the deficiency on the body.



	Very high	High	Neutral	Low	Very Low
>8	9	12	7	18	7
<8	6	2	3	7	5
>18	0	0	1	0	1
<18	17	24	20	9	4

Figure 39. Significant difference between dietary risks with confidence of “knowing why women are at more risk for the deficiency”

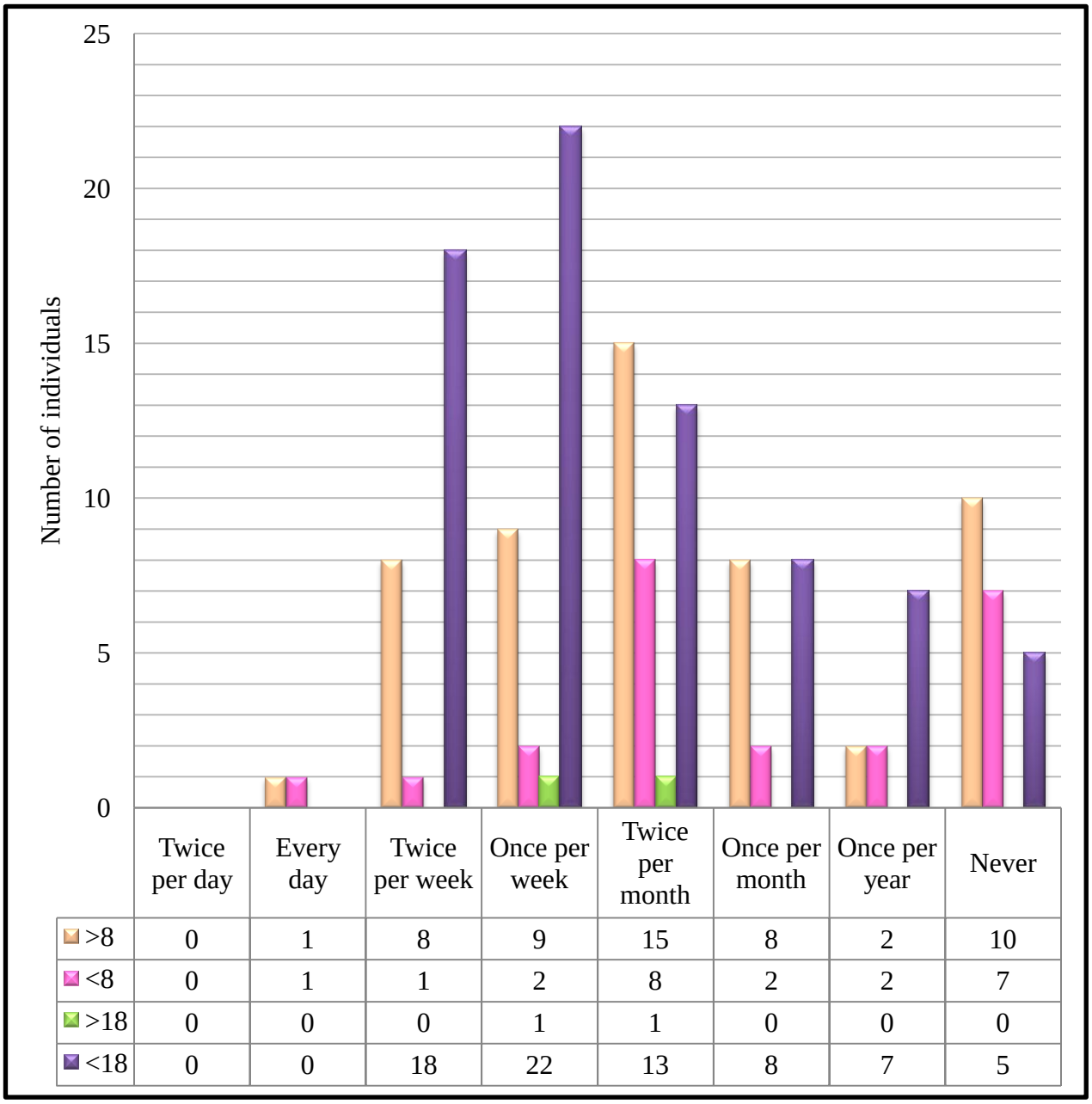
The female sampled participants at most risk for the deficiency felt high confidence in knowing why women were at more risk. The male sampled participants who were not at risk for the deficiency felt low confidence in this area.



	Very high	High	Neutral	Low	Very Low
>8	15	14	11	11	2
<8	1	5	8	5	4
>18	0	0	1	1	0
<18	9	25	14	20	6

Figure 40. Significant difference between dietary risks with the confidence of "knowing that having the deficiency can lead to heart problems"

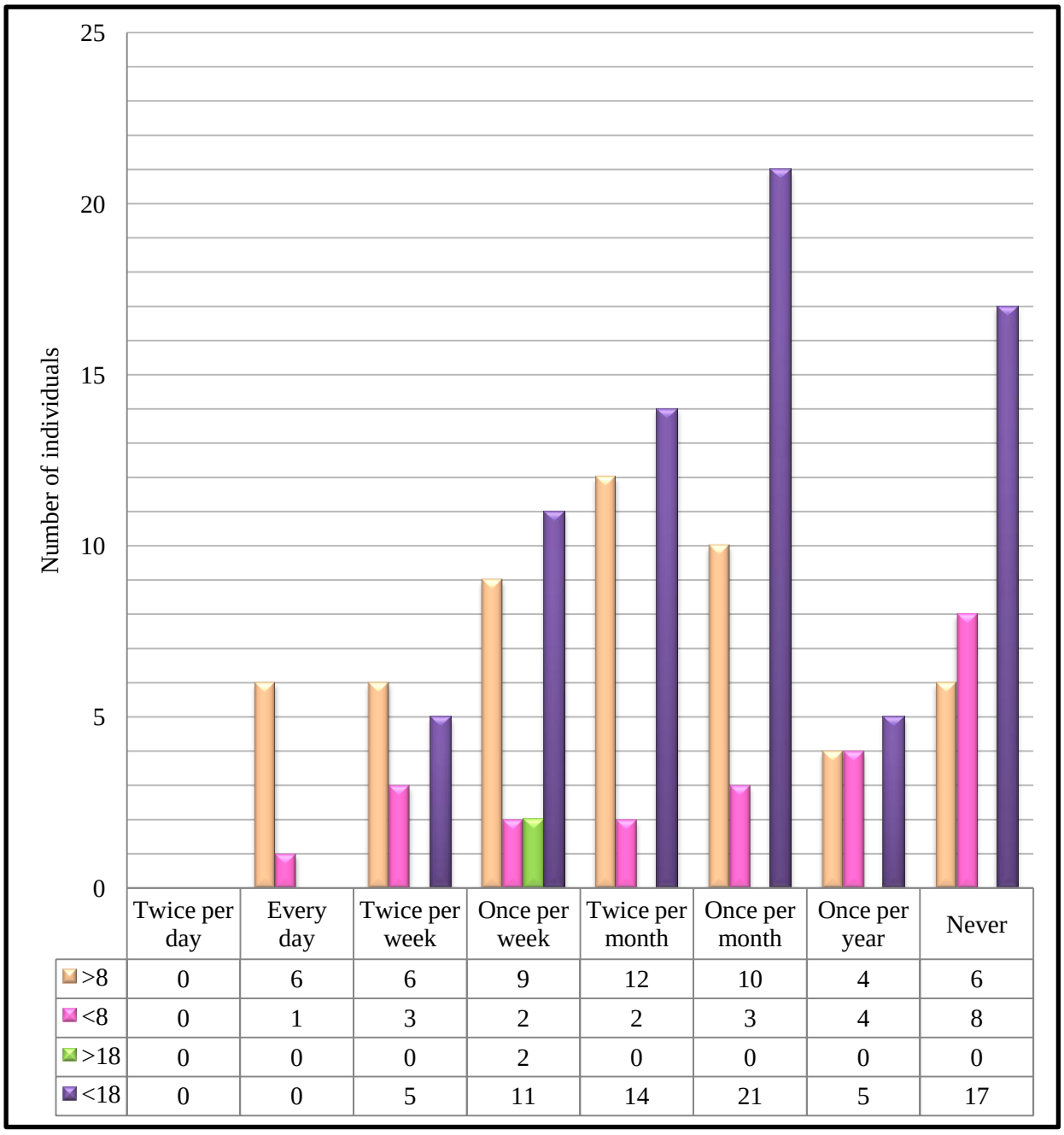
A large number of the female sampled participants at risk for the deficiency felt high confidence towards knowing that the deficiency can lead to hear problems. A large number of the male sampled participants who were not at risk felt very high confidence in this area.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
>8	0	1	8	9	15	8	2	10
<8	0	1	1	2	8	2	2	7
>18	0	0	0	1	1	0	0	0
<18	0	0	18	22	13	8	7	5

Figure 41. Significant difference between dietary risks with consumption of “broccoli”

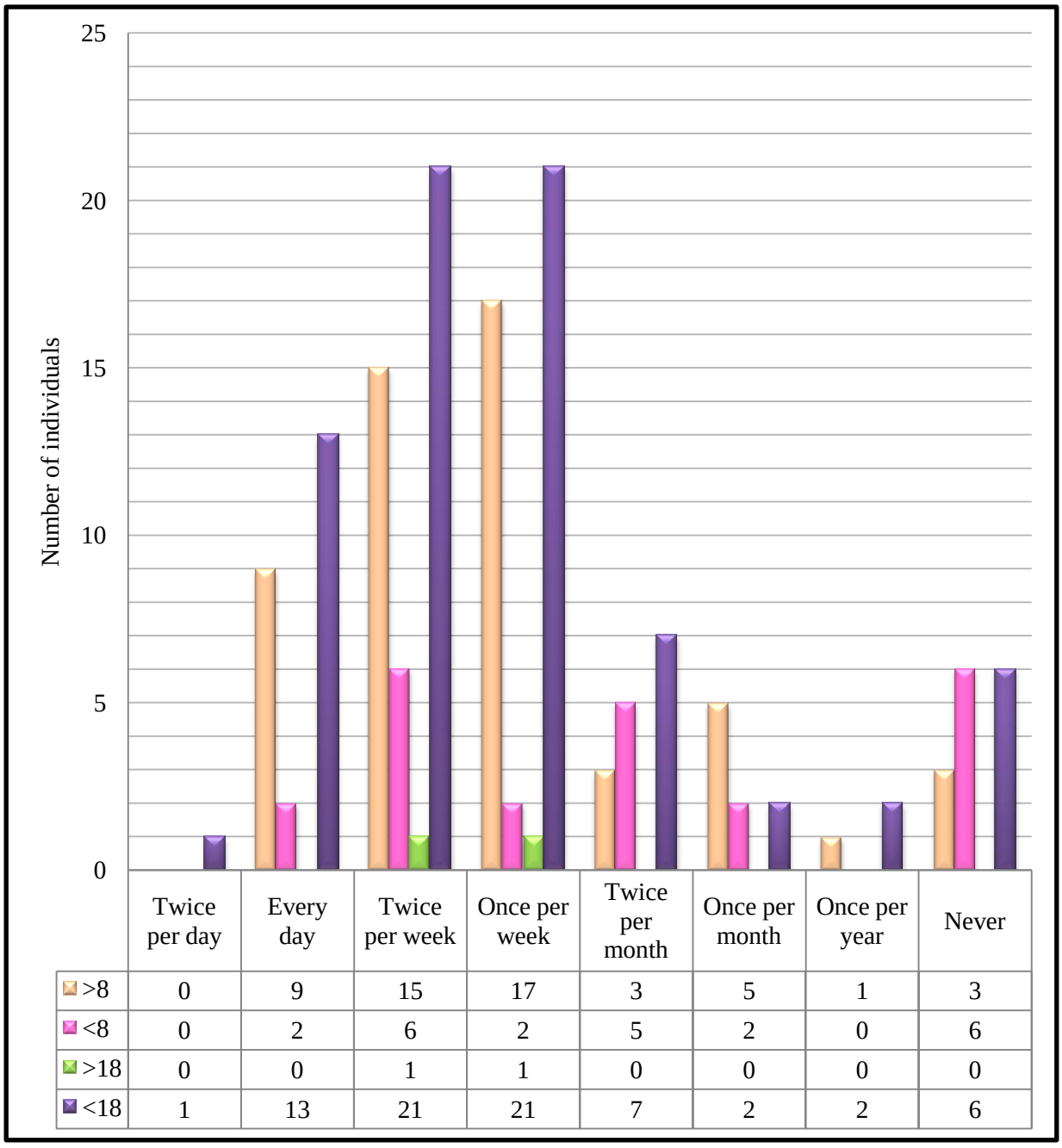
None of the sampled participants at risk or not at risk consumed broccoli twice per day. Most of the female sampled participants at risk consumed this item once per week and twice per week. Most of the male sampled participants not at risk consumed this item less than the female sample participants, twice per month. The female sampled participants not at risk consumed this item once per week to twice per month. The male sampled participants at risk consumed this item twice per month.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
>8	0	6	6	9	12	10	4	6
<8	0	1	3	2	2	3	4	8
>18	0	0	0	2	0	0	0	0
<18	0	0	5	11	14	21	5	17

Figure 42. Significant difference between dietary risks with consumption of “raisins”

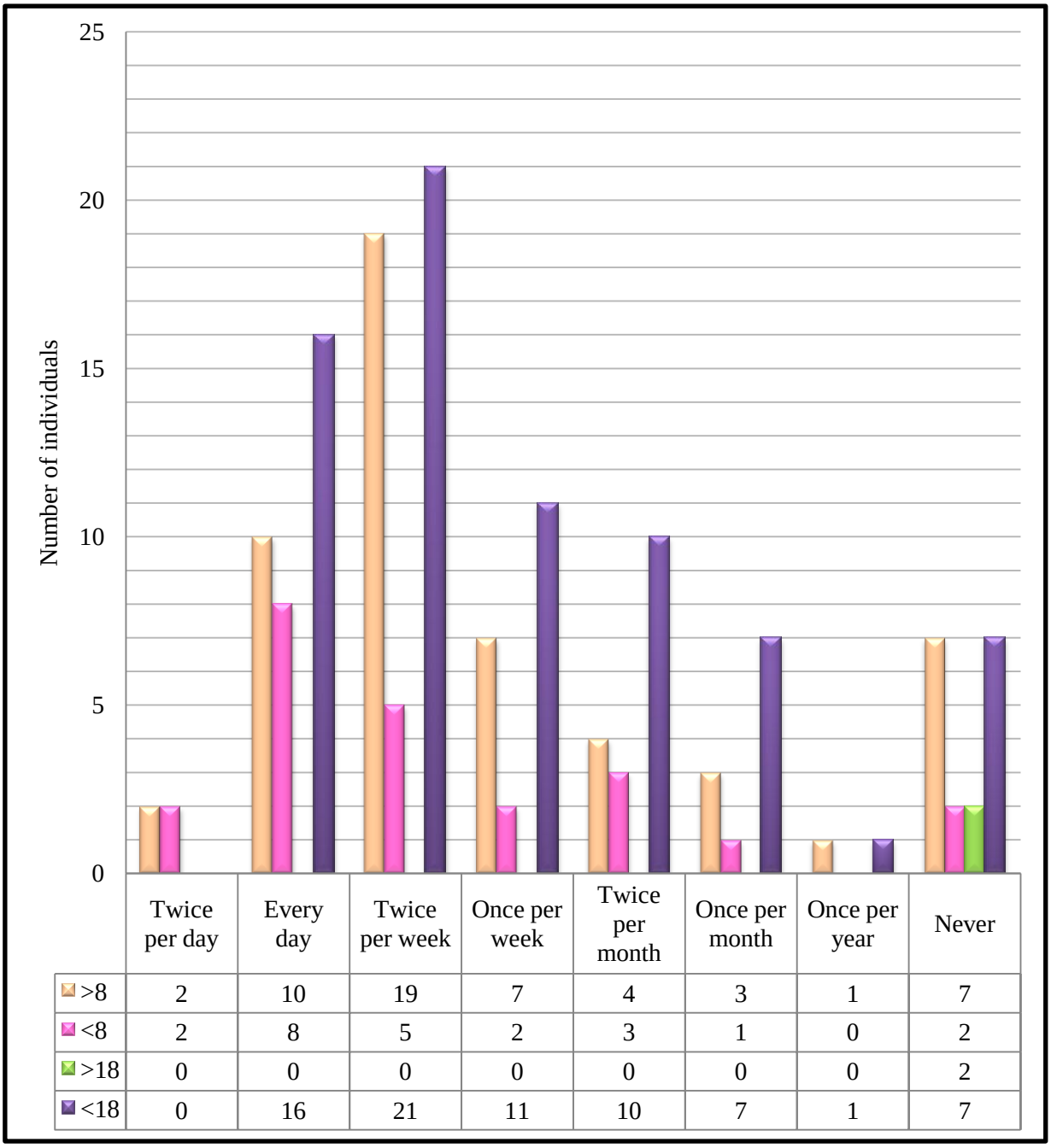
None of the sampled participants at risk consumed this item twice per day. Most of the female participants at risk consumed this item once per month and never. Most of the female participants not at risk consumed it once per week. Most of the male participants not at risk consumed this item once per week. Most of the male participants at risk never consumed this item.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
>8	0	9	15	17	3	5	1	3
<8	0	2	6	2	5	2	0	6
>18	0	0	1	1	0	0	0	0
<18	1	13	21	21	7	2	2	6

Figure 43. Significant difference between dietary risks with frequency of consumption of “cocoa products”

The female participants at most risk consumed this item twice per week to once per week equally. The female participants not at risk did not consume this item. The male participants at risk consumed this item twice per week and never equally. The male participants not at risk consumed this item once per week.



	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
>8	2	10	19	7	4	3	1	7
<8	2	8	5	2	3	1	0	2
>18	0	0	0	0	0	0	0	2
<18	0	16	21	11	10	7	1	7

Figure 44. Significant difference between dietary risks with frequency of consumption of “soft drinks”

The female participants most at risk consumed this item twice per week. The female participants not at risk never consumed this item. The male participants at risk consumed this item every day and the male sample participants not at risk consumed this item twice per week.

CHAPTER 5: DISCUSSION

This study is unique as it is the first to assess awareness, dietary habits and risk of iron deficiency anaemia among year one students in the University of the West Indies, St Augustine Campus. Iron deficiency is highly prevalent in Trinidad as 24.9% of the population was at risk in 2008 (Benoist et al. 2008). This anaemia can affect cognitive abilities of students and increase fatigue which can be risky to academic performance (Abalkhail and Shawky 2002). The strengths of this study were that it assessed over one hundred students. An equal number of male and female students participated which reduced bias. Only eighteen students did not fill out the three day diet and a reliable nutrition site was used to assess iron intake of the participants, all questions on awareness of this anaemia were answered, food records were detailed, significance was found when looking at gender, vegetarian status, ethnicity and risk for the deficiency. SPSS was used to analyse data. It is reliable software that can help predict outcomes and show correlations between variables in the study. It allows predictive knowledge to be obtained (IBM 2012).

Frequency (%) analysis of the overall participants showed that most were aware of iron deficiency anaemia. This was not supported by Abalkhail and Shawky (2002) nor Kaur, Bassi and Sharma (2011) or Yusoff, Wan Daud and Ahmad (2013) as it was found that awareness as low among older adolescents, however, Hussainab and Shua (2010) found awareness to be increasing for this anaemia and stated that it was high among female adolescents. Participants felt high confidence in awareness of the deficiency. When assessing the frequency of consumption of high iron foods, it was found that participants were generally not consuming enough to provide for their daily needs. Only 20% of participants consumed iron supplements. Participants were found to consume more iron inhibiting foods such as tea and cocoa products. This can increase the risk for the deficiency and was supported by Mufloz et al. (1988) and Hunt (2003). Only 10% of the participants never consumed any of the iron reducing foods listed. Foods that helped increase iron absorption were frequently consumed. It was found that 48% of the participants claimed to consume Vitamin C supplements every day. This is beneficial to individuals since it was found to help increase iron absorption (Cook, Dassenko and Lynch 1991; Craig 1994; Schultink and Gross 1996; Abalkhail and Shawky 2002; National Institutes of Health 2011). Through dietary assessment, 57% of the students were at risk for the deficiency;

43.5% being females and 13.5% being males. It was found that 43.5% of the participants did not know if they were consuming enough iron containing foods to decrease the risk for the deficiency. This was supported by Yusoff, Wan Daud and Ahmad (2013) who found that there is a high risk for this anaemia among the older adolescent population.

Statistical analysis showed areas where students lacked knowledge about this anaemia; the first being that participants did not know that this type of anaemia was worldwide. The students were also unaware if their family members had the deficiency and mostly related tiredness and weakness as a symptom of this type of anaemia. About 17% of the participants did not know about the symptoms of the deficiency and only 12% of the participants stated that all the symptoms listed related to the deficiency. In fact, all of the symptoms listed were found to relate to the deficiency; therefore it shows the lack of awareness in this area (MayoClinic 2013). Participants were unaware that there are foods that can reduce absorption of iron, which vegetarians have greater risk for the deficiency and how the deficiency is tested. The participants felt neutral confidence toward the meaning of the deficiency, effects if iron on the body, what can increase the risk for this nutritional disorder, knowing children were at risk for the deficiency and low confidence in knowing that a low social life can affect the risk for the deficiency. Childs et al. (1997) found that with an increase in awareness, the risks for this type of anaemia was not reduced. This was because of the failure of the education program. The recommendation was to focus on groups to help reduce the prevalence of the defciiency. Sabah, Fatima and Ramzan (2010) disagreed as they said that education can help reduce the risk for the deficiency.

The FFQ assessed the consumption of high iron containing foods. Out of the 14 items listed, the overall participants never consumed six items including beef, liver, soybeans, clams, oysters and pumpkin seeds which are very high in iron. The participants generally consumed none of the items twice per day or every day (Table 5 to 8). This shows that the participants were generally not consuming enough high iron containing foods. Overall, 30% of the participants never consumed high iron containing foods. Consuming legumes and vegetables with a cereal based diet was related to a decrease in the risk for the deficiency (Tatala, Svanberg and Mduma 1998). It was supported that high iron sources include meat, poultry, fish and fortified foods (Sabah, Fatima and Ramzan 2010; National Institutes of Health 2011).

It was found that 80% of participants do not consume iron supplements. This can be a problem if they are at risk for the deficiency. Iron supplements can help provide iron that the

body needs to function properly. Therefore only 20% of the participants were definitely not at risk for the deficiency.

Another FFQ in Table 9 and 10 looked the consumption of items that inhibit or slow down iron absorption. Out of the six items listed, only one item was never consumed, which was coffee. Dairy products were consumed every day at 52%. On the whole, the participants consumed these iron reducing foods every day at 29%. Overall, 10% of the participants never consumed any of the foods listed. Therefore, items that reduce iron absorption were consumed often. This increases the risk for the deficiency as it reduces the iron available for absorption. Tea, coffee and cocoa products have phenols which inhibit non-heme iron absorption. Consuming this after meals or during can increase the risk for the deficiency since the iron consumed will not be absorbed (Nutrition MD 2013). It was found that students (55%) consumed whole grains every day. Foods high in fibre can also reduce the absorption of iron from foods. The lower the consumption of iron inhibiting foods, the lower the risk for this type of anaemia (Kelsay, Behall and Prather 1979; Hallberg, Rossander and Skanberg 1987; Mufloz et al. 1988; Cook, Dassenko and Lynch 1991; Hunt 2003).

Table 10 and 11 looked at the frequency of consumption of four times that increased iron absorption. Two were consumed everyday and two were consumed twice per week. This shows that these foods were consumed often as it was found that 48% of the participants consumed Vitamin C supplements every day and only 8.8% never consume these supplements. Overall, 36% of the participants consumed these foods that help increase iron absorption every day when 4% never consumed them. Foods that reduce iron absorption prevent iron from being absorbed in the upper intestinal tract happening and allow the iron to pass through the body (Johnson 2012).

The female participants were more at risk for the deficiency than the male participants. 43.5% of the population did not know if they consumed enough high iron foods. This was confirmed by many articles as the female population have a greater blood loss at adolescents which increases the risk for the deficiency (Tatala, Svanberg and Mduma 1998; Abalkhail and Shawky 2002; Beinner and Lamouneir 2003; Harvey et al. 2005; Kaur, Bassi and Sharma 2011). Overall the risk was high among the population (57%). This was supported articles that found the risk to be highest among this population (Kaur, Bassi and Sharma 2011; Yusoff, Wan Daud and Ahmad 2013).

When the students completed the questionnaire, they commented on how poor their diet was. Some also claimed to not know much about the deficiency when they were actually diagnosed with iron deficiency anemia by a doctor. Other students said, “I am not dead yet, so I cannot possibly have it,” or, “I am a guy, only girls can get this anaemia.” This shows just how poor the level of knowledge is in this area among the students. Most of them never consumed breakfast and claimed that they had no time to prepare breakfast with their hectic class schedules. This can increase the risk for the deficiency as it was supported by Abalkhail and Shawky (2002) that meal skipping is related to this anaemia and a decrease in academic performance. Most of the participants claimed to not have iron deficiency anemia (57.6%), however they were unaware of how it was tested (80%). This shows that this question cannot represent the prevalence of this anemia as most of them could have guessed their anemic status.

Significance statistical difference (sig. <0.05) was found with mean comparisons, using ANOVA, between gender and awareness. The female population showed significance in awareness of the term for this anaemia more than the male students. This was supported by an article that also found a difference between gender and awareness as females were more aware of their anemic status than males (Abalkhail and Shawky 2002).

When assessing the significance of gender with the symptoms of awareness, it was found that the male population was more unaware of light skin and light headedness being a symptom of the deficiency. Both genders were unaware of chilly hands and feet and irritability as symptoms of the deficiency. The students were unaware that all the symptoms listed related to the deficiency.

Statistical analysis showed statistical significance between genders pertaining to the confidence of knowing women are at greater risk for the development of iron deficiency. Most females felt high (29%) to neutral (27%) confidence in knowing the reason for the increased risk. Male students (32%) felt low confidence in knowing about the difference in risk by gender. They were unaware of the relation between iron and the female gender. This can mean that students did not know about the link iron has with blood. Articles were not available to support this finding.

A significant difference was found between gender and having confidence in knowing that a low social life affects anaemia. It was shown that the female participants (35%) had low to very low confidence in this area. The male participants (32%) felt more neutral and the same

amount of males felt low to very low confidence in this area (24%). There were a very small number of individuals who felt very high confidence (8% males, 5% females) to high confidence (13% males, 9% females). A low social life, with fewer meals consumed during the day and a poor diet can reduce the iron consumed from meals putting those individuals at risk (National Institutes of Health 2011).

There was no significance between gender and beef consumption, however an article found that generally beef consumption was higher for the male population than for the female population. It was said to be this way because more females were vegetarians or were around vegetarians more (Gossard and York 2003). Articles also supported that males consumed more meat than females (Liebman, et al. 2003; Prättälä et al. 2006). Harvey et al. (2005) and Sabah, Fatima and Ramzan (2010) found that with less meat consumption, the risk for this anaemia increases. This can be because females tend to watch their figures when males want to build more muscle.

Consumption of liver as a high iron containing food was statistically significant when compared to gender. It was found that 58% of the female students and 45% of the male students never consumed liver. None of the population consumed this item twice per day and only 1% of the female population consumed liver every day. Liver was lacking in most of the students diet. Females need more iron than the male participants; therefore should consume more high iron containing foods. The recommended amount is 8 mg for men and 18mg for women (Centers for Disease Control and Prevention 2011). With liver consumption, the risks for the deficiency can decrease as it is a good source of heme iron and is easily absorbed in the body (Johnson 2012).

Analysis by ANOVA revealed statistical significance between genders and consumption of broccoli, a high iron food. The female participants consumed broccoli once per week (29%). Many of the male students consumed broccoli twice per month (27%). Less females than males never consumed this item (20% males, 7% females). Only some of the male population consumed this item twice per day (1%) and every day (2%). Liebman, et al. and Prättälä et al. (2003; 2006) supported this significance since it was found that women consume more vegetables than men.

A mean comparison between gender and consumption of clams showed statistical significance as most of the female (78%) and male (71%) students never consumed this item. None of the population consumed this item twice per day or every day. Clams are available in

this country and can be consumed more often. With a lack of clams in the diet, iron needs can be harder to reach. Unfortunately, articles were not available to support this significance.

Statistical analysis between gender and consumption of oysters showed significance similar to calm consumption. Both the female (67%) and male (61%) students never consumed this item. Only 1% of the male population consumed clams twice per day, every day and 3% twice per week. Females need to increase their intake so that they can reduce their risk significantly. It is a great source of iron and should be included in the diet (Johnson 2012).

Significant difference between genders and consumption of raisins, a high iron containing food, was observed. A large part of the female participants (22%) never consumed this item. There were more female students who consumed raisins once per month (27%) and more male students who consumed this item twice per month (20%). The male students consumed more raisins overall, than the female students. This item can provide a significant amount of iron in the diet (Johnson 2012). Articles were not available to support this significance.

Overall, the consumption of high iron foods was low among the participants; however males were seen to consume a bit more than the female population. An article found that with an increase in financial resources, the access to iron rich foods can be enhanced (Hussainab and Shua 2010). Meat consumption was seen to have a significant impact on the iron status of individuals (Harvey et al. 2005; Pasricha et al. 2008).

There was no significance between gender and consumption of iron supplements, foods that reduce iron absorption or foods that increase iron absorption. It was supported that females consuming iron supplements can reduce the risk for the deficiency which can help improve school performance (Soemantri, Pollitt and Kim 1985; Ballin et al. 1992; Patterson, Brown and Roberts 2001; World Health Organization 2001; National Institutes of Health 2011; Lucca, Hurrell and Potrykus 2013).

Dietary risk assessed from the three day record was significant when compared to gender. It was noticed that 88% of the female participants were at risk for this deficiency. Males (69%) were at less risk for the deficiency since they met their daily iron needs of 8mg of iron or more per day (31% of the males were at risk). This revealed that females were not including enough high iron containing foods to provide for their daily needs (18 mg of iron) (Centers for Disease Control and Prevention 2011). This supports the hypothesis that the female participants had greater risk for the deficiency than the male participants and was supported by an article that

found the risk to be high in the female population. Skipping meals can also be a cause of this high risk (Abalkhail and Shawky 2002). Challenges arise when women are unaware of their risks (Stoltzfus and Dreyfuss, Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia 2003).

There was no significance between genders and if the students thought that they consumed enough iron in their meals to provide for their daily needs. This is because the significance value was above 0.05. There was no relationship.

ANOVA analysis showed significance between ethnicity and awareness of high iron foods. Among all the ethnic groups, all ethnicities claimed to have been aware of high iron foods. Mixed (86%) and East Indian participants (85%) sampled knew of high iron foods than the African participants (64%). This can mean that the East Indian and mixed descent individuals were more exposed to knowledge on high iron foods. Unfortunately, articles were not available to support this statistical significance.

According to analysis, a significant difference between ethnicity and awareness that vegetarians are at greater risk for the deficiency was shown. A large number of East Indian (63%) and African (64%) students did not know that vegetarians have a greater risk for the deficiency. A large number of the mixed participants (64%) claimed to know that vegetarians are at higher risk. This can be because they were exposed to this information before. This shows that the East Indian and African sample participants were unaware of the link between iron, food and the vegetarian status.

Consumption of beef was significantly related to ethnicity. The East Indian participants (56%) never consumed this item. This can be because of their religion as Hinduism restricts the consumption of beef, or their vegetarian status and life choices, or due to a lack of availability of beef and not choosing this item when consuming meals. Most of the East Indians were non-vegetarians however; therefore there should not be a restriction of this item from their diet. Mixed individuals (34%) consumed this item once per week. This is a good source of iron and therefore can reduce their risk for the deficiency. The African students (32%) consumed this item once per month. The East Indian participants would be at more risk as they lack this high iron containing food. This was supported as an article related beef consumption to ethnicity and social influences since it was found that Africans consumed more beef (Gossard and York 2003). However, Xie et al. (2003) found that Africans consumed more vegetables than other ethnicities.

This can be because of the different locations and availability of foods. Reddy, Hurrell and Cook (2006) found that consuming more meat products can significantly reduce the risk for the deficiency.

Significance was revealed with comparison of ethnicity and soybean consumption. It was shown that most of the ethnicities never consumed this item (73% of Africans, 32% East Indians, 41%). Soybean is very high in iron as it can contain approximately 4mg iron per ounce (Nutrition Data 2012). No articles were found to support this finding.

ANOVA analysis found significant difference between ethnicity and oyster consumption. It was found that most of the participants never consumed this item (59% East Indian, 77% Africans, 71% mixed). Articles were not available to support this significance.

Statistical analysis showed significance between ethnicity and coffee consumption. An even number of East Indians never consumed coffee and consumed it every day (21%) as well as mixed participants (24%) and African participants (41%). Therefore the risk is more for the mixed and East Indian participants as they consume this item more often than the African participants. If they consume this item with meals or after meals, it increases the risk for the deficiency as the absorption of non-heme iron is inhibited from sources such as vegetables and soybean products (Centers for Disease Control and Prevention 2011). Tea and coffee are both significant reducers in iron absorption, but according to studies, tea has a high effect on the reduction of iron absorption from food. Coffee consumption after a meal reduces iron absorption more than if it was consumed before a meal (Morck, Lynch and Cook 1983).

There was no significance between ethnicity and confidence in knowing of certain aspects of the deficiency, consuming iron supplements, foods that increase iron absorption, dietary risk from the three day record and the thought of consuming enough iron in their diet to provide for their daily needs. Articles were not available to support this.

ANOVA analysis between vegetarian status and awareness of foods that reduce iron absorption showed significance difference. Most of the non-vegetarian participants (67%) did not know of foods that can reduce iron absorption. Generally the vegetarian (80%), lacto-vegetarian (67%) and the one pescatarian was all aware of these foods. Participants who can eat more high iron containing foods were less aware than those limited by their vegetarian status.

Significance was found between vegetarian status and beef consumption. All of the vegetarian groups indicated that they never consumed beef. Even though the non-vegetarians are

not limited by their diet, they still did not consume this high iron containing item (36% non-vegetarian, 100% vegetarian, 100% lacto vegetarian, 100% pescatarian). Non-vegetarians may not consume this item because of their religion for example Hinduism. Consuming lean pieces of beef, high in iron, can help reduce the risk for the deficiency (Johnson 2012).

Statistical analysis showed statistical significance between vegetarian status and chicken consumption. Non-vegetarians consumed this item twice per week (47%) and the pescatarian consumed chicken every day. This could have been a mistake by the individual, it could have been someone who chose a random status or someone who did not understand the terms used to describe the vegetarian status. Pescatarians normally do not consume any meat items, only fish and seafood (Hackett, Pescatarian 2013). The vegetarians and lacto vegetarians never consumed this item (100% each). Non-vegetarians consumed this item more often.

Consumption of liver when compared to vegetarian status showed significant difference. All participants of the vegetarian and lacto vegetarian statuses never consumed this item (100% each). This is because of their restricted diet. Non-vegetarians also never consumed liver (49%). The pescatarian consumed this item twice per week. The pescatarian can be wrongly classified and should be under the non-vegetarian status. There can be many reasons for the lack of consumption by non-vegetarians such as not liking the taste of liver, lack of availability or the lack of knowledge about the benefits of consuming liver.

A significant difference was found between vegetarian status and consumption of turkey, a high iron containing food. The vegetarians and lacto vegetarians never consumed this item due to their restrictive diet (100% each). Non-vegetarians (39%) and the pescatarian did not consume this item often as most consumed turkey once per year.

There was significance between fish consumption compared to vegetarian status. The vegetarians and lacto vegetarians never consumed this item due to their restrictive diet (100% each). Non-vegetarians consumed this item twice per month (29%). The pescatarian consumed fish once per week. The risk remains high for the participants as they are not consuming enough of this high iron food. Unfortunately, articles were not available to support this significance.

ANOVA analysis showed statistical significance between vegetarian status and soybean consumption. All of the participants can consume this item, it was found that the vegetarians consumed soybeans every day and twice per week (50% each), lacto vegetarians consumed soybeans twice per week and once per week (50% each) and non-vegetarians never consumed

this item (42%). The pescatarian consumed this item once per week. The risk was higher for the non-vegetarians. It was supported that soybeans are high in iron and can reduce the risk for vegetarians (Lönnerdal 2009; National Institutes of Health 2011). However, Shaw et al. (1995) concluded that without animal products, soybean and vegetarian lifestyles cannot provide sufficient iron.

Statistical analysis between vegetarian status and consumption of oyster, a high iron food, showed significance. Even though all of the participants can consume this item, it was found that the vegetarians, lacto vegetarians and non-vegetarians never consumed this item (80%, 100%, 64% respectfully). The pescatarian consumed this item twice per week. This increases the risk for all the participants except the pescatarian. Articles were not available to support this finding.

All of the students under restricted dietary practices do not consume meat. Vegetarians have depleted iron and zinc stores because of the lack of meat in the diet (Hunt 2003). Plant constituents can inhibit non-heme iron absorption, Vitamin C and organic acids can help non-heme iron absorption from a vegetarian diet (Craig 1994). It was also supported that diets without heme iron are more at risk for the deficiency (Reddy, Hurrell and Cook 2006; Hackett 2013).

No significance was found when vegetarian status was compared with confidence in knowing about different aspects of this anaemia, iron supplement consumption, foods that reduce iron absorption, foods that increase iron absorption, or thinking that they consumed enough iron in their meals. Articles were not available to support this significance.

There was no statistical significance between vegetarian status and dietary risk for this anaemia. It was supported that vegetarian status did not affect prevalence of the deficiency as both non-vegetarians and vegetarians were at risk (George et al. 2000; Harvey et al. 2005).This was not supported by Hunt (2003) who found that there is an increased risk for vegetarians because of the lack of high iron containing foods such as meat. Other articles supported that there would be depletion in iron stores due to dietary restrictions that deplete iron stores and increases the risk for this anaemia (Craig 1994; Tatala, Svanberg and Mduma 1998; Sandstead 2000; Kaur, Bassi and Sharma 2011).

Dietary risk compared with hearing of the term for the deficiency showed significance. Most of female participants at risk and the male participants not at risk heard about the term. Even though about 95% the female participants heard of the term, the risk for the deficiency was

not affected. A large number of the male participants were not at risk (77%) and heard of the deficiency. They were less at risk because their diet provided enough daily iron (>8mg iron) since they need a much smaller amount of iron then females (>18mg iron) (Centers for Disease Control and Prevention 2011). It was supported that the female population was more aware of their anaemia status than the male population (Abalkhail and Shawky 2002).

Statistical significance was found between awareness of the symptom tiredness and dietary risk. Most females at risk (85%) and all females not at risk related the symptom tiredness to the deficiency. A large number of the male participants who were not at risk (77%) related the symptom to the deficiency. Both at risk and not at risk participants therefore knew that tiredness was related to the deficiency.

ANOVA analysis found significance between relating light skin to the deficiency and dietary risk. The female participants at risk (57%) and all not at risk did not relate this symptom to the deficiency as well as the male participants at risk (78%) and not at risk (66%). There was a lack of awareness in this area.

Statistical analysis showed statistical significance between the symptom weakness and dietary risk. The female participants at risk (78%) and all not at risk related this symptom to the deficiency. The male population not at risk also related the symptom to the deficiency (70%) when the male population at risk (52%) did not relate this symptom to the deficiency.

A significant statistical difference was found between dietary risks with awareness that the symptom loss of breath related to iron deficiency anemia. The female participants not at risk (54%) and all participants at risk related this symptom to the deficiency. The male participants not at risk (42%) and at risk (70%) did not relate the symptom to the deficiency. The male participants were less aware of this relation.

Analysis between the symptom headache and dietary risk showed statistical significance. The female participants at risk evenly denied and agreed that the symptom was related to the deficiency (50%). The male population at risk (74%) and not at risk (68%) did not relate the symptom to the deficiency.

Comparing dietary risk with awareness of the symptom light headedness and its relation to the deficiency showed significance. The female participants at risk (66%) agreed that the symptom was related to the deficiency. The male population at risk (65%) and not at risk (64%) did not relate the symptom to the deficiency.

Statistical significance was found when dietary risk was compared to awareness of the symptom chilly hands and feet and its relation to the deficiency. Only the female participants not at risk related this symptom to the deficiency. The female participants at risk (55%), the male participants at risk (74%) and not at risk (74%) did not relate to the symptom to the deficiency.

ANOVA analysis showed statistical significance between dietary risk and awareness of the symptom weak nails and its relation to the deficiency. The female participants not at risk related this symptom to the deficiency when the female participants at risk (73%), the male participants at risk (87%) and not at risk (72%) did not relate to the symptom to the deficiency. Martínez-Navarrete et al. (2002) supported that all the symptoms listed related to the deficiency.

Not knowing any of the symptoms of this anaemia showed statistical significance with diary risk. The female participants at risk (92%), not at risk and the male participants at risk (52%) and not at risk (85%) did not know the symptoms of the deficiency. This shows a lack of awareness. Articles were not available to support the significance.

A significant difference was found between dietary risk and confidence in knowing of the effect of iron on the body. The female participants at risk (38%) and all not at risk felt neutral confidence in knowing the effect of iron in the body. The male participants not at risk (34%) felt high confidence in this area and the male participants at risk (26%) felt low to very low confidence. This shows the lack of awareness on the topic of iron and the relation to the body. Articles were not available to support this significance.

Analysis between dietary risk and confidence, in knowing why women have an increased risk for the deficiency, showed statistical significance. Females at risk for the deficiency (32%) felt high confidence and females not at risk felt neutral and very low confidence (50% each). Males at risk felt (30%) low confidence as well as males not at risk (34%) for the deficiency. The male participants were less confident in this area.

Statistical analysis between dietary risk and confidence in knowing that the deficiency can lead to hear problems showed significance. The female participants most at risk (34%) felt high confidence in this area. The female participants not at risk (50%) felt low to neutral confidence. The male participants not at risk (28%) felt very high confidence and the male participants at risk (35%) felt more neutral towards the topic. Those at more risk were less confident in this area. Articles were not available to support this significance in confidence.

Significance was found between dietary risk and consumption of broccoli, a high iron food. The female participants most at risk (30%) consumed this item once per week when female participants not at risk (50%) consumed it once per week and twice per month. The male participants not at risk (28%) consumed this item twice per month and the male participants at risk (35%) consumed broccoli twice per month. This relationship does not show that broccoli consumption would decrease the risk as the participants at risk consumed it regularly up to once per week. If consumption were increased to twice per week or every day, the risk can be decreased as broccoli is high in iron.

Consumption of raisins and dietary risk analysis showed significance. The female participants most at risk (29%) consumed raisins up to once per month when all not at risk consumed raisins up to once per week. The male participants at risk (35%) never consumed this item and the male participants not at risk (28%) consumed it twice per week. This shows significance as the participants most at risk never consumed the item when the participants less at risk consumed the item regularly. This means that raisins can help reduce the risk of the deficiency if consumed regularly. This was supported by an article that found that iron status can be helped by organic acid consumption as they can counter act the inhibition of iron and increase iron absorption from foods (Craig 1994).

ANOVA analysis showed statistical significance between dietary risk and cocoa consumption. The female participants at risk (29%) consumed this item twice to once per week as well as the female participants not at risk (50%). The male participants not at risk (32%) consumed the item once per week and the male participants at risk (26%) consumed the item twice per week and never. Cocoa products are can reduce iron absorption of non-heme products such as plant items (Centers for Disease Control and Prevention 2011). The results show that the participants at risk consumed this item regularly as well as those not at risk. Further research on the type of product consumed and the time of consumption can help in analysis of this relationship. It was found that cocoa can reduce iron absorption by 71% and therefore increases the risk for the deficiency (Hurrell, Reddy and Cook 1999).

A comparison between dietary risk and soft drink consumption showed significance (sig 0.014). The female participants most at risk (29%) consumed this item twice per week. All the female participants not at risk never consumed the item. The male participants at risk (35%) consumed the item every day and the male participants not at risk (36%) consumed the iron

twice per week. This shows that the female participants were affected by this item that reduces iron absorption. Among the female participants who drank soft drink often, their risk was increased. This is not the same for the male participants however since some consume it often but they are not at risk. This was supported by Abalkhail and Shawky (2002) since it was found that cola drink and junk food consumption was related to an increased risk for this anaemia.

There was no significance with iron supplement, foods that increase iron absorption and the thought that they consumed enough iron in their meals with dietary risk. Unfortunately, there are no articles to support this.

Concern should be focused on the areas where awareness and confidence was lacking as well as the frequency of consumption of high iron foods, foods that can inhibit iron absorption and foods that increase iron absorption. There were great significances found with the lack of consumption of high iron foods as well as awareness of symptoms of the deficiency based on gender, ethnicity, vegetarian status and dietary risk. Females were at greatest risk for the deficiency. There was a high risk for this anaemia in the overall population which can affect school performance and reduce the true potentials of students at this university. With education, the risk can be significantly decreased if students apply what they learn to their daily life styles. This was supported by articles that found that education was linked to a decrease in the risk for the deficiency and increasing iron status of the individuals (Kaur, Bassi and Sharma 2011). It was supported that a low level of education was related to this increased risk (Sabah, Fatima and Ramzan 2010). Consuming more iron supplements can be beneficial if the diet cannot provide for their needs.

1.1 Limitations:

The limitations of this study include aspects of the design or method that impact the results.

1. Answering the questionnaire is a burden to individuals as it is time consuming.
2. The portions of meals recorded are dependent on the individual's ability to average sizes of meals eaten which leaves room for error. This could have lead to overestimation or underestimation of food and beverage portions such as fruits and vegetables and water consumption.
3. Lack of distribution among vegetarian status and ethnicity prevents better comparisons.
4. Questions that were not completed limited the accuracy of result conclusions.
5. Language barriers could have been a limitation as individuals might have not understood terms and phrases used in the questionnaire such as the vegetarian status terms.
6. There is a lack of research on iron deficiency anaemia in UWI St. Augustine in Trinidad and Tobago therefore this reduces the foundation for the study. Therefore, there is a need for further research pertaining to the topic of iron deficiency anaemia in Trinidad and Tobago.
7. Studies from the literature review used samples between 100 to 1000 individuals to test the prevalence, awareness and dietary habits individually. Due to time constraints and restricted resources, one hundred and seventy year one students were recruited for this research.

1.2 Recommendation for improvement:

1. Even though the sample size was deemed acceptable, a larger sample size could have increased the accuracy of results.
2. Reduce language barriers by using simpler terms and phrases. Provide explanations for scientific terminology used.
3. Recommendations to help increase awareness of dietary habits in relation to this anaemia should be implemented in the university, especially for the female (high risk) population. This can be done by an educational program targeting the high risk students. Education on high iron foods, foods that reduce iron absorption and foods that increase iron absorption should be discussed to help students make wiser choices with their meals.
4. Increasing the availability of high iron foods in the university can help the student population meet their daily iron needs.
5. Iron supplements can also be recommended to the students at risk to help provide iron to meet their daily needs. This should be recommended when iron cannot be sufficiently provided by the diet.
6. Finger prick testing for this anaemia should be offered to students due to their high risks as it can affect their academic performance in the university.

CHAPTER 6: CONCLUSION

Results showed that participants were aware of the deficiency, but were unaware of the symptoms of the deficiency and had a high confidence in awareness of different aspects of the deficiency. Dietary habits among students were poor as there was a lack of high iron foods, foods that reduce iron absorption, but a high intake of foods that help increase iron absorption. The participants at risk did not consume enough high iron foods to provide for their daily need. This was represented by the increased risk for the overall students (57%). This showed that there was a lack of knowledge in relation to the diet and the risk for the deficiency.

The female participants were more aware and confident in knowing about this type of anaemia than the male population. Males were found to consume more high iron foods. Females were more at risk for this type of anaemia. No relationship was found with consumption of foods that decrease iron absorption and those that increase iron absorption.

Ethnicity and its comparison with awareness and diet showed significance. The African population was less aware of this anaemia. The East Indian and African participants were less confident than the mixed participants. The African participants consumed more high iron foods. The African and mixed participants consumed less foods that inhibit iron absorption. No significance was found with dietary risk and ethnicity.

Non-vegetarians were less aware of this anaemia than the vegetarians, lacto vegetarian and the pescatarian. There was no significance with confidence and vegetarian status. None of the participants under this status consumed high iron foods. There was no significance with foods that inhibit iron absorption, those that increase iron absorption or with dietary risk.

Those at risk were more aware of the term. Females at risk were more aware than the males at risk. Those at risk felt neutral to high confidence in knowing about iron deficiency. Overall, those at risk did not consume enough high iron foods. Those not at risk and at risk consumed foods that inhibit iron absorption. No significance was found with consumption of foods that increase iron absorption.

An educational program is suggested to increase knowledge in the dietary aspect of the deficiency to reduce the risk and have a positive impact on school performance. The hypothesis was not supported since students were aware of this anemia, but their dietary practices were poor and their risk was high. Dietary habits had a significant impact on the risk for this anaemia.

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VI-APPENDIX

Appendix 1: Frequency (%) of participants relating specific symptoms to this anaemia.

Symptoms		Yes	Percent yes	No	Percent no	Missing	Total
1.	Tiredness	128	75.3	42	24.7	0	170
2.	Light skin	51	30.0	119	70.0	0	170
3.	Weakness	118	69.4	52	30.6	0	170
4.	Loss of breath	76	44.7	94	55.3	0	170
5.	Headache	69	40.6	101	59.4	0	170
6.	Light headedness	82	48.2	88	51.8	0	170
7.	Chilly hands and feet	57	33.5	113	66.5	0	170
8.	Belly pain	24	14.1	146	85.9	0	170
9.	Irritability	41	24.1	129	75.9	0	170
10.	Soreness of tongue	29	17.1	141	82.9	0	170
11.	Weak nails	42	24.7	128	75.3	0	170
12.	Fast heartbeat	48	28.2	122	71.8	0	170
13.	Deprived appetite	40	23.5	130	76.5	0	170
14.	Strange cravings	40	23.5	130	76.5	0	170
15.	All of the above	20	11.8	150	88.2	0	170
16.	None of the above	3	1.8	167	98.2	0	170
17.	I don’t know	29	17.1	141	82.9	0	170

This table represents information for percentage values of those who related the symptoms listed to the deficiency.

Appendix 2: Frequency (%) of participants being confident in knowing about the deficiency:

	1	%	2	%	3	%	4	%	5	%	Missing	Total
Understanding the meaning	27	15.9	46	27.1	53	31.2	34	20.0	10	5.9	0	170
Knowing the effects	17	10.0	53	31.2	57	33.5	33	19.4	10	5.9	0	170
What increases the risk	13	7.6	44	15.9	53	31.2	47	27.6	13	7.6	0	170
What to do if iron levels are low	22	12.9	61	35.9	37	21.8	37	21.8	13	7.6	0	170
Job of iron in the body	37	21.8	51	30.0	48	28.2	27	15.9	7	4.1	0	170
Dangers of anaemia	23	13.5	56	32.9	43	25.3	35	20.6	13	7.6	0	170
Iron and its relationship with haemoglobin	48	28.2	44	25.9	39	22.9	27	25.9	12	7.1	0	170
Why women are at more risk	37	21.8	42	24.7	35	20.6	38	22.4	18	10.6	0	170
Children and poor diet increases risk	24	14.1	52	30.6	60	35.3	24	14.1	10	5.9	0	170
Low social life and risk	11	6.5	19	11.2	43	25.3	50	29.4	47	27.6	0	170
Anaemia leads to heart problems	30	17.6	48	28.2	39	22.9	41	24.2	12	7.1	0	170
Total	290	169.9	518	293.6	510	298.2	397	241.3	170	97	0	1885
Total 1, 2, 3, 4, 5												1870

Key:

1	2	3	4	5
Very high	High	Neutral	Low	Very low

Levels of confidence among the population were condensed in the table above.

Appendix 3: Frequency (%) of participants consuming high iron containing foods:

Frequency	Beef	Chicken	Liver	Turkey	Fish	Fortified Cereal	Lentil	Soybean	Broccoli	Spinach	Clam	Oysters	Pumpkin Seeds	Raisin	
1	0	12	0	1	0	1	0	0	1	1	0	1	0	0	17
%	0.0	7.1	0.0	0.6	0.0	0.6	0.0	0.0	0.6	0.6	0.0	0.6	0.0	0.0	10.1
2	2	65	1	0	3	32	6	5	2	2	0	1	2	7	128
%	1.2	38.2	0.6	0.0	1.8	18.8	3.5	2.9	1.2	1.2	0.0	0.6	1.2	4.1	75.3
3	15	75	10	7	34	45	39	11	32	23	1	3	6	15	316
%	8.8	44.1	5.9	4.1	20.0	26.5	22.9	6.5	18.8	13.5	0.6	1.8	3.5	8.8	185.8
4	29	8	0	16	39	31	59	20	39	44	2	2	6	30	325
%	17.1	4.7	0.0	9.4	22.9	18.2	34.7	11.8	22.9	25.9	1.2	1.2	3.5	17.6	191.1
5	24	1	20	16	46	13	31	22	39	42	6	7	7	32	306
%	14.1	0.6	11.8	9.4	27.1	7.6	18.2	12.9	22.9	24.7	3.5	4.1	4.1	18.8	179.8
6	25	0	29	41	30	19	21	33	22	27	10	23	25	37	342
%	14.7	0.0	17.1	24.1	17.6	11.2	12.4	19.4	12.9	15.9	5.9	13.5	14.7	21.8	201.2
7	8	0	12	63	3	8	1	11	11	4	24	23	21	15	204
%	4.7	0.0	7.1	37.1	1.8	4.7	0.6	6.5	6.5	2.4	14.1	13.5	12.4	8.8	120.2
8	66	8	86	25	14	20	12	67	23	26	126	109	102	33	717
%	99.4	4.7	50.6	14.7	8.2	11.8	7.1	39.4	13.5	15.3	74.1	64.1	60.0	19.4	482.3
	329	268.4	251.1	268.4	268.4	268.4	268.4	268.4	268.3	268.5	268.4	268.4	268.4	268.3	3800.8
Total of 1, 2, 3, 4, 5, 6, 7, 8											2355				
Total answered down											169				

Total without rate for option never														Total
263	260.4	165.1	243.4	254.4	248.4	256.4	201.4	245.3	242.5	142.2	159.4	166.4	235.3	3083.8

Appendix 3 continued: Frequency (%) of the participants consuming foods high iron foods:

Statistics										
	Beef	Chicken	Liver	Turkey	Fish	Cereal	Lentils	Soybeans	Broccoli	Spinach
Valid	169	169	169	169	169	169	169	169	169	169
Missing	1	1	1	1	1	1	1	1	1	1

Statistics				
	Clams	Oysters	Pumpkin	Raisins
Valid	169	169	169	169
Missing	1	1	1	1

Key:

1	2	3	4	5	6	7	8
Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never

The consumption of high iron foods were listed above. Only one data was missing for all the items.

Appendix 4: Frequency (%) of the participants consuming foods that reduce iron absorption:

Frequency	Coffee	Tea	Dairy products	Cocoa products	Whole grains	Soft drinks	Total
1	9	9	12	1	1	7	39
%	5.3	5.3	7.1	0.6	0.6	4.1	23
2	28	52	88	29	55	41	293
%	16.5	30.6	51.8	17.1	32.4	24.1	172.5
3	29	31	41	46	40	48	235
%	17.1	18.2	24.1	27.1	23.5	28.2	138.2
4	21	29	15	45	39	22	171
%	12.4	17.1	8.8	26.5	22.9	12.9	100.6
5	16	14	5	16	13	17	81
%	9.4	8.2	2.9	9.4	7.6	10.0	47.5
6	14	20	4	13	7	11	69
%	8.2	11.8	2.4	7.6	4.1	6.5	40.6
7	11	3	0	3	2	2	21
%	6.5	1.8	0.0	1.8	1.2	1.2	12.5
8	41	11	4	16	12	21	105
%	24.1	6.5	2.4	9.4	7.1	12.4	61.9
	268.5	268.5	268.5	268.5	268.4	268.4	
Total of 1, 2, 3, 4, 5, 6, 7, 8					1014		

Key:

1	2	3	4	5	6	7	8
Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never

Foods that decrease iron absorption were condensed above.

Appendix 5: Frequency (%) of the participants consuming foods that increase iron absorption:

Frequency	Legumes	Green leafy vegetables	Fruits	Vitamin C supplements	Total
1	4	3	8	8	23
%	2.4	1.8	4.7	4.7	13.6
2	45	45	70	82	242
%	26.5	26.5	41.2	48.2	142.4
3	66	79	48	20	213
%	38.8	46.5	28.2	11.8	125.3
4	31	27	33	24	115
%	18.2	15.9	19.4	14.1	67.6
5	13	11	5	7	36
%	7.6	6.5	2.9	4.1	21.1
6	5	1	2	9	17
%	2.9	0.6	1.2	5.3	10
7	0	0	0	4	4
%	0.0	0.0	0.0	2.4	2.4
8	5	3	3	15	26
%	2.9	1.8	1.8	8.8	15.3
	268.3	268.6	268.4	268.4	1073.7
Total 1, 2, 3, 4, 5, 6, 7, 8			676		

Statistics					
		Legumes	Green	Fruit	Vitamin
N	Valid	169	169	169	169
	Missing	1	1	1	1

Consumption of foods that increase iron absorption was condensed above.

Appendix 6: List of iron content in food items

Food item	quantity	iron content (mg)
apple	1 medium	0.1
apple juice	1cup	0.3
avocado	1oz	0.2
Baked beans	1cup	0.7
baked chicken	1oz	0.3
baked fish tilapia	1oz	0.2
Baked potato	1	3.2
banana	1	0.3
banana bread	1slice	0.8
beef	1oz	0.6
beef burger	1	5.1
berry boost smoothie	1 cup	1.4
bodi	28g	0.2
bran flakes	3/4cup	8.1
Bread/bake	1 slice	0.9
breadstick	2	4.1
broccoli	1oz	0.2
buffalo wings	5	0.7
butter cookies	1	0.1
callaloo	1/2cup	1.9
carambola	1cup	0.1
carrots	1oz	0.1
cashews	1oz	1.7
channa and aloo	1oz	1.7
cheddar cheese	1 slice	0.2
cheerio's	1 cup	8.9
cheese pie	1	1.8
cheese sticks	1	0.5
chicken burger	1	2.7
chicken pastel	1	4.3
chicken pie	1	2.1
chicken pizza	1 slice	1.8
chicken sausage	1	0.5
Chinese chicken	1/2breast	1
Chinese noodles	1cup	2.1
chocolate cookie	1	0.4
chocolate ice cream	1/2 cup	0.6
chocolate milk	1 cup	0.8

Food item	quantity	iron content (mg)
Christophine	1cup	0.4
cinnamon cereal	1 cup	4.5
cinnamon roll	1	2.8
coconut cookie	1	0.2
coffee	6oz	0.1
coleslaw	1/4cup	0.4
cookies and cream	1 cup	0.3
corn	1oz	0.1
corn flakes	1cup	5.4
corned beef	1 slice	0.4
cottage cheese	1cup	0.3
crab	1cup	1.1
cranberry	1oz	0.1
cranberry juice	1 cup	0.6
cream of wheat	1cup	10.3
crème brulee	1/2cup	0.5
croissant and jam and cream cheese	1	1.4
cupcake	1	0.7
curried chicken	1 ounce	0.3
curry beef	314g	7.3
custard cone	1	1.5
Danish	1	0.5
dark chocolate	1oz	2.3
dhal	1 cup	2.5
dhalpuri	1/4 roti	1.2
doubles	1	2.4
doughnut	1	1.4
ensure	1cup	4.5
fibre milk	1 cup	4.14
flour	1oz	1.3
fried fish	1oz	0.2
fried rice	100g	0.4
fries	74g	0.4
Froot loops	1cup	4.2
frosted flakes	1 cup	9.1
fruit cup	1	0.7
fruit punch	1cup	0.5

Appendix 6: List of iron content in food items continued…

Food item	quantity	iron content (mg)
fry aloo	28g	0.1
garlic potatoes	1/2cup	0.2
goat	1oz	1
granola	100g	2.7
granola bar	1	0.7
grape juice	1cup	0.3
grapefruit juice	1cup	0.9
grapes	1cup	0.3
grits	1cup	1.5
ground provisions	1cup	0.7
gyro	1	3.6
ham	1oz	0.4
ham and cheese sandwich	1	3.2
hardboiled egg	1	0.6
hash browns	1cup	0.9
Hawaiian pizza	3slice	4.6
honey oats	1cup	16.8
hot choc	1cup	0.4
hotdog	1	2.3
jam	1tbsp	0.1
KFC biscuit	1	1.1
KFC breast	1	1.4
KFC drumstick	1	0.7
KFC thigh	1	1.4
kiwi	1 medium	0.2
lamb	100g	1.1
lamb chop	3oz	2.1
lasagna	1 cup	2.5
leg baked	1	1.5
lentils	1cup	6.6
lime juice	1cup	0.2
M&M	1oz	0.4
macaroni pie	1cup	2
macaroni salad	2oz	0.7
mashed potatoes	1 cup	0.5
meat lovers pizza	1 slice	1.8
milk	1cup	0.1

Food item	quantity	iron content (mg)
milk chocolate	1 ounce	0.7
muffin	1 medium	4.7
mushrooms fried	1cup	0.3
nacho and cheese	113	1.3
noodles	1 cup	1.8
nuts	1oz	0.9
oatmeal cookie	1	0.6
oats	1cup	5.8
ochro	1/2 cup	0.2
orange	1 fruit	0.1
Oreo	4	0.5
orange juice	1 cup	0.4
pancake	1	0.7
passion fruit	1 cup	0.1
pasta and chicken and tomato sauce	252	2.3
peanut butter	2tbsp	5.3
peas	1cup	1.2
pecans	1oz	0.8
personal pizza chicken	1 slice	3.6
pineapple juice	1cup	0.8
pomegranate juice	1 cup	0.2
popcorn	100g	2.4
potato wedge	1oz	0.2
pretzel	10	3.1
Pringles	1oz	0.2
pumpkin	1cup	1.4
pumpkin seed	1cup	2.1
ramen	1 cup	1.8
red beans	1 cup	5.2
rice	1 cup	2.9
rice crisp	4g	0.1
rotisserie chicken	100g	0.5
roti	28g	0.7
salad	1cup	0.4
salmon	3oz	0.3
salt fish	3oz	2.1
sardine	Tin	2.7

Appendix 6: List of iron content in food items continued…

Food item	quantity	iron content (mg)
sausage sandwich	1	1.9
scalloped potato	1 cup	1.4
shrimp	3oz	1.1
shrimp wontons	1	0.4
snow cone	1 cup	0.3
soda	1 cup	0.5
Food item	quantity	iron content (mg)
soymilk choc	1cup	1.4
spaghetti	100g	1.1
spinach	1cup	6.4
sponge cake	1slice	0.7
squid	3oz	0.9
scrambled egg	1	0.7
stew fish	1oz	0.4
stewed chicken	1ounce	0.3
strawberry cheesecake	1slice	0.4
subway chicken	6"	5.4
sunrise muffin	1	1.8
supligen	1 cup	6.3
sweet bread	1slice	1.8
tangerine	1	0.1
tomato	1cup	1.6
tomatoes choka	28g	0.3
tuna	28g	0.3
tuna salad	3oz	0.9
turkey	slice	0.3
turkey and ham sandwich	1	2.4
vege pizza	slice	1.8
potato	1cup	1.1
vegetables	1/2cup	0.7
veggie hotdog	1	1.2
veggie patty	1 slice	1.2
Vienna sausage	1	0.1
wafer	6g	0.2
watermelon	1oz	0.1
west Indian cherry	1cup	0.2

Food item	quantity	iron content (mg)
whole wheat bread	1slice	0.7
whole wheat pasta	1cup	1.5
wonton skin	1	0.3
yogurt crush	1 cup	2.6
zinger	1	1.8
yogurt	8oz	0.2
chicken Pattie	1	0.3
puff	40g	1
chewy	1	0.7
cassava	1cup	0.6
Food item	quantity	iron content (mg)
oat cereal	1 cup	2.4
cabbage cooked	1/2cup	0.1
flaxseed	1cup	9.6
pawpaw	1 cup	0.1
corn chip	1 bag	2.6
squash	1cup	0.6
omelette	1	0.9
channa	1cup	4.7
bagel	1	0.9
strawberry tart	1	1.8
potato pie	1	0.9
brownie	56g	1.3
plantain	1cup	1.2
beef soup	bowl	2.2
celery	stalk	0.1
plantain chip	1oz	0.2
baigan	1cup	0.2
smalta	1 cup	1.8
soya	1oz	4.1
wheat snack	1	0.4
cracker	1oz	1.2
chicken soup	1 cup	0.5
cabbage raw	1 cup	0.6
yam	1cup	0.7
butter	1 tbsp	0
onion	1 cup	0.3

Appendix 6: List of iron content in food items continued…

Food item	quantity	iron content (mg)
chicken liver	1 oz	3.3
apple jack cereal	1 cup	6.2
cocoa puff cereal	1oz	4.2
nectarine	1 small	0.4
beer	1 oz	0
pineapple	1 cup	0.5
coconut water	1 cup	0.7
vanilla cookie wafer	1oz	0.7
snickers bar	1	0.4
pumpkin seed	1oz	0.4
raisin	1oz	0.5
avocado	1 cup	0.8
mango	1 cup	0.2
duck	1 cup	3.8
fruit punch	1oz	0.1
potato chip	1 bag	3.7
tofu	1oz	1.4
milkshake	100 g	0.3
chocolate pudding	1oz	0.4

Food item	quantity	iron content (mg)
carbonated soft drink	1 oz	0
lime juice	1 cup	0.2
kit kat	1 bar	0.5
caramel	1oz	0
pork	1 slice	0.1
potato salad	1 cup	1.6
beet	1 oz	0.2
ribs	1oz	0.5
lucky charms	1 cup	6.4
squash	1 cup	0.7
white bread	1 slice	0.9
wheat germ	1 cup	7.2
cantaloupe	1 cup	0.4
tomato sauce	1 cup	1.9
turkey sandwich	1	2.1
beef pie	1	1.5
cheese sandwich	1	2.2
goat	1oz	1
vege soup	1 cup	1.1
breadfruit	1 cup	1.2

Values in the tables above represented the iron content in foods and were used to assess the iron content in the three days record from questionnaires. These values helped assess the risk among the student participants.

THE UNIVERSITY OF THE WEST INDIES

IRON DEFICIENCY ANAEMIA AWARENESS AND ITS RELATION TO DIETARY HABITS OF FIRST YEAR STUDENTS AT THE UNIVERSITY OF THE WEST INDIES ST. AUGUSTINE CAMPUS

QUESTIONNAIRE

BY: CANDIDA KHAN

B.Sc. Human Nutrition and Dietetics

Supervisor: Dr. Bawa

2013

Purpose:

This research project is associated with the course HUEC 3012. It investigates awareness of iron deficiency anaemia, eating habits and nutrition status among University students.

Requirements:

There are 33 questions in this questionnaire. Please answer all questions to the best of your ability. Tick and fill in accordingly. This questionnaire is for Year 1 students ONLY.

Acknowledgements:

I thank you for participating in this research. Your contribution is much appreciated. This data will help to improve iron deficiency awareness as well as dietary habits in the hope of decreasing the occurrence in the community of students at the University of the West Indies.

Confidentiality

I understand that my identity and the results of the analysis will not be given to anyone except the investigator.

_____ _____ _____

Participants Date Investigator

(480-5380 or candida.khan@gmail.com)

DEMOGRAPHICS

1. Gender: ☐ Male ☐ Female
2. Ethnic group: ☐ African ☐ East Indian ☐ Mixed ☐ Chinese ☐ Caucasian
3. Are you a: ☐ Non-Vegetarian ☐ Vegetarian ☐ Lacto -vegetarian ☐ Pescatarian ☐ Vegan

AWARENESS

A. Knowledge:

4. Have you heard of the term iron deficiency anaemia? ☐ Yes ☐ No
5. Is iron a part of all cells that helps your muscles to store and use oxygen?

   ☐ Yes ☐ No ☐ I don't know
6. Have you heard of iron deficiency anaemia as being one of the most prevalent nutritional deficiency on a worldwide basis: ☐ Yes ☐ No
7. Do you have iron deficiency anaemia: ☐ Yes ☐ No ☐ I do not know
8. Do members of your family suffer from iron deficiency anaemia:

   ☐ Yes ☐ No ☐ I don't know
9. What symptom or symptoms are related to iron deficiency (You can tick more than one):

   ☐ Tiredness ☐ Light skin ☐ Weakness ☐ Loss of breath

   ☐ Headache ☐ Light Headedness ☐ Chilly hands and feet

   ☐ Belly pain ☐ Irritability ☐ Soreness of your tongue

   ☐ Weak nails ☐ Fast heartbeat ☐ Deprived appetite

   ☐ Strange cravings for non-nutritive substances for example ice, dirt or starch

   ☐ All of the above ☐ None of the above ☐ I don't know

B. Effects of diet:

10. Do you think iron deficiency anaemia can be affected by your diet: ☐ Yes ☐ No
11. Can a well balanced diet help reduce the risk of iron deficiency anaemia?

    ☐ Yes ☐ No ☐ I don't know
12. Do you know that there is iron in your food? ☐ Yes ☐ No
13. Are you aware of any high iron containing foods? ☐ Yes ☐ No
14. Are you aware that there are foods that reduce iron absorption? ☐ Yes ☐ No
15. Did you know that vegetarians are at a greater risk for iron deficiency anaemia?

    ☐ Yes ☐ No
16. Are you aware of how iron deficiency anaemia is tested? ☐ Yes ☐ No

C. How confident are you concerning the questions below;

Scale: 1 = Very High 2 = High 3 = Neutral 4= Low 5 = Very low

17.	Understanding what iron deficiency anaemia means	1 2 3 4 5
18.	Knowing the effects of iron deficiency anaemia on the body	1 2 3 4 5
19.	Knowing what increases the risk for iron deficiency anaemia	1 2 3 4 5
20.	Knowing what you need to do if your iron levels are low	1 2 3 4 5
21.	Knowing what foods can help reduce your risk for anaemia	1 2 3 4 5
22.	Understanding the job of iron in the body	1 2 3 4 5
23.	Knowing the dangers that come with anaemia	1 2 3 4 5
24.	Knowing the relation between iron and haemoglobin	1 2 3 4 5
25.	Understanding why women are more at risk for anaemia	1 2 3 4 5
26.	Knowing that children are at risk because of their poor diet	1 2 3 4 5
27.	Understanding that a low social life affects the risk of anaemia	1 2 3 4 5
28.	Knowing that anaemia can eventually lead to heart problems	1 2 3 4 5

DIET

D. Food and Beverage Intake

29. What is your frequency of consumption of the following foods? (Tick Accordingly)

Food item	Frequency of consumption							
	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Beef								
Chicken								
Liver								
Turkey								
Fish								
Fortified Cereal								
Lentils								
Soybeans								
Broccoli								
Spinach								
Clams								
Oysters								
Pumpkin seeds								
Raisins								

30. Do you take iron supplements on a regular basis? ☐ Yes ☐ No

31.What is your frequency of consumption of the following foods? (Tick accordingly)

Food item	Frequency of consumption							
	Twice per day	Every day	Twice per week	Once per week	Twice per month	Once per month	Once per year	Never
Coffee								
Tea								
Dairy products								
Cocoa products								
Whole grains								
Soft drinks								
Legumes								
Green leafy vegetables								
Fruits								
Vitamin C supplement								

32. A 3 Day Food Record

Instructions:

A three day food record is aimed at analyzing what you consume over 3 days. It entails a short description of what you eat and drink. Information will be analysed to assess your iron intake over a three day period. These three days include two days during the week e.g. Monday and Tuesday as well as a weekend day e.g. Saturday. Three days were chosen for this diet record as it provides an accurate representation of the overall diet. The iron content of meals will be calculated by the investigator ONLY.

Follow instructions below:

- Write down foods and drinks as soon as you consume them!
- Start when you wake up and when you go to sleep.
- Please try to be accurate and record everything you eat / drink (include water, coffee, pastry snacks etc.)
- Include detailed information about item (for example; fat free or the type of juice whether it's orange or grape etc.)
- Include preparation method (fried, steamed, baked or curried)
- Record any three days that are most "typical" to you.
- Include portion sizes (1 cup, 1 pot spoon etc). Avoid "bowl" "helping" "plate."
- List all ingredients in dish (for example; sandwich – tuna paste, 1 lettuce leaf and 2 slices of whole wheat bread)

Guidelines for estimating portion sizes

3 oz. cooked meat, poultry or fish	=	a deck of cards
½ cup vegetables, fruit, cooked cereal, pasta, or rice	=	a small fist
½ bagel	=	the width of a large coffee lid
1 muffin	=	a large egg
1 tsp margarine or butter	=	a thumb tip
2 tsp peanut butter	=	a golf ball
1 small baked potato	=	a computer mouse
1 medium apple or orange	=	a baseball
4 small cookies (such as a vanilla wafer)	=	4 casino chips
1 ½ oz cheese	=	6 dice or a small pager
1 tortilla	=	a small (7”) plate
1 pancake or waffle	=	a 4” cd
1 scoop of ice cream	=	a round mouse
1 tsp olive oil or other cooking oil	=	an eye shadow compact
a serving of pretzels or other snack food	=	a coffee mug (6 oz.) full

DIETARY RECORD: DAY 1 (Week day)			
	Food Item (pizza and water)	Quantity (cups, ml)	Notes (ingredients e.g. beef)
Breakfast			
Snack			
Lunch			
Snack			
Dinner			
Snack			
Total iron (mg/day)			

DIETARY RECORD: DAY 2 (Week day)			
	Food Item (pizza and water)	Quantity (cups, ml)	Notes (ingredients e.g. beef)
Breakfast			
Snack			
Lunch			
Snack			
Dinner			
Snack			
Total iron (mg/day)			

DIETARY RECORD: DAY 3 (Weekend day)			
	Food Item (pizza and water)	Quantity (cups, ml)	Notes (ingredients e.g. beef)
Breakfast			
Snack			
Lunch			
Snack			
Dinner			
Snack			
Total iron (mg/day)			

33.Do you think that you are consuming enough iron containing foods to provide for your daily needs?

☐ Yes ☐ No ☐ I don't know

END OF QUESIONNAIRE! THANK YOU