EVALUATION OF KNOWLEDGE AND ATTITUDE RELATED TO ANEMIA AMONG FEMALE UTAR UNDERGRADUATE STUDENTS: A CROSS-SECTIONAL STUDY

By

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ABSTRACT

EVALUATION OF KNOWLEDGE AND ATTITUDE RELATED TO ANEMIA AMONG FEMALE UTAR UNDERGRADUATE STUDENTS: A CROSS-SECTIONAL STUDY

Lock Yee Sin

Anemia or iron deficiency is one of the most prevalent medical around the whole especially among female population due to several underlying reasons related. Still, there has been very limited investigation of anemia or iron related knowledge and attitudes among undergraduate students in Malaysia. Hence, this study conducted as to assess the knowledge and attitude related to anemia or iron among undergraduate students in Universiti Tunku Abdul Rahman (UTAR). A cross-sectional study design with convenience sampling method was adopted by using validated survey among 171 female undergraduate students whereby the questionnaire uncomposed of knowledge and attitude related to anemia or iron were self-administered through social platforms. The data obtained were later analyzed using SPSS version 27.0 in the form of descriptive and inferential statistics. The associations between knowledge and attitude, knowledge and attitude with selected demographic variables were analyzed using the Chi-square test and Spearman's rho correlation test was used to determine the strength and direction of the knowledge and attitude variables. Among 171 students, the majority (70.2%) had poor knowledge but a neutral

attitude (60.8%) related to anemia or iron in which average score were 46.51% and 73.33% respectively. The knowledge was moderately associated with the attitude ($r = 0.403$, $p < 0.001$). Age showed a statistically significant association with knowledge but not with attitude ($p = 0.032$; $p = 0.111$). The average menstruation duration was associated statistically with the knowledge ($p = 0.041$). The knowledge level was compared between study fields (health and non-health science) and found a significant association ($p < 0.001$). Further studies are needed to strengthen the existing findings from previous studies. Information from this study can be used as a reference to raise awareness regarding the importance of anemia prevention which is essential to help improve women's quality of life.

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Finally, I would like to express my appreciation to my family and friends for their unconditional love and support. The positivity they showed helped me a lot throughout the whole education journey. I would not be able to pass and get through those hard obstacles and challenges without their help.

DECLARATION

I hereby declare that this final year project report is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

Lock Yee Sin

APPROVAL SHEET

The final year project entitled "**EVALUATION OF KNOWLEDGE AND ATTITUDE RELATED TO ANEMIA AMONG FEMALE UTAR UNDERGRADUATE STUDENTS: A CROSS-SECTIONAL STUDY**" was prepared by LOCK YEE SIN and submitted as partial fulfillment of requirements for the degree of Bachelor of Science (Hons) Dietetics at Universiti Tunku Abdul Rahman.

Approved by:

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PERMISSION SHEET

It is hereby certified that **LOCK YEE SIN** (ID No: **20ADB05809**) has completed this final year project thesis entitled "EVALUATION OF KNOWLEDGE AND ATTITUDE RELATED TO ANEMIA AMONG FEMALE UTAR UNDERGRADUATE STUDENTS: A CROSS-SECTIONAL STUDY)" under the supervision of Dr. Chee Huei Phing (Supervisor) from the Department of Allied Health Sciences, Faculty of Science.

I hereby give permission to the University to upload the softcopy of my final year project thesis in pdf format into the UTAR Institutional Repository, which may be made accessible to the UTAR community and public.

Yours truly,

_____
(LOCK YEE SIN)

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LIST OF ABBREVIATIONS

Fe^{2+} — Iron ion in +2 oxidation state

Fe^{3+} — Iron ion in +3 oxidation state

IDA — Iron deficiency anemia

KAP — Knowledge, attitude and practice

MCH — Mean corpuscular hemoglobin

NHMS — National Health and Morbidity Survey

RBC — Red blood cell

RHC — Reticulocyte hemoglobin content

RNI — Recommended Nutrient Intake

Sg. Long — Sungai Long

SPSS — Statistical Package for Social Sciences

sTfR — Soluble transferrin receptor

TIBC — Total iron binding capacity

TSAT — Transferrin saturation

UNESCO — United Nations Educational, Scientific and Cultural Organization

UTAR — Universiti Tunku Abdul Rahman

WHO — World Health Organisation

CHAPTER 1

INTRODUCTION

1.1   Introduction to Anemia and Iron

Anemia is a condition when the body's red blood cells (RBC) or hemoglobin concentration lower than the normal concentration (cut-off point) whereby the associated factors like age, gender, daily lifestyles and etc have an impact on the incidence occurrence (WHO, n.d.). Anemia categorization is based on the morphology of the red blood cell, presentation for clinical purposes, and pathogenesis and can further be classified into nutritional and non-nutritional anemia. Non-nutritional anemia can be due to a predisposition of the health condition through hereditary, treatments that may affect the red blood cell production in the bone marrow or internal bleeding through health problems like stomach ulcers whereas nutritional anemias are due to deficiency in certain micronutrients. Among all the anemia types, iron deficiency anemia (IDA) is notably the most common (WHO, n.d.). IDA happens due to various reasons like low dietary iron intake, and the body's malabsorption of iron, and for women at their reproductive age may also be caused by the menstruation cycle which will have periodic blood loss.

3 stages of iron deficiency that can lead to IDA, starting from depletion of iron in the body by detecting the decreased serum ferritin level, followed by iron deficiency but the individual has yet to suffer from IDA whereby as a means of

attempting to improve the transport of iron to the cells, the body's serum iron and ferritin, transferrin saturation (TSAT), and hepcidin will have a reduction while an increase in the total iron-binding capacity (TIBC) and soluble transferrin receptor (sTfR) in which the red blood cells formed will be hypochromia due to mean corpuscular hemoglobin (MCH) and reticulocyte hemoglobin content (RHC) had decreased and eventually IDA that cause oxygen transportation impairment (Yang, et al., 2023). IDA is mainly related to the mineral iron whereby the micronutrient is necessary for health as it has much involvement in the body's function and metabolism. Iron is mainly involved in oxygen transport for cellular respiration as iron is used for hemoglobin synthesis which is a protein found in the RBC. Maintaining iron homeostasis is crucial to prevent iron deficiency which eventually can lead to anemia if preventive actions are not taken.

According to the National Coordinating Committee on Food and Nutrition, (2005), the recommended nutrient intake (RNI) for dietary iron consumption for women and men above the age of 18 per day is 2.94 and 1.37 mg respectively while infants and children ranged between 0.58 and 0.93 depending on their age. Dietary iron can be obtained from dietary sources in two forms, hem or non-hem iron. Hem iron can be found mostly in the fleshes of meats, poultry, and fish while non-hem iron can be found in plant-based food like dark leafy green such as spinach, legumes, etc.

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1.2 Iron Metabolism

Iron is mainly obtained from dietary sources (hem and non-hem iron) as the human body is unable to synthesize the element. Iron homeostasis is maintained through absorption and minimum loss of iron (around 1 to 2 mg) through skin and enteric desquamation as well as loss of blood which is regulated by hepcidin, a type of hormone synthesized by the hepatocytes whereby the amount of hepcidin produced is depending on the transport protein, transferrin available in the blood plasma (Waldvogel-Abramowski, et al., 2014; Knutson, 2017). Iron is absorbed through the intestinal wall in the form of Fe^{2+} by binding to ferroportin and bound to a specific transport protein, transferrin which then enters the bloodstream as Fe^{3+} (Knutson, 2017). Iron in around 90% can be recycled from dead red blood cells in the liver, spleen, and bone marrow by the local macrophages which are needed for erythropoiesis (Knutson, 2017; Slusarczyk and Mleczko-Sanecka, 2021). However, the bioavailability of iron can also be affected by several nutrients. Iron absorption can be enhanced by ascorbic acid (Vitamin C) while inhibited by oxalic acid, polyphenols, phytic acid, and calcium (Piskin, et al., 2022).

1.3 Research Background

Among all non-communicable diseases, anemia is one of them that has serious health concerns confronting global development in the twenty-first century, and for both developing and developed countries, the prevalence is high and particularly affects young children, women at reproductive or child-bearing age, and pregnant women. Iron deficiency anemia is noted as the most common

among anemia cases as nutritional deficit of iron is notably the reason for the IDA occurrence particularly in central Asia, South Asia, and Andean Latin America (Lopez, et al., 2016). IDA can cause health problems for infants or children's brain development and for adults, the most notable signs are fatigue and weakness (Piskin, et al., 2022). In Malaysia, pregnant women have a prevalence of 20.8% to 21.2% whereas women in their reproductive age have a prevalence of 10.3% towards iron deficiency anemia (Loh and Khor, 2010; Rahman, et al., 2022).

According to WHO (n.d.), the specific cut-off points for both high-risk group children and pregnant women are 11.0 g/dL while the cut-off point for women at their reproductive age (non-pregnant women) is 12.0 g/dL whereby any of the hemoglobin level below these cut-off point considered as anemic. In Malaysia and based on NHMS 2019 findings (National Institute of Health (NIH), 2020), the prevalence of anemia in Malaysia is 21.3%, and other than pregnant women and young children, women at their reproductive age (15 – 49) years also considered a high-risk group with around 29.9% of them having anemia globally and 32% in Malaysia (WHO, n.d.; World Bank Group, n.d.; National Institute of Health (NIH), 2019).

1.4   Problem Statement

Despite the fact that anemia or IDA is a serious health problem with addition of most common prevalent group are pregnant or non-pregnant women (30% and

36%) and children (40%), females university student is also vulnerable to this health problem as more focus were given to their academic performance which can lead to diet and health neglection like consumption of unhealthy food in their eating habits as well as undergoing menstruation cycle monthly that eventually leads to loss of the mineral iron which can directly cause nutrient deficit (Azma, et al., 2012; Ganasegeran, et al., 2012; Huong, et al., 2022; Stevens, et al., 2022). One of the risk factors brought may be an inadequate amount of knowledge, attitude, and practice (KAP) as knowledge lacking can contribute to undesirable or negative attitudes and practices that can be reflected through poor food consumption habits in daily lives (Huong, et al., 2022; Wong, et al., 2022).

Most of the studies on knowledge and attitude conducted in Malaysia were among young children and pregnant women population. Limited in-depth studies on the knowledge and attitude related to anemia were conducted among young women or female university students that are in their reproductive age as this incidence can affect them evenly as mentioned earlier. There is a study, done by Huong et al. (2022) showed that most of the female Malaysian university students studying in a medical university among 180 of them have a good level of knowledge towards IDA. However, in terms of their perceived attitude towards preventing the occurrence is still poor. Still, knowledge and attitude are the key contributors to practice as they act as a foundation for a person to practice a behavior (Ritchie, Snelgrove-Clarke and Murphy, 2019). Hence, the present study aimed to fulfilled the literature significant gap that can

evaluate the current level of knowledge and attitude related to anemia among female UTAR undergraduate students from both Sg Long and Kampar campuses.

1.5   Research Objective

1.5.1   General Objective

To determine and assess the knowledge and attitude related to anemia among female UTAR undergraduate students.

1.5.2   Specific Objectives

1. To determine the association between knowledge and attitude among female UTAR undergraduate students.

2. To determine the correlation between knowledge and attitude related to anemia among female UTAR undergraduate students.

3. To determine the association between knowledge, attitude, and age of the female UTAR undergraduate students.

4. To determine the association between knowledge and average duration of menstruation among female UTAR undergraduate students.

5. To determine the association in knowledge level related to anemia between the study fields of female UTAR undergraduate students.

1.6 Research Questions

1. What are the knowledge and attitude scores among the female UTAR undergraduate students?

2. Is there any association between knowledge and attitude related to anemia among female UTAR undergraduate students?

3. Is there any correlation between knowledge and attitude related to anemia among female UTAR undergraduate students and what is the strength of the correlation if present?

4. Is there any association between knowledge and attitude related to anemia with the age of the female UTAR undergraduate students?

5. Is there any association between knowledge related to anemia and the average duration of menstruation of the female UTAR undergraduate students?

6. Is there any association between the knowledge level related to anemia and the study field of female UTAR undergraduate students?

1.7 Hypothesis

1.7.1 Null Hypothesis

i. Knowledge was not significantly associated with attitude related to anemia among female UTAR undergraduate students.

ii. Knowledge was not significantly correlated with attitude related to anemia among female UTAR undergraduate students.

iii. Age was not significantly associated with knowledge related to anemia of the female UTAR undergraduate students.

iv.	Age was not significantly associated with attitude related to anemia of the female UTAR undergraduate students.

v.	Average duration of menstruation was not significantly associated with the knowledge related to anemia of the female UTAR undergraduate students.

vi.	There was no significant association in knowledge level related to anemia with the study field of female UTAR undergraduate students.

### 1.7.2	Alternative Hypothesis

i.	Knowledge was significantly associated with attitude related to anemia among female UTAR undergraduate students.

ii.	Knowledge was significantly correlated with the attitude related to anemia among female UTAR undergraduate students.

iii.	Age was significantly associated with knowledge related to anemia of the female UTAR undergraduate students.

iv.	Age was significantly associated with attitude related to anemia of the female UTAR undergraduate students.

v.	Average duration of menstruation was significantly associated with the knowledge related to anemia of female UTAR undergraduate students.

vi.	There was a significant association in knowledge level related to anemia with the study field of female UTAR undergraduate students.

1.8 **Operational Definitions**

1.8.1 **Conceptual Definition**

1.8.1.1 Evaluation

A methodical use of scientific procedures to evaluate the results of research and make numerical judgments in a systematic way.

1.8.1.2 Knowledge

The information, abilities, and understanding gained through learning, education, or experience.

1.8.1.3 Attitude

A person's perception, evaluation, and assessment of an item or a person.

1.8.1.4 Anemia

A medical condition is when the body lacks of red blood cells or hemoglobin.

1.8.1.5 Iron Deficiency Anemia

A medical condition occurs when the body lacks of the metal, specifically the iron for a prolonged period which eventually leads to nutritional anemia of iron.

1.8.1.6 Iron

A type of micronutrient that needed for physiological function of the body. It can be recycled within the body as well as obtained from various types of functional food.

1.8.1.7 Undergraduate Student

A student enrolled in a university or college for their higher or tertiary education to obtain a degree.

1.8.2   Operational Definition

1.8.2.1 Evaluation

A thorough gathering and investigation of the subject or topic of interest.

1.8.2.2 Knowledge

It is the awareness of anemia among UTAR undergraduate students. It is measured through 8 questions in which respondents were asked to answer multiple choices questions with a correct answer is given a point while zero points are for wrong responses. Individual responses to knowledge questions were totaled to provide a total raw score (ranging from 0 to 40) and then to be converted into percentage form.

1.8.2.3 Attitude

The mindset and behavior of a participant toward anemia. It is assessed by 6 questions on a three-point Likert scale. The scale ranged from 1 to 3 whereby a higher score indicating a more positive or desired attitude. Individual responses to attitude questions were totaled to provide a total raw score (ranging from 3 to 18) and later be calculated in the form of percentages.

1.8.2.4 Anemia

A medical health condition that the body lacks of red blood cells may be due to a lack of minerals, notably nutritional anemia or genetic predisposition, non-nutritional anemia. Nutritional anemias occur may due to poor dietary intake or lack of factors that are needed for certain mineral absorption through the digestive tract.

1.8.2.5 Iron

A nutrient that the body requires in a modest amount as needed for physiological function of the body such as hemoglobin synthesis and oxygen transportation for cellular respiration. In children, it is essential for their growth and brain development. In contrast, women require more iron for preparation of pregnancy and delivery as well as compensate monthly menstrual blood loss.

1.8.2.6 Undergraduate Student

A degree student aged between 19 and 30 that used as a candidate or participant in this study.

1.9   Significance of the Study

This study will provide general information regarding the relationship between knowledge and attitude related to anemia prevention among female UTAR undergraduate students. The results obtained could be used for future work of intervention development to raise awareness regarding anemia, iron or IDA for a better quality of life. Moreover, this research may educate students about anemia as well as may highlight the importance of iron rich food in preventing chronic illnesses like chronic heart failure at an early stage.

CHAPTER 2

LITERATURE REVIEW

2.1   Findings of Knowledge and Attitude related to Anemia in Malaysia

A study conducted using pregnant women found that during the pregnancy period, over half (55.7%) of the respondents had a good knowledge level of anemia with factors like the number of pregnancies experienced and the pregnancy week of the fetus showing an association with the knowledge scores obtained ($p < 0.01$ and $p < 0.05$ respectively) (Adznam, Sedek and Kasim, 2018). In addition, Zani, et al. (2020) proposed that none of the pregnant women from Kuala Terengganu have poor knowledge while most (80.3%) had moderate knowledge level towards anemia and iron absorption with an average score of 57.41. Contrast results were obtained by Kadir, et al. (2021) as pregnant women visiting Hospital Universiti Sains Malaysia mostly (90.7%) had a low knowledge level towards consumption of oral iron. A low knowledge level of oral iron consumption may indirectly affect the health status if the individual is predisposed to anemia like pregnant or poor iron intake as oral iron consumption is used if pregnant women lack iron in their blood. However, those studies have similar limitations, that is using a homogenous population that unable to generalize or represent the whole pregnant women population in Malaysia.

A study using student respondents aged between eight and ten showed that they are mostly at a moderate level (51%) regarding IDA knowledge while their

attitudes are mostly (72%) positive towards anemia with the guidance of their parents or guardians in the questionnaire answering during the research (Roslie, Yusuff and Parash, 2019).

In terms of university students, Huong, et al. (2022) proposed that there was a lack of good practice and positive attitude in preventing anemia despite it showed that female Malaysian undergraduate students have a good knowledge level towards anemia (60.3%). A high number of students had practiced skipping meals (81.7%) which can contribute to iron deficiency and thus anemia. Similarly, the majority of the non-anemic and anemic adolescents from the city of Kuala Lumpur have moderate knowledge level (47.8% and 46.7%) towards preventing nutritional anemia as well as adolescents that had high knowledge tends to be associated with anemia prevalence ($p = 0.046$) compared with low knowledge level adolescent (Wong, et al., 2022). Inconsistent findings were obtained concerning the knowledge and attitude towards anemia between the study populations. Moreover, there have been limited studies on the knowledge and attitude towards anemia using female undergraduate students in Malaysia.

2.2 Findings of Knowledge and Attitude related to Anemia in Asia

Similar to the result obtained by Huong, et al. (2022) in terms of the respondent knowledge level, Rizwan, et al. (2021) reported that an adequate amount of the reproductive-aged female participants used from tertiary level hospital in Cox's Bazar district, Bangladesh had knowledge of anemia whereby among them

around 11% had excellent level of knowledge, 21% had good knowledge level and 24% having satisfactory knowledge regarding anemia as well as most of their attitude in relation to anemia prevention also showed a positive level (50%). Furthermore, they also reported that the education level is associated with the knowledge and attitude level of the women ($p = 0.002$ and $p = 0.01$ respectively).

In addition, another study conducted by Kumar, Usha and Nandish (2020) in the rural area of India also obtained similar results, 42.22% had a good level of knowledge and 33.33% had an average level of knowledge about anemia respectively in the women at their reproductive age (15 – 49). The adolescent used in the study done by Danapure (2018) from selected areas of study location in India showed that 76% of them had average level, 17% were good and 2% were excellent regarding knowledge of anemia prevention whereas Dhivakar, Iswariya and Jobin (2020) found that female students from a college in Kanchipuram district, Tamil Nadu of India almost all of the students (92.5%) had excellent or high anemia knowledge with the addition of 77.5% of them had a moderate attitude towards anemia while none of them had high or positive attitude. The contrasting results from adolescents in India may be due to the age of the participants as the study of the former uses adolescents aged from 12 to 17 years old whereas the latter uses students aged 18 and 19 from allied science college that may have more exposure to science-related knowledge and the sample size in the latter is also lesser.

In contrast, Ahamed, Kotb and Hassanen (2018) found that although the respondents attending Assiut University Women Health Hospital, Egypt mostly had poor knowledge towards IDA (60%), more than half (79%) of the normal and anemic pregnant women had positive attitude towards IDA (85.2% and 66.2% respectively) with educational level showed differences ($p = 0.011$) in terms of the attitude in preventing IDA.

In Pakistan, a study conducted by Shahzad, et al. (2017) using female college students aged between 20 and 21 reported that half of the participants had adequate knowledge, positive attitudes, and moderate practice towards anemia. In terms of knowledge, 54% of the respondents had good in knowledge about anemia including the symptoms, and food that can prevent, reduce, or enhance iron absorption. Knowledge level showed a weak and positive correlation with the Hb level of the students ($r = 0.092$). In terms of attitude, 79% of the respondents overall showed a positive attitude towards anemia whereas there was almost no correlation between Hb level and attitude ($r = -0.005$) compared with the knowledge and Hb level correlation. Their attitude regarding the seriousness of anemia can bring is high (65.3%). For those non-anemic and anemic students from the University of Metro Manilla in the Philippines also showed similar results, having adequate knowledge level towards IDA specifically having knowledge in terms of risk factors, symptoms, causes, diagnosis, treatment, and prevention (Relacion, et al., 2021). Inconsistent findings obtained across different study populations from these studies may be

subjected to the sample recruiting method and the sociodemographic variables of the respondents.

2.3   Association between Knowledge and Attitude related to Anemia

In Malaysia, female university students from a private university used in the study of Huong, et al. (2022) acknowledged that there was a significant association present between knowledge with attitude ($p = 0.003$) with a positive correlation. The female university students showed to be having a better attitude towards anemia prevention corresponding to a better knowledge level regarding anemia. Similarly, a study by Hamed (2021) using anemic female college students from Medical Clinics, Hail University Student Hospital in Egypt also showed a statistically significant association between their knowledge and attitude ($p = 0.034$).

Adznam, Sedek and Kasim (2018) proposed that for pregnant women from Putrajaya, Malaysia, both variables, knowledge, and attitude of the participants were significantly associated with one another in which higher knowledge level of the pregnant women contributed to a better attitude towards anemia prevention with a moderate positive correlation existed between the variables ($p < 0.01$ and $r = 0.317$). Although all the studies did demonstrate there was an association between knowledge and attitude variables, however, there are limited studies conducted among Malaysian reproductive-age women

population like undergraduate students and thus, this study will be used to fill the literature gap.

2.4 Association of Age with Knowledge and Attitude Related to Anemia

In Malaysia, the study conducted by Zani, et al. (2020) showed no significant association between the pregnant women's age and their anemia knowledge level from Kuala Terengganu, which was in contrast with the study done by Kadir, et al. (2021) that highly related to anemia, that is used pregnant women attending Hospital Universiti Sains Malaysia in which the maternal age had influenced with the knowledge scores of regarding oral iron supplementation, increasing of awareness showed as the pregnant mother ages. Similar to the study of Zani, et al. (2020), the age of pregnant women from Bangladesh attending tertiary level hospital in Cox's Bazar district showed no association with the knowledge of anemia as well as the attitude towards anemia ($p = 0.121$, $p = 0.231$ respectively) (Rizwan, et al., 2021) as well as the study by Adediran, et al. (2021) pregnant women recruited in South-West Nigeria also show no statistical association ($p = 0.285$) between the age variable and knowledge level in relation to anemia. The same goes for the study done by Al-Rabeei, et al. (2023) in which it was proposed that the age of pregnant women from Sana'a City-Yemen showed no significant association ($p = 0.313$) with their knowledge level regarding IDA.

For another population group, adolescent girls from selected areas of India showed that their age was statistically associated ($p < 0.001$) with their knowledge scores in regard to anemia prevention (Danapure, 2018) whereas adolescent girls in rural area of Eastern India showed that their knowledge was not associated with their age ($p = 0.569$) (Mohanty, 2021). The findings were obtained differently across different age groups as well as the study location and it can be noticed that limited studies were conducted among women at their reproductive age such as undergraduate students.

2.5 Association of Knowledge related to Anemia and Menstruation

Blood loss like blood loss during menstruation is a factor that can cause anemia. A study done by (Sheriff, et al., 2021) in a tea estate community located in Hantana, Kandy district of Sri Lanka using randomly selected 236 reproductive age women showed that the women's menstruation duration was significantly associated with the chances of developing anemia with anemia occurrence prevalence increases when the women have a menstruation duration for more than 3 days ($p = 0.02$) but no significant association between knowledge and anemia prevalence was showed. Similarly, Roshana and Mahendran (2022) found a significant association were between the pregnant women's educational level and the causes of anemia, specifically their heavy menstrual bleeding history ($p < 0.01$) in which the study also found that educational level associated with the knowledge regarding causes of anemia.

In Indonesia, similar results were obtained whereby adolescent girls with abnormal menstrual length (duration more or less than between 3 and 8 days) showed a significant association with anemia incidence ($p < 0.05$) (Listiarini, et al., 2021). The researchers acknowledged that students who have poor anemia knowledge will lead to having unprepared prevention towards anemia during their menstruation but students with good iron intake did not experience anemia despite having abnormal menstruation patterns (Listiarini, et al., 2021). To date, literature reviews regarding direct understanding in terms of the relationship between menstrual duration and the subjects' knowledge among undergraduate students were still unavailable.

2.6   Association of Knowledge related Anemia with Study Field

A study in Poland done by Siemienas, et al. (2014) found that students from a medical university had a greater knowledge level regarding IDA and iron (hem and non-hem) food sources compared to students from other three universities and one academy that has life sciences, non-health science, and technology as well as physical education as their major, considering the same amount of sample size recruited. However, compared in terms of their excessive iron intake, students studying at the University of Life Sciences had the highest excessive iron consumption among the samples among the four Poznan universities including students studying technology at Poznan University of Technology.

However, Ali, AbdEl-Aziz and Sayed (2022) found that more than half of the nursing field students from hospitals' educational institutes located in the capital city of Egypt, Cairo (53.7%) that were currently suffering IDA had a knowledge level of not satisfactory that leads to low consumption of iron-rich food although those students were studying in the allied health science field. On the other hand, Koeryaman, et al. (2018) study proposed that almost half of the nursing students from an Indonesian university showed to be having a moderate level of knowledge regarding food rich in iron (41.62%) while only 23.85% of the sample size has good iron food sources knowledge that may directly affect their food choices that will be relatively high in iron to prevent IDA.

To date, the available works of literature on the association of knowledge level related to anemia between health science and non-health science students in Malaysia are very limited, and inconsistent findings were found between the study fields. Further investigations are needed which can act as or provide solid evidence to optimize students' knowledge and attitude level.

CHAPTER 3

METHODOLOGY

| Literature Review |
| Determine Target Population |
| Sample Size Estimation |
| Determine Sampling Technique |
| Questionnaire Development |
| Get Ethical Approval |
| Data Collection |
| Statistical Analysis |
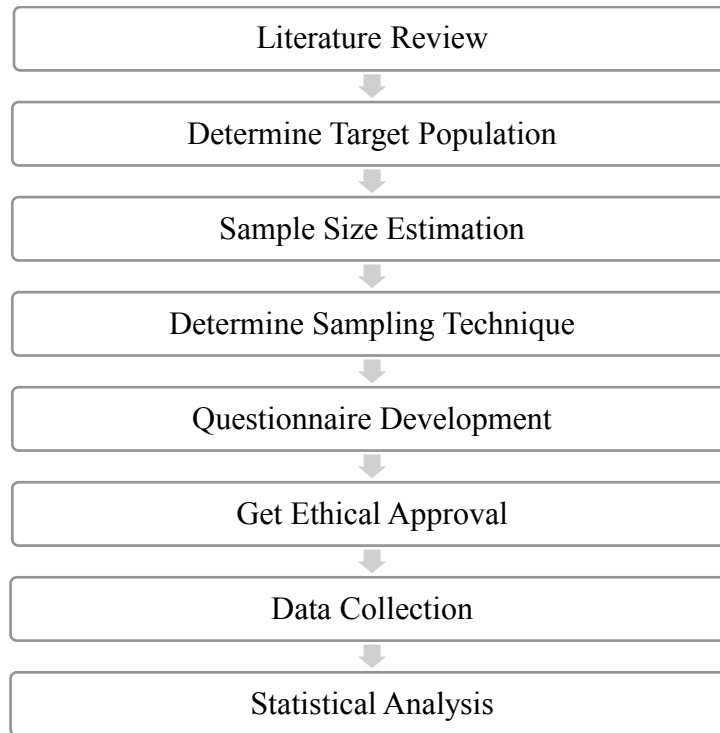
Figure 3.1: Flow chart showing an overview of the research methodology.

3.1   Study Design

This is an observational quantitative descriptive, cross-sectional study. A cross-sectional study is an observational study that examines data from a certain population at a specific time period. In this study, the knowledge and attitudes related to anemia among female UTAR undergraduates were used. This research design is easy to conduct with a limited budget required.

3.1.1 Setting of the Study

This study was conducted at Universiti Tunku Abdul Rahman (UTAR), from both Kampar and Sg. Long campuses located in Peninsular of Malaysia.

3.2 Variables

Independent and dependent variables were employed in the study. When assessing the association between knowledge and attitude, knowledge is the independent variable and attitude is the dependent variable. When assessing the association between knowledge, and attitude with the age of the participants, age is the independent variable while knowledge and attitude are the dependent variables. When assessing the association between knowledge and average menstruation duration, the independent variable will be average menstruation duration while the knowledge is the dependent variable. The same goes for the association between knowledge and study fields whereby the study field is the independent variable while knowledge is dependent variable.

3.3 Sampling Method

The convenience sampling method was used as the accessibility of the respondents will be easier and save in terms of the time and cost (Bornstein, Jager and Putnick, 2013). By applying this sampling method, a list of respondents is not required which benefits in terms of time and money. Respondents from both campuses, Sg Long and Kampar will be obtained and chosen as it will be easier to reach them.

3.4   Sample Size Calculations

$$n = \frac{Z^2 P (1-P)}{e^2}$$

where n = sample size

     Z = Z statistic for a level of confidence,

     P = expected prevalence or proportion

     e = sample error

$$n = \frac{1.96^2 (0.103) (0.897)}{0.05^2}$$

$$= 141.97$$

$$\approx 142$$

Assume 20% drop out rate,

$$n = 142 + 20\%$$

$$= 170.4$$

$$\approx 171$$

In terms of survey research, Suresh and Chandrashekara (2012) stated that the margin of error appropriate is between 5% and 10%. Thus, a 5% margin error is selected as the sample size is inversely proportional to the margin of error, meaning that a larger sample size will obtain a smaller margin of error. Based on the sampling formula from Cochran (1977) and the prevalence of iron deficiency anemia was 10.3%, taken from the study done by Loh and Khor (2010), the sample size needed is estimated to be 142. With an additional 20% dropout rate as having a dropout rate below 20% may result in an unreliable

conclusion as according to Thiese (2014), the total sample size needed for the study is 171.

3.5 Sampling Criteria

Table 3.1: Inclusion and exclusion criteria for the study populations

Inclusion Criteria	Exclusion Criteria
Undergraduate female UTAR students	Family history of anemia or IDA
Aged between 19 - 30	Undergraduate female UTAR students who are currently pregnant or lactating
Malaysian citizens	

Table 3.2: Inclusion criteria of the study field

Course Program	Field of Study
Health Science	Medicine and Health Sciences
Non-Health Science	Accounting, Business and Economics
	Actuarial Science, Mathematics and Process Management
	Agricultural and Food Science
	Arts, Social Science and Education
	Chinese Studies
	Creative Industries and Design
	Engineering, Technology and Built Environment
	Information and Communication Technology
	Life and Physical Sciences

Table 3.1 outlined the inclusion and exclusion criteria for the study sample recruited as the students that unable to meet the inclusion criteria were later sorted out during the screening phase. Table 3.2 on the other hand illustrated the criteria for a study program to be considered a health science or non-health science program through the classification by the International Standard

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Classification of Education (UNESCO, 2012). Regarding the study programs available was attached in the Appendix section (Appendix A).

3.6   Study Instrument

An online-based questionnaire was used for the data collection. Google Forms was used for the questionnaire distribution through social platforms (e.g., Microsoft Teams, WhatsApp, and Instagram) in approaching the respondents from the selected population until the targeted sample size (N = 171) was reached. The questionnaire was distributed in the form of English that consisted of three sections. Section I is the sociodemographic questions; Section II is the knowledge related to anemia and Section III is the attitude related to anemia. The information obtained from the respondents was kept confidential for the whole study. The data then later were analyzed after the completion of data collecting.

3.6.1   Sociodemographic Questionnaire

In the first part of the survey, close-ended sociodemographic questions in regard to age, ethnicity, campuses, study field and faculties will be asked to construct a basic understanding of our respondents. Moreover, their duration of menstruation in average, and their diet style whether they are vegetarian or non-vegetarian will be asked as well.

3.6.2 Knowledge related to Anemia Questionnaire

A questionnaire on anemia-related knowledge was adopted and modified from a previous study (Shahzad, et al., 2017). Participants were asked to respond according to the selection provided for all 8 questions. For a correct answer, one point was awarded while 'zero' was for a wrong response. All individual answers to knowledgeable questions were determined to obtain total raw scores (ranging from 0 to 39) and converted into percentages.

$$\text{Knowledge Score} = \frac{\text{Total raw scores}}{40} \times 100\%$$

A score of 80% - 100% was considered as good knowledge, 60% to 79% was moderate, and 59% or less indicated as poor knowledge based on Bloom's cutoff categories (Alzahrani, et al., 2022).

3.6.3 Attitude towards Anemia Questionnaire

A questionnaire on anemia-related attitudes was adopted from a previous study (Shahzad, et al., 2017). 6 questions regarding attitude towards anemia were included. For scoring, 1 to 3 with a higher score for positive attitude whereby given 1 score for poor attitude, 2 score for average desired attitude, and 3 score for good attitude.

$$\text{Attitude Score} = \frac{\text{Total raw scores}}{18} \times 100\%$$

A score of 80% - 100% was considered a positive attitude, 60% to 79% was a neutral attitude and 59% or less indicated a negative attitude based on the Bloom's cutoff categories (Alzahrani, et al., 2022).

3.7   Data Analysis

Data analyses will be analyzed by using Statistical Package for Social Sciences (SPSS) version 27.0. Descriptive data obtained from demographic questions will be presented and summarized in number (n) and percentage (%). For instance, age, ethnicity, campuses, course, faculties, and duration of menstruation on average. On the other hand, continuous data will be summarized in mean (μ) and standard deviation (σ). The overall knowledge and attitude will be reported in mean and standard deviation based on the total score (%) obtained for each participant. The normality test was performed to examine the distribution of the variables for further analysis of the knowledge and attitude score based on the tests of Kolmogorov-Smirnov test, visual inspection from the plotted histogram, and normal Q-Q plot.

The chi-square test was adopted to determine the association between knowledge and attitude related to anemia, the association between knowledge related to anemia and age, the association between attitude related to anemia and age, the association between knowledge related to anemia and average menstruation duration and the association between knowledge related to anemia and study fields. The strength and direction of the association will be analyzed using Spearman's rho correlation test. The chi-square and Spearman rho correlation test results were considered statistically significant if the *p-value* obtained is less than 0.05 ($p < 0.05$). In the chi-square test, if more than 20% of the expected cell count is less than five, Fisher-Freeman-Halton Exact test will be used instead.

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3.8 Statistical Data Processing and Analysis

All the responses collected were screened for eligibility taking the exclusion and inclusion criteria into consideration. A total of 171 participants were first needed for the research. Following the screening of individuals in compliance with the inclusion and exclusion criteria, all 171 participants were qualified and included in the final sample. The Chi-square test and Spearman's rho correlation analysis were performed to determine the association between the selected variables. In Spearman's rho correlation analysis, the variables' result (r) has a stronger correlation when the result (r) closer to +1. For a positive r value signified an increase in the dependent variable as the independent increase while a negative r value demonstrated a decrease in dependent variable when the independent variable increases.

Table 3.3: Summary of categorical and continuous data.

Categorical Data	Continuous Data
• Sociodemographic variables (age, ethnicity, campuses, faculties, study fields, average duration of menstruation and vegetarianism status) • Knowledge level • Attitude level	• Knowledge mean score • Attitude mean score

CHAPTER 4

RESULT

4.1 Descriptive and Inferential Analysis

4.1.1 Descriptive Analysis

The categorical data were presented in number (n) and percentage (%) and the continuous data were presented in mean (μ) and standard deviation (σ). The categorical data consist of the sociodemographic variables (age, ethnicity, campuses, faculties, study fields, average duration of menstruation and vegetarianism status) as well as the knowledge and attitude level of the respondents were presented in number (n) and percentage (%) whereas knowledge and attitude mean score were presented in mean (μ) and standard deviation (σ).

4.1.2 Inferential Analysis

The Chi-square test or Fisher-Freeman-Halton Exact tests were used to present and determine the data's association, which are the association of knowledge and attitude, the association of knowledge and age, association of attitude and age, average duration of menstruation and knowledge as well as the difference in knowledge level between study field. Spearman's rho correlation analysis was performed to determine the direction of the association between knowledge and attitude.

4.2   Descriptive Statistics

4.2.1   Characteristics of Participants

Table 4.1 illustrated the sociodemographic characteristics of the total 171 participants used in this research study. Age categorization are divided into 4 groups, starting from 19 – 20 years old, 21 – 22 years old, 23 – 25 years old and above 25 (until 30 years old). Most of the participants are in the age group of 21 – 22 years old, around 62% (n = 106), followed by 23 – 25 years old, contributing 19.9% (n = 34) and lastly 19 – 20 years old, 18.1% (n = 31).

In terms of ethnicity, Chinese made up the majority of the data collected, around 95.9% (n = 164), followed by Indian in 3.5% (n = 6) and 0.6% of Malay (n = 1). Out of 171 of the participants, 131 of them (76.6%) are studying in the campus located in Kampar, Perak which has the greatest participation rate whereas the other 40 of them (23.4%) are from Sg Long Campus. In terms of the study fields, 50.3% (n = 86) of the respondents had a health science-related program as their major while the other 85 (49.7%) were studying non-health science-related programs.

In terms of the faculty of their studies, the majority are from the Faculty of Science, taking up 49.1% of the sample size (n = 84), followed by 13.5% of students from the Faculty of Business and Finance (n = 23). Lee Kong Chian Faculty of Engineering and Science had the third highest number of students participating, around 11.1% (n = 19), followed by 11 participants from the

Faculty of Accountancy and Management (6.4%). Students from the Faculty of Engineering and Green Technology and the Institute of Chinese Studies were the least, accounting for only 1.2% (n = 2) for the whole sample size.

Regarding the average duration of menstruation the participants have, most of them (n = 134) classified themselves as having around 5 -7 days, accounting for 78.4% of the total, followed by 13.5% of them having around 2 – 4 days (n = 23) while the least was made up only 8.2% for those (n = 14) with more than 7 days of menstruation. In terms of vegetarianism status, only 7 of the totals are vegetarian, accounting for 4.1% whereas 95.9% of them are non-vegetarian (n = 164).

Table 4.1: Characteristics of participants (N = 171).

Sociodemographic Characteristics	n	%
Age (years old)		
19 – 20	31	18.1
21 – 22	106	62
23 – 25	34	19.9
Ethnicity		
Chinese	164	95.9
Malay	1	0.6
Indian	6	3.5
Campuses		
Sg. Long campus	40	23.4
Kampar campus	131	76.6
Study Field		
Health Science Related	86	50.3
Non-Health Science Related	85	49.7
Faculties		
M. Kandiah Faculty of Medicine and Health Sciences	7	4.1
Faculty of Science	84	49.1
Faculty of Accounting and Management	11	6.4
Faculty of Business and Finance	23	13.5
Faculty of Arts and Social Science	9	5.3
Faculty of Creative Industries	5	2.9
Faculty of Information and Communication Technology	9	5.3
Faculty of Engineering and Green Technology	2	1.2
Institute of Chinese Studies	2	1.2
Lee Kong Chian Faculty of Engineering and Science	19	11.1
Average Duration of Menstruation		
2 – 4 days	23	13.5
5 – 7 days	134	78.4
More than 7 days	14	8.2
Vegetarianism Status		
Vegetarian	7	4.1
Non-vegetarian	164	95.9

N = Total sample size, n = number of students, categorical data presented in n and % form.

4.2.2   Mean Scores of Knowledge and Attitude

Table 4.2 illustrated the mean scores obtained for the knowledge and attitude scores. Compared with the mean value obtained, the attitude mean score was higher than the knowledge mean score whereby the mean score for attitude was 13.2% (SD = 2.07) while the knowledge mean score was 18.6% (SD = 9.60). The illustration for both variables' score distribution was demonstrated and attached in the Appendix section whereby both scores were not normally distributed (Appendix E).

Table 4.2: Mean Score of knowledge and attitude scores among female UTAR undergraduate students (N = 171).

Variables	Mean	SD	Min	Max
Knowledge score (%)	46.51	24.01	2.5	100.0
Attitude score (%)	73.33	11.49	44.44	100.0

N = total sample size, SD = standard deviation, Min = minimum value, Max = maximum value.

4.2.3   Knowledge and Attitude Scores Categorization

Table 4.3 showed the knowledge and attitude score categorizations of the respondents' sample used in this research. From the total sample, the majority (70.2%) of the students had poor knowledge (n = 120) but majority of their attitudes are neutral, accounting for 60.8% (n = 104) regarding information related to anemia.

Table 4.3: Knowledge and attitude score categorization among female UTAR undergraduate students (N = 171).

Categorization	n	%
Knowledge		
Good	20	11.7
Moderate	31	18.1
Poor	120	70.2
Attitude		
Positive	47	27.5
Neutral	104	60.8
Negative	20	11.7

N = total sample size, n = number of students, categorical data showed in the form of n and %.

4.2.4 Knowledge Statements related to Anemia

Table 4.4 illustrated the responses to the knowledge statements related to anemia. Overall, the majority of the participants (n = 145, 84.8%) heard before the health problem, iron deficiency anemia whereas 15.2% of the total (n = 26) did not know about iron deficiency anemia. The highest scores of the knowledge statements were the symptoms of anemia with the selection of weakness/fatigue as one of the symptoms (91.23%) whereas 16 of the participants did not know the symptoms of anemia (9.36%). More than half of the participants knew that lack of dietary iron and heavy menstrual bleeding were the causes of anemia (n = 149, 87.13% and n = 105, 61.40% respectively). Moreover, 87.13% of the respondents (n = 149) knew that eating iron-rich foods is one of the ways to prevent anemia.

In terms the foods rich with iron, liver, beef and spinach were the iron rich foods that most of the participants knew about, accounting for 69.01%, 60.82% and

69.01% (n = 118, n = 104 and n = 118) respectively while only 37 participants

knew that sweet potato and whole wheat flour are rich in iron (21.64% of the

total participants). For foods that enhance iron absorption, only oranges and

lemons are the foods that more than half of the total participants (n = 99 and n

= 88) knew were the enhancers (57.89% and 51.46% respectively). The

beverage consumption taken during the meal that can cause inhibition of iron

absorption question showed that more than half of the respondents knew both

coffee and tea as the inhibitor (61.40% and 56.14%). In contrast, more than half

(50.88%) of the total respondents do not know the foods that hinder iron

absorption if taken during meals. The lowest scores of knowledge statements

were lentils, the food that can hinder iron absorption, accounting for only 6.43%

of the total respondents got the answer correct.

Table 4.4: Multiple responses on the knowledge statements related to anemia of the female UTAR undergraduate students (N = 171).

Knowledge Statements	n	%
1. Have you heard about iron deficiency anemia?		
Yes	145	84.8
No	26	15.2
2. Do you know the symptoms of anemia?		
Weakness/fatigue	156	91.23
Pallor	82	47.95
Unusual rapid heartbeat	68	39.77
Shortness of breath	92	53.80
Difficult concentration	81	47.37
Headache	80	46.78
Don't know	16	9.36
3. Do you know the causes of anemia?		
Lack of dietary iron	149	87.13
Sickness/infection	69	40.35
Heavy menstrual bleeding	105	61.40
Don't know	22	12.87

Table 4.4 continued: Multiple responses on the knowledge statements related to anemia of the female UTAR undergraduate students (N = 171).

Knowledge Statements	n	%
4. Do you know about the ways of preventing anemia?		
Eat iron rich foods	149	87.13
Eat vitamin C rich foods during or right after meals	85	49.71
Treat other causes of anemia	84	49.12
Don't know	17	9.94
5. Do you know about iron rich foods?		
Liver	118	69.01
Kidney	67	39.18
Mutton	57	33.33
Beef	104	60.82
Fish	69	40.35
Chicken	58	33.92
Spinach	118	69.01
Sweet potato	37	21.64
Kale	78	45.61
Beet greens	51	29.82
Soya beans	61	35.67
Lima beans	38	22.22
Fortified breakfast cereals	72	42.11
Whole wheat flour	37	21.64
6. Do you know about the foods that help in iron absorption?		
Oranges	99	57.89
Lemons	88	51.46
Bell peppers	49	28.65
Guavas	55	32.16
Strawberries	51	29.82
Don't know	57	33.33
7. Do you about the beverages that decrease iron absorption when taken with meals?		
Coffee	105	61.40
Tea	96	56.14
Don't know	55	32.16
8. Do you know about the foods that hinder iron absorption if taken during the meals?		
Milk	74	43.27
Yoghurt	54	31.58
Walnuts	25	14.62
Lentils	11	6.43
Eggs	22	12.87
Don't know	87	50.88

4.2.5   Attitude Statements related to Anemia

Table 4.5 illustrated the responses towards the attitude statements related to anemia. In terms of attitude towards the likelihood of becoming iron deficient, 71 of the respondents from the total (41.5%) are not sure or feeling neutral that they will be anemic or iron deficit. A total of 115 students think that iron deficiency or anemia is a serious issue (67.3%). Following that, 119 students (69.6%) have a positive or good feeling in regard to iron-rich meal preparation, but around 59.6% of the students have a neutral feeling towards difficulty in preparing iron-rich food meals for themselves. In terms of confidence in preparing iron-rich food meals, only 18.7% (n = 32) of them feel that they have the confidence. However, only 8.2% of the respondents had a dislike feeling towards the taste of iron-rich food items.

Table 4.5: Multiple responses on the attitude statements related to anemia of the female UTAR undergraduate students (N = 171).

Attitude Statements	n	%
1. How likely do you think you are to be iron deficient/anemic?		
Not likely	64	37.4
Not sure	71	41.5
Likely	36	21.1
2. How serious do you think iron deficiency/anemia is?		
Not serious	16	9.4
Not Sure	40	23.4
Serious	115	67.3
3. How good do you think it is to prepare meals with iron-rich foods?		
Not good	13	7.6
Not sure	39	22.8
Good	119	69.6

Table 4.5 continued: Multiple responses on the attitude statements related to anemia of the female UTAR undergraduate students (N = 171).

Attitude Statements	n	%
4. How difficult is it for you to prepare meals with iron-rich foods?		
Difficult	35	20.5
Neutral	102	59.6
Not difficult	34	19.9
5. How confident do you feel in preparing meals with iron-rich foods?		
Not confident	51	29.8
Neutral	88	51.5
Confident	32	18.7
6. How much do you like the taste of iron-rich food item?		
Dislike	14	8.2
Neutral	95	55.6
Like	62	36.3

4.3   Inferential Statistics

4.3.1   Association between Knowledge and Attitude

After the normality test was performed for both knowledge and attitude scores, the results showed that the p-value from the Kolmogorov-Smirnov test was less than 0.05 ($p < 0.001$) for both scores, and the data were positively skewed for both knowledge and attitude scoring, thus indicating the data was not normally distributed (a non-normal distribution) (Appendix E).

Fisher-Freeman-Halton Exact test was used to determine the association between knowledge and attitude. Table 4.6 illustrated the category for both knowledge and attitude. The majority of the participants had poor knowledge but neutral attitude related to anemia (n = 78, 45.6%). However, the number of students with a positive attitude was higher among students with poor

knowledge (n = 25, 14.6%). 12 students (7.0%) showed a good knowledge level

with a positive attitude related to anemia when compared with only half of the

students in the good knowledge category with neutral attitudes (n = 6, 3.5%).

The association was statistically significant as the *p*-value obtained was less

than 0.05 (*p* = 0.003). Thus, the null hypothesis (i) was rejected and can be

conclude that knowledge was significantly associated with attitude related to

anemia among female UTAR undergraduate students.

Table 4.6: Association between knowledge and attitude among female UTAR undergraduate students (N = 171).

Knowledge level	Attitude level			χ^2	df	*p*-value
	Positive n (%)	Neutral n (%)	Negative n (%)			
Good n (%)	12 (7.0)	6 (3.5)	2 (1.2)	14.782	-	0.003*
Moderate n (%)	10 (5.8)	20 (11.7)	1 (0.6)			
Poor n (%)	25 (14.6)	78 (45.6)	17 (9.9)			

*Significant association at significance level, *p*<0.05, df = degree of freedom, N = total sample size.

4.3.2   Correlation between Knowledge and Attitude

Table 4.7 shows the correlation between knowledge and attitude related to

anemia. Spearman's rho correlation analysis showed there was a statistically

significant moderate correlation between both variables, knowledge and attitude

at a significance level of 0.05 (*r* = 0.403, *p* < 0.001). Thus, the null hypothesis

(ii) was rejected and thus knowledge was significantly correlated with the

attitude related to anemia among female UTAR undergraduate students.

Table 4.7: Correlation between knowledge and attitude related to anemia among female UTAR undergraduate students.

Variables	Spearman's correlation coefficient (r)	p-value
Knowledge and attitude	0.403	<0.001*

*Significant correlation at p-value <0.005.

4.3.3 Association between Knowledge and Age

Fisher-Freeman-Halton Exact test was performed to determine the association between knowledge and age of the participants. Table 4.8 showed the association between knowledge and age among female undergraduates. The majority of the students from the age group of 21 and 22 (n = 77, 45.0%) showed that they have poor knowledge related to anemia. Similarly, when comparing within the age category for both 19 – 20 and 23 – 35 age groups, most were having poor knowledge (n = 26, 15.2% and n = 17, 9.9% respectively). The association between knowledge and age was statistically significant as the p-value obtained is smaller than 0.05 (p = 0.032). Therefore, the null hypothesis (iii) was rejected and age was significantly associated with knowledge related to anemia of the female UTAR undergraduate students.

Table 4.8: Association between age and knowledge of the female UTAR undergraduate students (N = 171).

Age Group	Knowledge level			χ^2	df	p-value
	Good n (%)	Moderate n (%)	Poor n (%)			
19 - 20 n (%)	1 (0.6)	4 (2.3)	26 (15.2)	10.179	-	0.032*
21 - 22 n (%)	11 (6.4)	18 (10.5)	77 (45.0)			
23 - 25 n (%)	8 (4.7)	9 (5.3)	17 (9.9)			

*Significant association at significance level, $p<0.05$, df = degree of freedom, N = total sample size
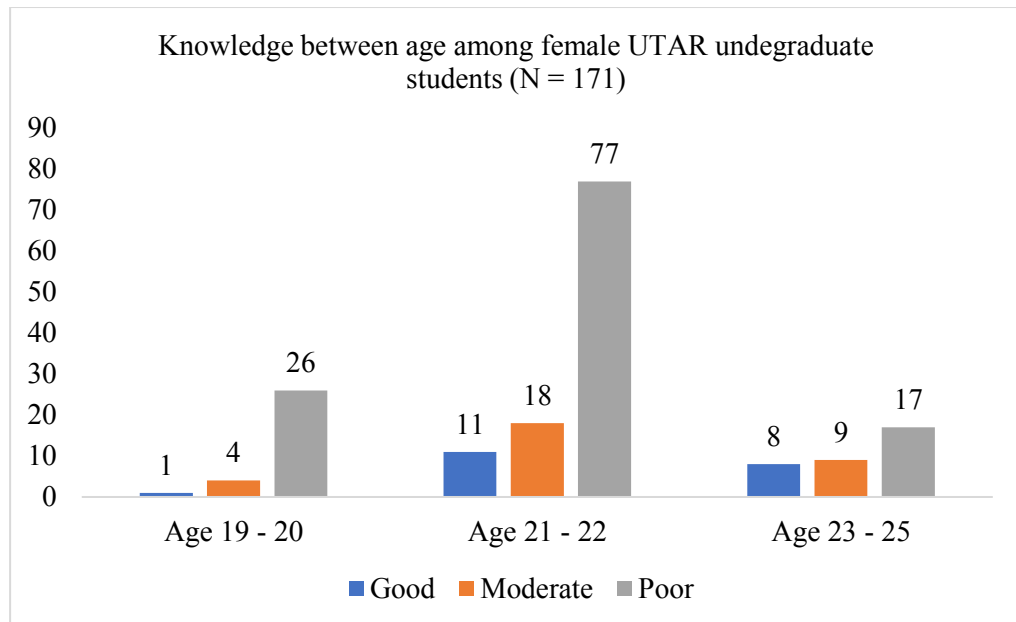
Figure 4.1: Age and knowledge among female UTAR undergraduate students (N = 171).

4.3.4 Association between Attitude and Age

A chi-square test was performed to determine the association between age and attitude. Table 4.9 demonstrated the association between age and attitude among the 171 female undergraduate students. The majority of the students from the age group of 21 and 22 showed that they had a neutral attitude related to anemia (n = 64, 37.4%). Comparing within the age group, both age groups of 19 to 20 and 23 to 25 showed a majority of the students have neutral attitude related to anemia (n = 24, 14.0% and n = 16, 9.4% respectively). In regards to negative attitude, all 3-age groups have the least students as compared to neutral and positive attitude whereby ages 19 and 20 accounted for 1.2% (n = 2), 6.4% accounted for students aged 21 and 22 (n = 11) and 7 students from age group 23 and 25 (4.1%). The association between attitude and age was not statistically significant as the p-value obtained was not less than 0.05 (p = 0.111). Hence, the null hypothesis (iv) was accepted and can be concluded that age was not

significantly associated with attitude related to anemia of the female UTAR

undergraduate students.

Table 4.9: Association between age and attitude among female UTAR undergraduate students (N = 171).

Age Group	Attitude level			χ^2	df	p-value
	Positive n (%)	Neutral n (%)	Negative n (%)			
19 - 20 n (%)	5 (2.9)	24 (14.0)	2 (1.2)	7.519	4	0.111
21 - 22 n (%)	31 (18.1)	64 (37.4)	11 (6.4)			
23 - 25 n (%)	11 (6.4)	16 (9.4)	7 (4.1)			

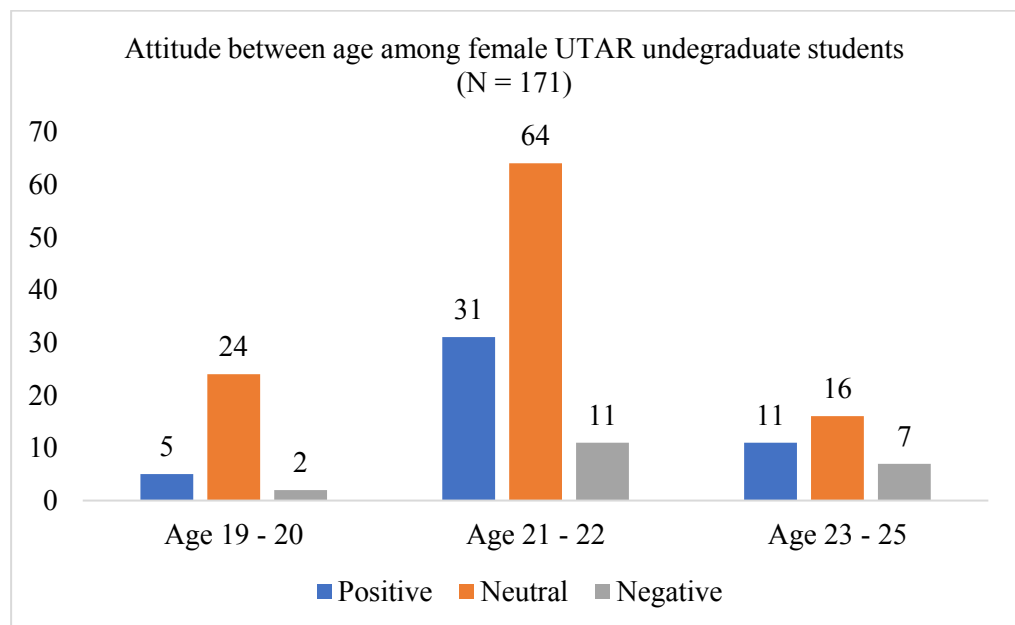Significance level at $p<0.05$, df = degree of freedom, N = total sample size.

Figure 4.2: Age and knowledge among female UTAR undergraduate students (N = 171).

4.3.5   Association between Average Duration of Menstruation and Knowledge

Chi-square test was performed to determine the association between the average duration of menstruation and knowledge. Table 4.10 illustrated the association between association between average duration of menstruation and knowledge among 171 female undergraduate students. Most of the students were having an average of 5 to 7 days of menstruation showed poor knowledge related to anemia (n = 95, 55.6%). More number of students from 2 – 4 days and 5 – 7 days had good knowledge when compared with those having menstruation for more than 7 days (n = 7, 4.1% and n = 12, 7.0%) The association between average duration of menstruation and knowledge was statistically significant since the p-value obtained was less than 0.05 (p = 0.041). Therefore, the null hypothesis (v) was rejected and the average duration of menstruation was significantly associated with the knowledge related to anemia of the female UTAR undergraduate students.

Table 4.10: Association of average duration of menstruation and knowledge among female UTAR undergraduate students (N = 171).

Average duration of menstruation	Knowledge level			χ^2	df	p-value
	Good n (%)	**Moderate n (%)**	**Poor n (%)**			
2 – 4 days n (%)	7 (4.1)	2 (1.2)	14 (8.2)	9.993	4	0.041*
5 – 7 days n (%)	12 (7.0)	27 (15.8)	95 (55.6)			
> 7 days n (%)	1 (0.6)	2 (1.2)	11 (6.4)			

*Significant association showed at significance level, $p<0.05$, df = degree of freedom, N = total sample size.
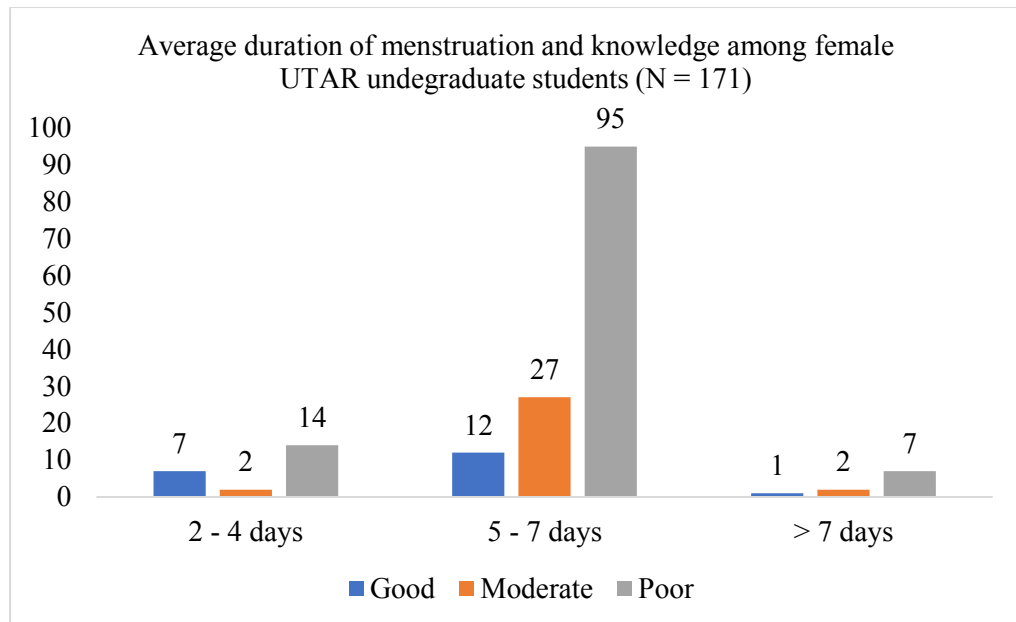
Figure 4.3: Average duration of menstruation and knowledge among female UTAR undergraduate students (N = 171).

4.3.6 Association between Study Field and Knowledge

Chi-square test was used to determine the association between the study field and knowledge. Table 4.11 illustrated the association between study fields among the 171 female undergraduate students. Overall, health science students were having a higher proportion (n = 19, 22.1% and n = 28, 32.6%) for both good and moderate knowledge level as compared to non-health science respondents (n = 1, 1.2% for good and n = 3, 3.5% for moderate respectively). In the class of poor knowledge level, most of the respondents (n = 81, 17.30%) were from non-health science programs and health science programs had a rather lesser number of respondents (n = 39, 45.3%). The Chi-square test suggested the knowledge level between health science and non-health science was significantly different since the p-value obtained was less than 0.05 ($p <$ 0.001). Therefore, the null hypothesis (vi) was rejected and there was a

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significant association in knowledge level related to anemia with the study field

of female UTAR undergraduate students.

Table 4.11: Association between study field and knowledge among female UTAR undergraduate student (N = 171).

Knowledge level	Study Field		χ^2	df	*p*-value
	Health Science (n) %	Non-Health Science (n) %			
Good	19 (11.1)	1 (0.6)	51.057	2	<0.001*
Moderate	28 (16.4)	3 (1.8)			
Poor	39 (22.8)	81 (47.4)			

*Significant association showed at significance level, *p*<0.05, df = degree of freedom, N = total sample size.
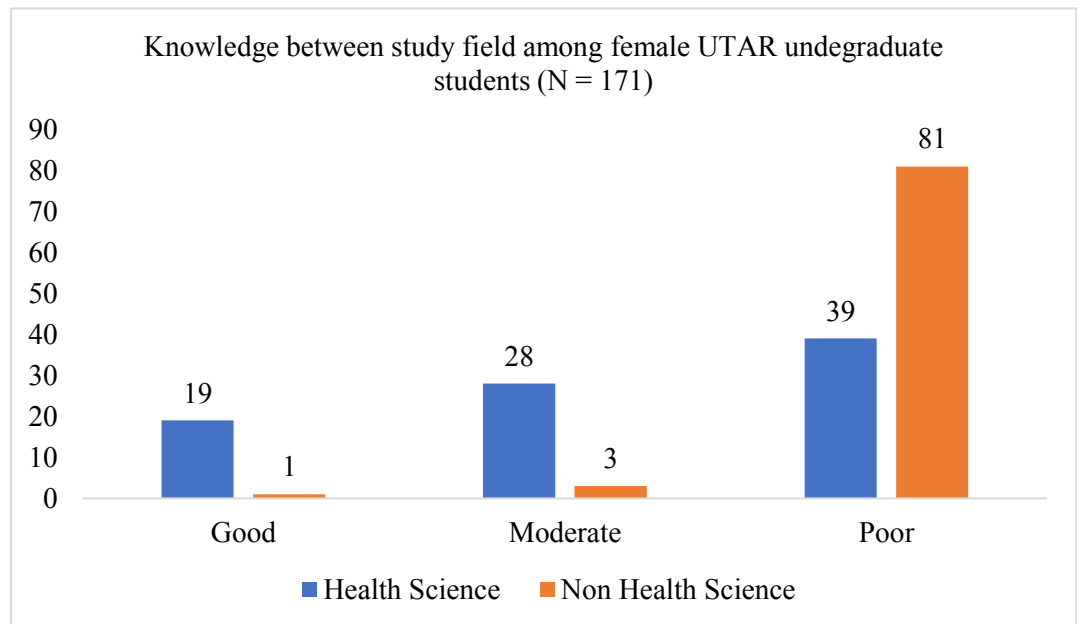
Figure 4.4: Knowledge between study field among female UTAR undergraduate students (N = 171).

4.4 Summary

The results from the data analysis showed that the majority of the respondents had poor knowledge (70.2%) while the majority had a neutral attitude related to anemia (60.8%). Knowledge had an association with attitude ($p = 0.003$). Health science students (27.5%) were more knowledgeable regarding anemia than non-health science students (2.4%) with statistically significant association shown between study field and the knowledge related to anemia ($p < 0.001$). Furthermore, knowledge and age showed significant association ($p = 0.032$) while attitude showed no significant association with age ($p = 0.111$). Moreover, when comparing the knowledge with the average days of menstruation, more than half of the students (n = 95, 55.6%) from the age group of 21 – 22 have poor knowledge and a significant association was shown between the average menstruation duration and the knowledge level ($p = 0.041$).

CHAPTER 5

DISCUSSION

5.1 Discussion on Major Findings

5.1.1 Anemia or Iron-related Knowledge

Knowledge is a subject's understanding regarding the topic given, in our case is the understanding in regard to anemia in terms of the symptoms, prevention, causes, and underlying risk factors that may promote the problem's occurrence. Having adequate knowledge is essential as a foundation for the prevention of disease development.

In this study, more than half of the participants knew about at least 2 symptoms, causes and ways to prevent anemia. The majority of the participants (n = 120, 70.2%) had an average knowledge score of 47%, showing a poor knowledge level. Another study, similarly related to anemia is regarding oral iron consumption among pregnant women attending Hospital Universiti Sains Malaysia, located in Kelantan, whereby the population demonstrated poor knowledge level, obtaining an average knowledge score of 11% by Kadir et al. (2021) while a study conducted in Tanzania by Margwe and Lupindu (2018) also showed low knowledge level by the pregnant women with a with an overall score of 5.2 from 11 points summated scale. The adolescent population from Delhi, India was also in accordance with the findings obtained, most were screened to have poor knowledge although the exact score was not available

(Singh, Rajoura and Honnakamble, 2019). However, the findings in this study contrasted with studies conducted by Huong, et al. (2022) and Adznam, Sedek and Kasim (2018) whereby the university students from the former and pregnant women from the latter showed good knowledge, an average of 60.3% for the university students while 84.2 of a median score for the pregnant women. The disparities of knowledge were likely to be associated with the family vegetarianism status and type of education received. To assess public knowledge and awareness related to anemia, a wide or diverse range of methods needed to be implemented. The people should be given facts and figures in the respective languages regarding the significance of anemia to women in regards to facts related like pregnancy, and menstrual bleeding that makes women highly susceptible to this health problem to avoid complications like heart problems (irregular heartbeat), adverse pregnancy effects like preterm baby or baby born with low birth weight.

According to the findings obtained in our study, the majority of participants (50.88%) chose the selection of "do not know" the food that can hinder iron absorption when taken during mealtime. Only 43.27% and 31.58% of the respondents knew that milk or milk products like yoghurt can inhibit iron absorption, which was similar to a previous study done among pregnant women in Malaysia (Kadir, et al., 2021). According to the study by Shahzad, et al. (2017), only 29.3% correctly recognized that yoghurt can inhibit iron absorption while 48.7% for milk option. Taken together, these findings indicated that 2 different populations were unaware of the role of milk or milk products like

yoghurt in interfering with iron absorption in the gut due to the cow's milk protein, casein, and calcium content that can be found in those products which caused the inhibition of iron absorption that negatively affected iron's uptake in the gut (Milman, 2020).

In regards to iron-rich food, only 37 students (21.64%) knew that whole wheat flour and sweet potato are high in iron whereas food like liver and beef were known by more than half of the students (69.01% and 60.82%) to be high in iron concentration, which was aligned with the previous research that most of the respondent knew that liver and meat from animal are high in iron (Adznam, Sedek and Kasim, 2018). Only spinach is the non-meat food that was known by the students to be high in iron (69.01%). This may be suggested that most of the respondents are non-vegetarian and will have intake a various type of food that have meat flesh as a study conducted in India found that knowledge scores regarding anemia prevention was associated with the vegetarianism status of the subjects (Danapure, 2018). Thus, this will affect the subjects' knowledge regarding foods that are rich in iron. In addition, more than half of the students knew that oranges and lemons were able to assist in iron's uptake in the gut while limited students knew that bell peppers were also able to help in iron absorption (57.89%, 51.46% and 28.65% respectively) other than the option "don't know", this was in line with the study among college students in Pakistan (76.7%, 75.3% and 15.3%) (Shahzad, et al., 2017). Nonetheless, the incidence of anemia may or may not associated with KAP scores obtained as having high

knowledge but poor attitude or practice will not effectively prevent anemia occurrence (Agustina, et al., 2021)

5.1.2 Anemia or Iron Related Attitude

Attitude is an important variable in exploring the individuals' self-efficacy towards the prevention of a certain health problem as the attitude of the population is vital in determining the needs for health intervention programs. Self-efficacy can help to determine the possibility of behavioral changes. Motivation can lead to a good attitude towards health problem prevention, in this case, anemia or iron deficiency prevention especially when individuals know that the problem can be prevented or lowered through adopting a positive behavior.

In this present study, the majority (n = 104, 60.8%) of the participants had neutral attitudes with the average attitude score of the samples being 73%. This result was not consistent with the local study done by Adznam, Sedek and Kasim (2018), which found that pregnant women had a good attitude related to anemia during pregnancy with a mean score of 72.4%. The study by Al-Rabeei, et al. (2023) using pregnant women in Yemen overall also showed that they were showing a positive attitude, same goes for the study in Ethiopia by Oumer and Hussein (2019), pregnant women majority (52.3%) showed favorable attitude towards iron deficiency anemia but the exact mean score was not available for the former while the latter was 32.8 that also act as cut off point

for the attitude scoring. The difference in results for the different populations may be likely due to the participants being in different stages of age, whereby pregnant women were currently childbearing and will give more priority towards the personal and the fetus' health while students may be likely to give more focus towards their academic studies in this stage of life instead of their health.

By analyzing each attitude statement question related to anemia, the finding demonstrated that 41.5% of the respondents were not sure about the chances of them being iron deficient or anemic. However, the majority of the participants (n = 115, 67.3%) were aware that iron deficiency or anemia is a serious health issue. This was in line with the college students from Pakistan Shahzad, et al. (2017) while dissimilar with the study's findings from Abu-Baker, Eyadat and Khamaiseh (2021) and Zarkada, et al. (2022) whereby the majority of the adolescents from the former felt that it was not serious while the participants from the latter majority did not know. The findings of Huong, et al. (2022) were also not in line as the undergraduate students' majority in their studies felt that the health problem seriousness was just moderate. The possible interpretation for the differences in these findings from different populations may be due to the perceived susceptibility of the health condition towards the individual themselves as those perceived themselves as having higher risk will have better health behavior which can indirectly reduce the risk of developing the disease (Onoruoiza, et al., 2015). In addition, individuals' change throughout their lives

psychologically, hormonal, and physically will affect and modify the persons' respective attitudes (Abu-Baker, Eyadat and Khamaiseh, 2021).

Furthermore, the positive attitude of feeling good in preparing iron-rich food was shown by the majority (n = 119, 69.6%) of the students in this study. This was in line with the study by Abu-Baker, Eyadat and Khamaiseh (2021) whereby a majority of the adolescent felt good if prepared food rich in iron (60.6%) and the study by Zarkada, et al. (2022) among reproductive age women (69.7%). The positive attitude as if having the belief towards the severity of anemia should be accompanied by preventive actions with an addition of good knowledge as an advantage (Andani, Mahmudiono and Adhela, 2021). However, in regards to liking the taste of iron-rich food, difficulty, and having confidence in preparing iron-rich food, the majority had a neutral attitude (55.6%, 59.6%, and 51.6% respectively). This may be due to the hands-on experience (meal preparation) not being present in regards to having the feeling of difficulty, preparing and liking the taste of iron-rich food as hands-on activities will often improve and help the person's interest in that particular subject (Holstermann, Grube and Bögeholz, 2010). More studies should be conducted to determine the perceived susceptibility, severity, and benefits that may affect the attitude levels regarding anemia prevention to educate people about the benefits of having a good preventive attitude towards anemia that may affect the susceptibility of the individual.

5.1.3 Association between Knowledge and Attitude related to Anemia

The findings of the present study showed that knowledge level did influence the attitude related to anemia among female UTAR undergraduate students. The association between the variables was statistically significant with a *p*-value of 0.003. This result was consistent with the findings of Huong, et al. (2022) among 180 undergraduate students from various schools in a private university located in Kuala Lumpur and (Hamed, 2021) among anemic college female students from Medical Clinics, Hail University Student Hospital in Egypt as well as study from Putrjaya, Malaysia by Adznam, Sedek and Kasim (2018) involving pregnant women. Rather than a similar study design, cross-sectional was employed, the factor of consistency might be the educational level of the participants which the participants recruited for the studies mentioned were having higher educational levels in which more than half (75.4%) of the pregnant women were having education level of Malaysian higher school certificate or diploma and above while the other 2 studies and our study were using students that are having their tertiary education. However, the reliability of these findings was still questioned as cross-sectional studies are susceptible to bias like non-response bias and interpretation of the association might be difficult (Wang and Cheng, 2020). Nonetheless, the study using pregnant women from Putrajaya employed a random sampling method, increasing the reliability of the findings as compared with our study and the other 2 studies. Although the students showed poor knowledge regarding anemia, their attitudes towards anemia were neutral instead of poor. Higher education can improve a person in a way that person's understanding can be engaged through knowledge and relate it with the current situation (Ashwin, 2014). As a result, the

complexity of the knowledge a person has is essential in assisting individuals to decide to the extent of relying on their attitudes to shepherd them to have the behavior (Fabrigar, et al., 2006). Nonetheless, knowledge is essential in preventive action or having preventive beliefs which can promote a positive attitude and thus promote a positive practice towards a medical problem (Wahed, et al., 2020). Adequate knowledge is required for the commission of taking preventative actions that help in reducing anemia-related or iron deficiency-related disease through practice like consuming iron-rich food, taking food that may promote or inhibit iron absorption at the correct timing, and taking supplements to prevent any deficiencies that may lead to anemia.

5.1.4   Correlation between Knowledge and Attitude related to Anemia

The influence of knowledge did show towards the attitude related to anemia in regards to the relationship in between. The present findings of this study found that the attitude related to anemia increases as knowledge increases, indicating the correlation between the variables was positive and significant with the relationship strength revealed to be moderate ($r = 0.403$, $p < 0.001$). This was in accordance with another local study conducted by Adznam, Sedek and Kasim, (2018) among female pregnant women from Putrajaya. These findings were comparable with Huong, et al. (2022), as it was reported to have a significant weak correlation ($r = 0.218$) between the variables mentioned. The reason behind this might be explained by the fact the former 2 studies' data were non-normally distributed while the latter had normally distributed data in which distribution of the data can affect the strength of the correlation between

variables test taking other possible observations range into consideration like difference in variance that may shift the correlation coefficient causal relationship (Janse et al., 2021) as well as an observational study design prohibited the researchers from having the chance to evaluate and assess the development in terms of their behavior. As this study found that overall, only 27.5% of the students showed positive prevention anemia-related attitude, the correlation results obtained can be used to weigh and emphasize the need to provide more evidence-based iron nutrient deficit consequences information as to brush up their anemia-related knowledge level.

5.1.5   Association between Knowledge related to Anemia and Age

Based on the findings of the present study, the association was statistically significant between the knowledge related to anemia and the age of the female UTAR undergraduate students. This was parallel with the study conducted by Danapure (2018) using adolescent girls from India as well as the study by Kadir et al. (2021) that highly related to anemia incidence, involving pregnant women who were attending Hospital Universiti Sains Malaysia in which the maternal age had influenced the knowledge scores regarding their oral iron supplementation. Although the variables differed slightly, the few questions assessed were quite similar in terms of assessing their knowledge regarding iron-rich food, foods that enhance iron uptake while the rest were regarding iron supplementation, but this was also related as iron supplementation was used to prevent iron deficiency that is closely related to anemia. However, these findings were not parallel with several studies conducted in different countries

and populations (Adznam, Sedek and Kasim, 2018; Zani, et al., 2020; Adediran, et al., 2021; Mohanty, 2021; Rizwan, et al., 2021; Al-Rabeei, et al., 2023) whereby Mohanty (2021) used adolescent girls while the other studies used pregnant women. Taken together, these findings were dissimilar may be due to the age disparities among the population whereby those involving pregnant women and showed no significant association were having a wider age gap while our study involved only a small age gap between the population. Although the age gap can be one of the reasons, education level and area of living (rural or urban) also can be a factor as limited resources, and exposure to a diversity of experiences and opportunities can restrict a person's insight towards the health problem as most of the study that had no association mentioned majority were from rural and having lower educational level participants. In addition, the sample size of the study also will affect the results in terms of estimation precision, bias and variability, statistical power, and margin of error. Future research might recruit more or larger participants of all ages and educational levels that are equally distributed.

5.1.6 Association between Attitude related to Anemia and Age

In this study, the students viewed and showed anemia-related attitudes neutrally, but the association between attitudes related to anemia and the participants' age was not statistically significant. This result was parallel with a local study by Adznam, Sedek and Kasim (2018) and a Bangladesh study by Rizwan, et al. (2021). Another study conducted in Egypt regarding the difference between attitude and age group also showed statistics of not significant (Ahamed, Kotb

and Hassanen, 2018). Similar findings may be due to the same sampling method and study design, observational study design. Also, this might be explained by the attitudes towards the particular issue as varying associations were found between implicit or explicit types of attitudes as implicit is unconscious and automatic while explicit is conscious and formed or reported intentionally (Chopik and Giasson, 2017). Therefore, it might not be affected by the age of the individuals. Individuals' differences vary across aspects like personal traits, beliefs, past experiences, availability to access healthcare and information as well as the education and awareness in terms of equal accessibility and effective education and awareness programs across all age groups and thus no difference in terms of the prevention attitude (Deeks, et al., 2009; Nakamura, et al., 2022 and World Health Organisation (WHO), n.d.). Rather than age, the physical and mental behavior are more essential in terms of having an attitude regarding preventative actions (Butler, et al., 2011).

5.1.7 Association between Knowledge related to Anemia and Average Duration of Menstruation

The findings of our study were statistically significant regarding the female UTAR undergraduate students' anemia-related knowledge and their average menstruation duration. Until now and to our knowledge, there was no prior research that had investigated the association between these 2 variables specifically. However, there was a study conducted in Sri Lanka by Roshana and Mahendran (2022) showed that the causes of anemia, and the history of having heavy menstrual bleeding were associated with the educational level of

the pregnant women they used. Within the same study, the educational level showed a significant association with the knowledge regarding causes of anemia among the participants.

In addition, few of the studies conducted previously showed that there is a significant association between the anemia incidence prevalence and the menstruation duration of the female participants the researchers used in the study, a population of adolescent and reproductive-aged women (Listiarini, et al., 2021; Sheriff, et al., 2021). Thus, taking together these findings, it can be justified that the knowledge of the individuals was affected by their educational level and educational level can affect the amount of information regarding certain diseases and the predisposed or underlying causes that may lead to the development of certain health problem, in this case, is blood loss during menstruation that can affect the blood volume of the body if actions were not taken to compensate back the nutrient loss through dietary prevention. Higher education is likely to have better knowledge or increase the understanding of the diseases through higher awareness such as recognizing symptoms related to the disease that can lead to taking action in advance for earlier prevention (Raghupathi and Raghupathi, 2020). Nonetheless, future research was recommended to be conducted in regards to determining the relationship of blood loss through menstruation and education and prevention knowledge level that can affect the attitude and practice towards anemia or iron deficiency prevention in order to better educate people about anemia-related underlying causes that can be prevented in advance through their dietary habits.

5.1.8   Association of Knowledge related to Anemia and Study Fields

To our knowledge, there was no prior research that had studied the relationship between these 2 variables among Malaysian university students. The finding in this study was the knowledge related to anemia and study fields of the respondent are statistically significant. The surveyed students from health science-related field of study showed more knowledge related to anemia than students from non-health science fields of study. This was consistent with the study among students from several institutions with various academic years and departments in Poland (Siemienas, et al., 2014). However, although another two studies using nursing students by Ali, AbdEl-Aziz and Sayed (2022) in Egypt and Koeryaman, et al. (2018) in Indonesia and the study was not directly test for the association or relationship between the knowledge and study fields, the result for the nursing students of the former was not showing satisfactory knowledge level of iron deficiency anemia while the latter showed moderate knowledge level related to high iron food that is highly related to iron deficiency anemia. Taken together, these findings showed disparities were probably due to the overall exposure to educational materials and the amount of curriculum by the health science students during their study years can also be affected by their personal pace of learning, accessibility towards the learning resources, and practical experiences towards the particular health problem. In a psychological perspective, non-cognitive attributes, in this case self-discipline can affect the cognitive attribute of the students, which is the prior knowledge they had (Gong, et al., 2014). Surprisingly, our study did show that almost half of the students from health science (n = 39, 22.8%) had poor knowledge levels related to anemia or iron deficiency. More and future research should be conducted to

determine the disparities regarding knowledge levels related to anemia among different groups of individuals in Malaysia to promote additional health-related programs for all students regardless of their profession as to help in updating the students' anemia-related knowledge.

5.2   Limitations of the Study

Several limitations related to the methodology of this study were identified. The main aspect was that this study was an observational study (cross-sectional), it may not explore the external factors that can affect the female undergraduate students' health behaviors and perception towards anemia or iron deficiency, it was designed to understand the relationship behind the sociodemographic variables with the respondent knowledge and attitude. Thus, it should not be used to draw definite conclusions regarding the causal relationship and underlying reasons for the results of our study depending on the information derived from the respondents' point of view.

In addition, as can be noticed which majority of our participants were Chinese which may be due to the non-probability sampling method employed. Although the convenience sampling method was generally easy, time and cost-saving, this method may not be a valid representation of the population as the recruiting process of the sample is unable to generalize the findings. As the validated questionnaire was adopted and administered online to the respondents, it poses a challenge as participants may simply fill out the questionnaire resulting in

recall and report bias. Moreover, the findings of the data also showed not normally distributed which can be due to data being self-reported and possibly different understanding that leads to various interpretations regarding the questions asked, thus skewing the data's accuracy.

5.3   Recommendations for future research

As the study findings had just only 20 students (11.7%) showed good knowledge related to anemia, additional health-related events and programs should be implemented to boost their knowledge and understanding of facts related to anemia or iron deficiency in preventing the other complications related like chronic heart failure, chronic kidney disease, and inflammatory bowel disease. In addition, more cross-sectional studies can be conducted among other local students to increase the accuracy and reliability of research focusing on knowledge and attitude with an addition of practice-related anemia. The sampling method may also consider all those probability sampling methods like simple random or systematic sampling that may help in reducing the bias that can promote accuracy and reliability. Moreover, the survey administered to the respondents for data collection should consider a physical survey with face-to-face interviews to supervise the participants when answering which may help prevent data bias and survey fraud.

CHAPTER 6

CONCLUSION

In conclusion, the present study revealed that undergraduate students at UTAR had a poor knowledge level but neutral attitude related to anemia with an average score of 46% and 73% respectively. The majority knew at least one of the symptoms and underlying cause and prevention of the health problem in terms of the intake of dietary foods. However, since the study was focused on undergraduate students, it was expected to have a good knowledge and positive attitude related to anemia or iron deficiency as the educational level is higher. Moreover, our study found that there was an association between knowledge and attitude, indicating that with a good knowledge level, the participants were more likely to have a positive attitude related to anemia or iron deficiency prevention although the correlation between these variables was just moderately correlated. In addition, significant associations were found between knowledge and with age of the respondents but not their attitude. Meanwhile, health science students showed significantly better anemia-related knowledge than non-health science students with an additional of significant association found between the knowledge and average menstruation duration of the female undergraduate students.

Since the samples were obtained from just 1 study setting, these findings may not be applicable to the whole community. Still, our study may be an insight for

future studies in regard to the knowledge, attitude, and practice related to anemia or iron deficiency among the general population. In addition, it might be better if future research considers the anemic status of the population as a factor that can affect knowledge, attitude, and thus practice. The importance of iron and anemia complications shall be highlighted to susceptible population groups through the implementation of health programs to prevent the prevalence and occurrence of anemia from increasing among the population.

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Appendix A

List of Course Program According to Study Field

A. MEDICINE AND HEALTH SCIENCES

Faculty of Medicine and Health Sciences (Sg. Long)
Faculty of Science (Kampar)

Bachelor of Medicine and Bachelor of Surgery
Bachelor of Chinese Medicine (Honours)
Bachelor of Nursing (Honours)
Bachelor of Physiotherapy (Honours)
Bachelor of Science (Honours) Biomedical Science
Bachelor of Science (Honours) Dietetics

B. ACCOUNTING, BUSINESS AND ECONOMICS

Faculty of Accountancy and Management (Sg. Long)
Faculty of Business and Finance (Kampar)

Bachelor of Accounting (Honours)
Bachelor of Building and Property Management (Honours)
Bachelor of Business Administration (Honours)
Bachelor of Business Administration (Honours) Banking and Finance
Bachelor of Business Administration (Honours) Entrepreneurship
Bachelor of Business Administration (Honours) Healthcare Management
Bachelor of Business Administration (Honours) in Logistics and Supply Chain Management
Bachelor of Business Administration (Honours) Retail Management
Bachelor of Business Administration (Honours) Risk Management
Bachelor of Business Administration (Honours) Tourism Destination Marketing
Bachelor of Commerce (Honours) Accounting
Bachelor of Economics (Honours) Financial Economics
Bachelor of Economics (Honours) Global Economics
Bachelor of Finance (Honours)
Bachelor of Finance (Financial Technology) with Honours
Bachelor of International Business (Honours)
Bachelor of Marketing (Honours)
Bachelor of Public Administration (Honours)

C. ACTUARIAL SCIENCE, MATHEMATICS AND PROCESS MANAGEMENT

Lee Kong Chian Faculty of Engineering and Science (Sg. Long)
Faculty of Science (Kampar)

Bachelor of Science (Honours) Actuarial Science
Bachelor of Science (Honours) Applied Mathematics with Computing
Bachelor of Science (Honours) Financial Mathematics
Bachelor of Science (Honours) Logistics and International Shipping
Bachelor of Science (Honours) Statistical Computing and Operations Research

D. AGRICULTURAL AND FOOD SCIENCE

Faculty of Science (Kampar)

Bachelor of Science (Honours) Agricultural Science
Bachelor of Science (Honours) Food Science

E. ARTS, SOCIAL SCIENCE AND EDUCATION

Faculty of Arts and Social Science (Kampar)
Faculty of Creative Industries (Sg. Long)

Bachelor of Arts (Honours) English Education
Bachelor of Arts (Honours) English Language
Bachelor of Arts (Honours) Journalism in Chinese Media
Bachelor of Communication (Honours) Advertising
Bachelor of Communication (Honours) Journalism
Bachelor of Communication (Honours) Public Relations
Bachelor of Corporate Communication (Honours)
Bachelor of Early Childhood Education (Honours)
Bachelor of Social Science (Honours) Guidance and Counselling
Bachelor of Social Science (Honours) Psychology

F. CHINESE STUDIES

Institute of Chinese Studies (Kampar)

Bachelor of Arts (Honours) Chinese Studies

G. CREATIVE INDUSTRIES AND DESIGN

Faculty of Creative Industries (Sg. Long)

Bachelor of Arts (Honours) Digital Animation
Bachelor of Arts (Honours) Game Design
Bachelor of Arts (Honours) Graphic Design and Multimedia
Bachelor of Communication (Honours) Broadcasting
Bachelor of Media and Creative Studies (Honours)
Bachelor of Science (Honours) Game Development

H. ENGINEERING, TECHNOLOGY AND BUILT ENVIRONMENT

Lee Kong Chian Faculty of Engineering and Science (Sg. Long)
Faculty Of Engineering And Green Technology (Kampar)

Bachelor of Biomedical Engineering with Honours
Bachelor of Chemical Engineering with Honours
Bachelor of Civil Engineering with Honours
Bachelor of Electronic Engineering with Honours
Bachelor of Telecommunications Engineering with Honours
Bachelor of Electrical and Electronic Engineering with Honours
Bachelor of Civil Engineering (Environmental) with Honours
Bachelor of Engineering (Honours) Industrial Engineering
Bachelor of Materials Engineering with Honours
Bachelor of Mechanical Engineering with Honours
Bachelor of Mechatronics Engineering with Honours
Bachelor of Engineering (Honours) Petrochemical Engineering
Bachelor of Science (Honours) Architecture
Bachelor of Science (Honours) Construction Management
Bachelor of Science (Honours) Environmental, Occupational Safety and Health
Bachelor of Science (Honours) Quantity Surveying
Bachelor of Technology (Honours) in Electronic Systems
Bachelor of Technology (Honours) in Industrial Management

I. INFORMATION AND COMMUNICATION TECHNOLOGY

Lee Kong Chian Faculty of Engineering and Science (Sg. Long)
Faculty of Information and Communication Technology (Kampar)

Bachelor of Computer Science (Honours)
Bachelor of Information Systems (Honours) Business Information Systems
Bachelor of Information Systems (Honours) Digital Economy Technology
Bachelor of Information Systems (Honours) Information Systems Engineering

Bachelor of Information Technology (Honours) Communications and Networking
Bachelor of Information Technology (Honours) Computer Engineering
Bachelor of Information Technology (Honours) Industrial Interlligent Systems
Bachelor of Science (Honours) Software Engineering
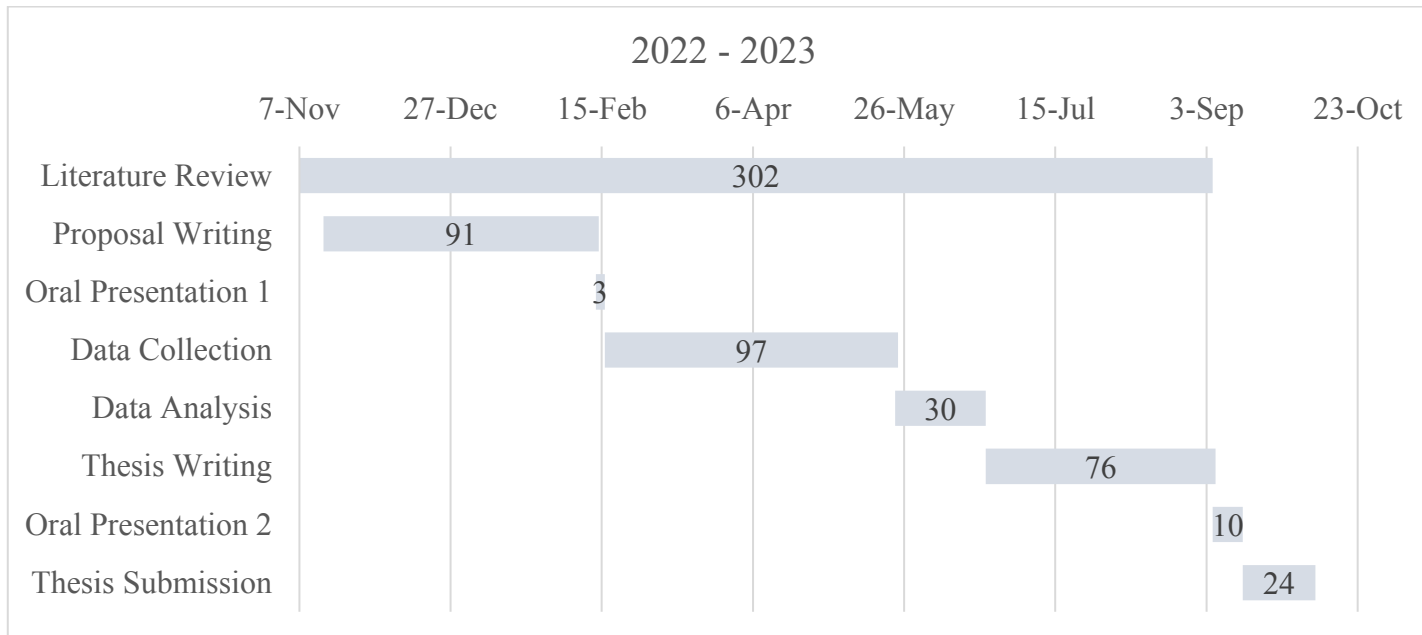

J. LIFE AND PHYSICAL SCIENCE

Faculty of Science (Kampar)
Lee Kong Chian Faculty of Engineering and Science (Sg. Long)

Bachelor of Science (Honours) Biochemistry
Bachelor of Science (Honours) Biotechnology
Bachelor of Science (Honours) Chemistry
Bachelor of Science (Honours) Microbiology
Bachelor of Science (Honours) Physics

Appendix B

Gantt Chart and Project Milestones

2022 - 2023

	7-Nov	27-Dec	15-Feb	6-Apr	26-May	15-Jul	3-Sep	23-Oct
Literature Review				302				
Proposal Writing		91						
Oral Presentation 1			3					
Data Collection				97				
Data Analysis					30			
Thesis Writing						76		
Oral Presentation 2							10	
Thesis Submission							24	

Appendix C

Ethical Approval

UTAR

UNIVERSITI TUNKU ABDUL RAHMAN *DU012(A)*

Wholly owned by UTAR Education Foundation *Co. No. 578227-M*

Re: U/SERC/122/2023

17 May 2023

Dr Teh Lai Kuan
Head, Department of Allied Health Sciences
Faculty of Science
Universiti Tunku Abdul Rahman
Jalan Universiti, Bandar Baru Barat
31900 Kampar, Perak.

Dear Dr Teh,

Ethical Approval For Research Project/Protocol

We refer to the application for ethical approval for your students' research projects from Bachelor of Science (Honours) Dietetics programme enrolled in course UDDN3108. We are pleased to inform you that the application has been approved under <u>Expedited Review</u>.

The details of the research projects are as follows:

No	Research Title	Student's Name	Supervisor's Name	Approval Validity
1.	Association Between Dietary Pattern with Academic Performance and Mental Health Among UTAR Students	Lee Jun Kent	Dr Chee Huei Phing	17 May 2023 – 16 May 2024
2.	Knowledge, and Awareness of Colorectal Cancer (CRC), Risk Factors and Symptoms Among University Students UTAR, Kampar	Lim Peh Nee		
3.	Evaluation on Knowledge and Attitude Related to Anemia Among Female UTAR Undergraduate Students: A Cross-Sectional Study	Lock Yee Sin		
4.	Knowledge, Attitude and Practices (KAP) of UTAR Undergraduate Students Towards Mediterranean Diet and Its Association with Body Mass Index (BMI)	Wong En Li		

The conduct of this research is subject to the following:

(1) The participants' informed consent be obtained prior to the commencement of the research;

(2) Confidentiality of participants' personal data must be maintained; and

(3) Compliance with procedures set out in related policies of UTAR such as the UTAR Research Ethics and Code of Conduct, Code of Practice for Research Involving Humans and other related policies/guidelines.

(4) Written consent be obtained from the institution(s)/company(ies) in which the physical or/and online survey will be carried out, prior to the commencement of the research.

Should the students collect personal data of participants in their studies, please have the participants sign the attached Personal Data Protection Statement for records.

Thank you.

Yours sincerely,

Professor Ts Dr Faidz bin Abd Rahman
Chairman
UTAR Scientific and Ethical Review Committee

c.c   Dean, Faculty of Science
       Director, Institute of Postgraduate Studies and Research

Kampar Campus : Jalan Universiti, Bandar Barat, 31900 Kampar, Perak Darul Ridzuan, Malaysia
Tel: (605) 468 8888   Fax: (605) 466 1313
Sungai Long Campus : Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor Darul Ehsan, Malaysia
Tel: (603) 9086 0288   Fax: (603) 9019 8868
Website : www.utar.edu.my

80

2. I hereby agreed to participate this study *

    Mark only one oval.

    ◯ I have been notified by you and that I hereby understand, consented and agreed to participate this survey.

    ◯ I disagree to participate to this survey.

    Section A: Sociodemographic Characteristics of the Respondents

3. Gender *

    Mark only one oval.

    ◯ Female

    ◯ Male

4. Age (in years old) *

    Mark only one oval.

    ◯ 19 - 20

    ◯ 21 - 22

    ◯ 23 - 25

    ◯ > 25

5. Ethnicity *

    Mark only one oval.

    ◯ Malay

    ◯ Chinese

    ◯ Indian

    ◯ Others

6. UTAR Campus *

    Mark only one oval.

    ◯ Sg Long

    ◯ Kampar

7. Educational level *

    Mark only one oval.

    ◯ Foundation

    ◯ Degree

    ◯ Master

8. Mode of study *

    Mark only one oval.

    ◯ Full time

    ◯ Part time

9. Faculty *

Mark only one oval.

- ◯ Faculty of Medicine and Health Sciences (FMHS)
- ◯ Faculty of Science (FSc)
- ◯ Faculty of Accountancy and Management (FAM)
- ◯ Faculty of Business and Finance (FBF)
- ◯ Lee Kong Chian Faculty of Engineering and Science (LKC FES)
- ◯ Faculty of Arts and Social Science (FAS)
- ◯ Faculty of Creative Industries (FCI)
- ◯ Institute of Chinese Studies (ICS)
- ◯ Faculty Of Engineering and Green Technology (FEGT)
- ◯ Faculty of Information and Communication Technology (FICT)

10. Study Program (eg: Dietetics) *

Mark only one oval.

- ◯ Health Science-Related
- ◯ Non-Health Science-Related

11. Average duration of menstruation *

Mark only one oval.

- ◯ 2 - 4 days
- ◯ 5 - 7 days
- ◯ > 7 days

12. Vegetarian *

Mark only one oval.

⬭ Yes

⬭ No

Section B: Knowledge related to Anemia

Please give your opinions in the following statements.

13. Have you heard about Iron Deficiency Anemia? *

Mark only one oval.

⬭ Yes

⬭ No

14. Do you know the symptoms of anemia? (Can select more than 1 choice) *

Check all that apply.

☐ Weakness/fatigue

☐ Pallor

☐ Unusual rapid heartbeat

☐ Shortness of breath

☐ Difficult concentration

☐ Headache

☐ Don't know

15. Do you know the causes of anemia? (Can select more than 1 choice) *

Check all that apply.

☐ Lack of dietary iron

☐ Heavy menstrual bleeding

☐ Sickness/infection

☐ Don't know

16. Do you know about the ways of preventing anemia? (Can select more than 1 choice) *

   Check all that apply.

   - [ ] Eat iron rich food
   - [ ] Eat vitamin C-rich food during or right after meals
   - [ ] Take iron supplements
   - [ ] Treat other causes of anemia
   - [ ] Don't know

17. Do you know about the iron rich food? (Can select more than 1 choice) *

   Check all that apply.

   - [ ] Liver
   - [ ] Kidney
   - [ ] Mutton
   - [ ] Beef
   - [ ] Fish
   - [ ] Chicken
   - [ ] Spinach
   - [ ] Sweet potato
   - [ ] Kale
   - [ ] Beet greens
   - [ ] Soya beans
   - [ ] Lima beans
   - [ ] Fortified breakfast cereal
   - [ ] Whole wheat flour

18. Do you know about the foods that help in iron absorption? (Can select more than 1 choice) *

Check all that apply.

☐ Oranges
☐ Lemons
☐ Bell peppers
☐ Guavas
☐ Strawberry
☐ Don't know

19. Do you know about the beverages that decrease iron absorption when taken with meals? (Can select more than 1 choice) *

Check all that apply.

☐ Coffee
☐ Tea
☐ Don't know

20. Do you knows about the foods that hinder iron absorption if taken during the meals? (Can select more than 1 choice) *

Check all that apply.

☐ Milk
☐ Yogurt
☐ Walnuts
☐ Lentils
☐ Eggs
☐ Don't know

Section C: Attitude related to Anemia

Please give your opinions in the following statements.

21. How likely do you think you are to be iron deficient/anemic? *

Mark only one oval.

○ Not likely

○ Not Sure

○ Likely

22. How serious do you think iron deficiency/anemia is? *

Mark only one oval.

○ Not serious

○ Not sure

○ Serious

23. How good do you think it is to prepare meals with iron-rich foods? *

Mark only one oval.

○ Not good

○ Not sure

○ Good

24. How difficult is it for you to prepare meals with iron-rich foods? *

Mark only one oval.

○ Difficult

○ Neutral

○ Not Difficult

25. How confident do you feel in preparing meals with iron-rich foods? *

Mark only one oval.

◯ Not confident

◯ Neutral

◯ Confident

26. How much does you like the taste of iron-rich food item? *

Mark only one oval.

◯ Dislike

◯ Not sure

◯ Like

Participation Appreciation

APPENDIX E

Normality Test For Variables

I)   Variable: Knowledge Score of Participants
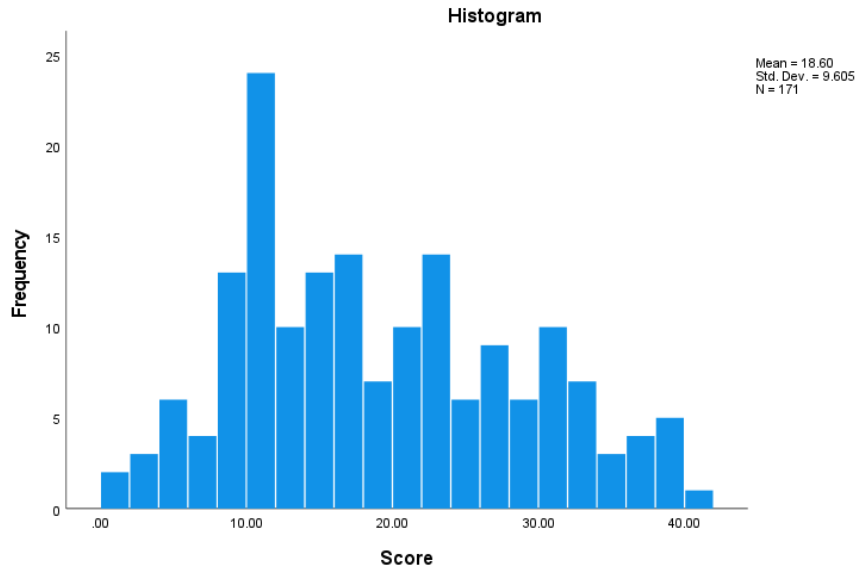
Non-normal distribution

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Score	.105	171	.000	.965	171	.000

a. Lilliefors Significance Correction

Normal Q-Q Plot of Score

Histogram

Mean = 18.60
Std. Dev. = 9.605
N = 171

Knowledge scores among female UTAR undergraduate students
(N = 171)
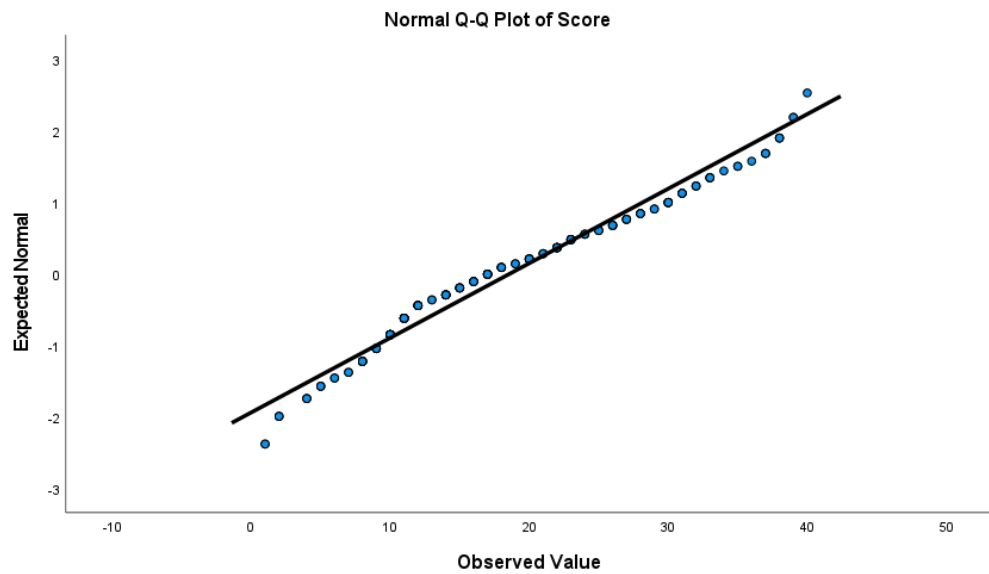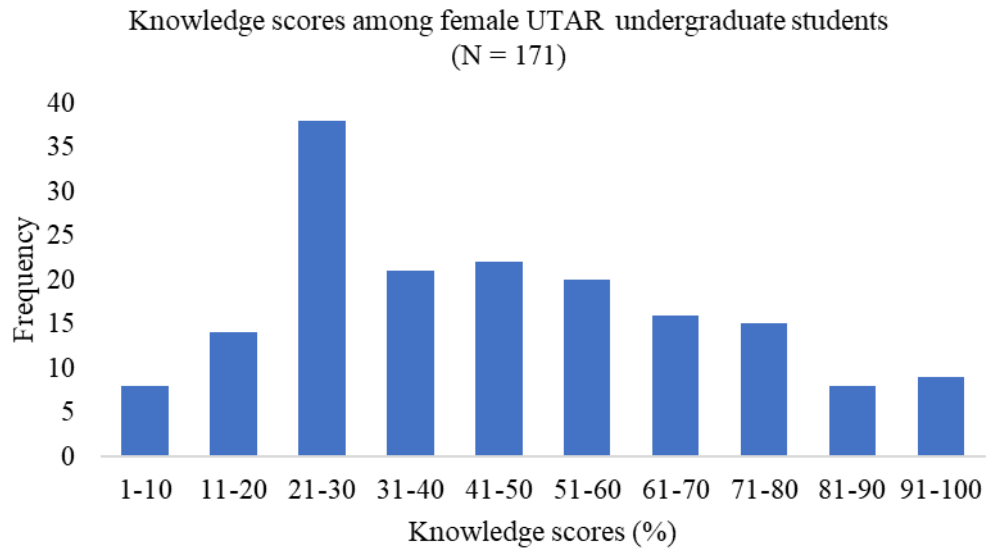
II)   Variable: Attitude Score of Participants

Non-normal distribution

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
AttitudeScore	.111	171	.000	.972	171	.002

a. Lilliefors Significance Correction

Normal Q-Q Plot of AttitudeScore

Histogram

Mean = 13.20
Std. Dev. = 2.068
N = 171
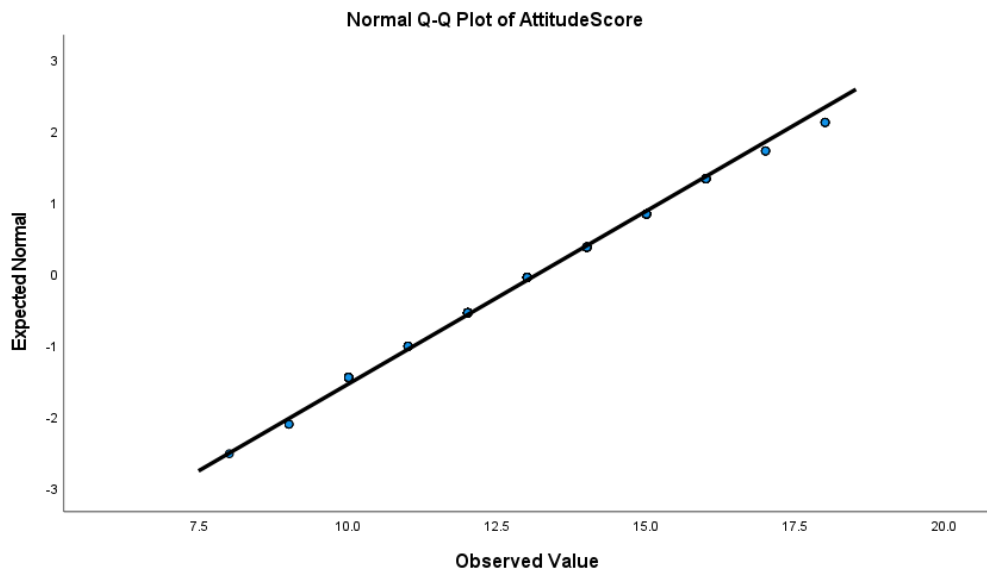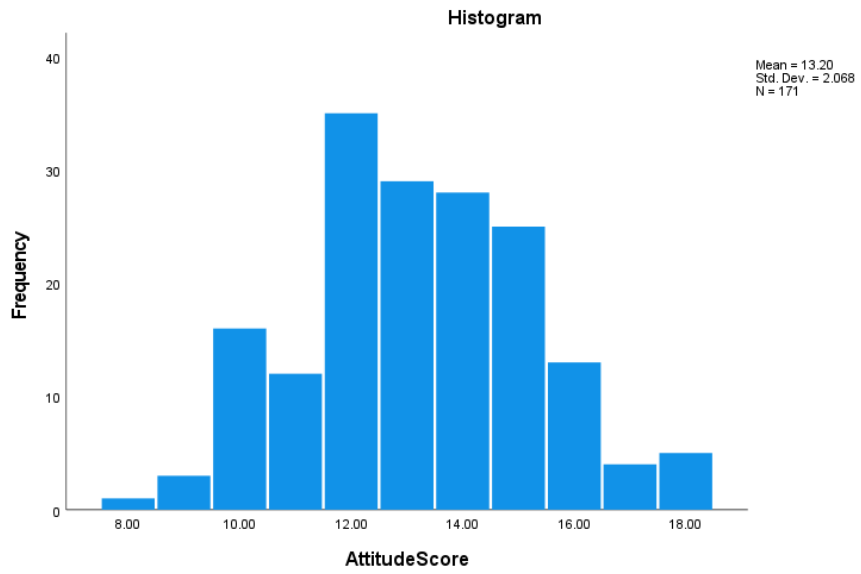
Attitude scores among female UTAR undergraduate students (N = 171)
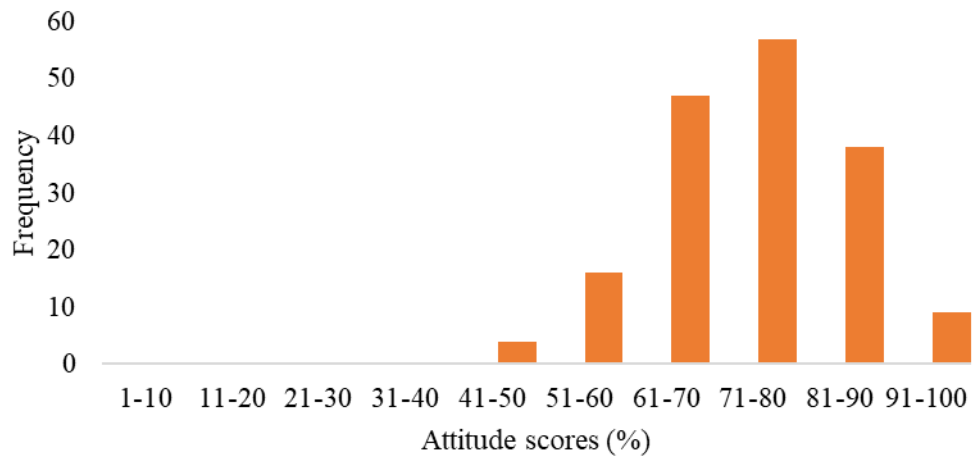
APPENDIX F

FM-IAD-005 Form

Universiti Tunku Abdul Rahman			
Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
Form Number: FM-IAD-005	Rev No.: 1	Effective Date: 3/10/2019	Page No.: 1of 1

FACULTY OF SCIENCE

Full Name(s) of Candidate(s)	Lock Yee Sin
ID Number(s)	20ADB05809
Programme / Course	Bachelor of Science (Honours) Dietetics
Title of Final Year Project	Evaluation of Knowledge and Attitude Related to Anemia Among Female UTAR Undergraduate Students: A Cross-Sectional Study

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index: ___10___ % **Similarity by source** Internet Sources: ___8___ % Publications: ___5___ % Student Papers: ___NA___ %	OK
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Chee HP

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Name: Dr. Chee Huei Phing

Date: _____12-09-2023_____

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