Awareness and Knowledge on Iron Deficiency Anemia and Associated Factors among College Students Attending Universities in Metro Manila, Philippines

Patrick R. Relacion[1*], Marie Mel C. Ordoñez[1], Gillan Kin Q. Robles[1], Danielle Tammy D. Nañasca[1], Samantha Nichole G. Magbuhat[1], Inez Cecilia G. Nocedo[1], Abbiegaelle R. Non[1], Vivian G. Villegas[1]

[1]Department of Medical Technology, Faculty of Pharmacy, University of Santo Tomas, Manila, Philippines.

**Corresponding Author: patrickrelacion@gmail.com*

Abstract: - Anemia is a public health concern affecting many adolescents across the world. Since there are only a limited number of studies about anemia among college students despite its increasing prevalence among them, this study aims to describe the level of knowledge and awareness of university students in Metro Manila, Philippines on iron deficiency anemia (IDA). A 5-part questionnaire that focuses on the socio-demographic profile, medical history, lifestyle practices, and knowledge and awareness on IDA was distributed electronically to college students who are currently enrolled in universities in Metro Manila and measures of central tendency were applied in the analysis of data gathered from the accomplished survey forms. As the scores of both groups in most questions about anemia are adjacent to each other, it can be concluded that anemic and non-anemic college students in Metro Manila are knowledgeable and aware of the risk factors, symptoms, causes, diagnosis, treatment, and prevention of IDA. The results of the study also show that there is no noteworthy difference in the level of knowledge and awareness between anemic and non-anemic students. For future studies, it is recommended to have a larger sampling population, utilize a different sampling method, and employ correlational studies in order to fully characterize the target population.

Key Words: — ***Iron-deficiency anemia, Social determinants, Awareness and knowledge.***

I. INTRODUCTION

Anemia is a condition characterized by a significant decrease in the number of red blood cells that causes lower oxygen levels in the blood, abnormal hemoglobin function, insufficient hemoglobin content, or low hematocrit count with respect to normal physiological reference ranges [1]. It has become a major public health concern all over the world, particularly among certain risk groups in developing countries where poverty, parasitism, and malnutrition are prevalent. Anemia can affect any individual regardless of age, sex, and race. It affects 1.74 billion people worldwide [2]. The top three causes of anemia identified globally include iron deficiency, beta-thalassemia, and vitamin A deficiency.

Manuscript revised August 25, 2021; accepted August 26, 2021. Date of publication August 29, 2021.

This paper available online at www.ijprse.com

ISSN (Online): 2582-7898

Conversely, most of the cases in the Philippines are caused by iron deficiency anemia (IDA). Many Filipinos are deficient in iron due to the lack of consumption of iron-rich food and iron-fortified products that causes poor physical performance, decreased productivity, and decreased immunity to sickness [3].

Recent studies show an increasing prevalence of anemia among college students [4,5]. IDA is common among anemic patients while females are more frequently associated with the disease compared to males. Among the factors seen to explain this occurrence are menstruation, poor nutritional status, and insufficient intake of iron-rich food of female students [6]. Nevertheless, the prevalence of anemia among students is still remarkably high regardless of gender and prior studies claimed that modifiable risk factors such as poor lifestyle choices on top of non-modifiable host factors such as age and gender contribute to this problem. Additionally, inadequate knowledge on management and prevention of anemia, as well as ineptitude to identify its symptoms are

observed in college students, aggravating their susceptibility in developing the disease.

II. CONCEPTUAL THEORY

The risk of developing iron deficiency anemia depends on two major factors: health related and non-health related factors. In non-health related factors, correct information regarding the disease, availability of factual and valid sources of health information, and lifestyle and behavioral patterns affect the risk for anemia. Conversely, health-related conditions and practices also contribute to the susceptibility of an individual to anemia. The presence of underlying genetic or health conditions, planned and good food choices, getting enough and good sleep, and engaging in regular exercise also influence the development of the disease. Together, these factors affect the development of anemia especially among risk groups.

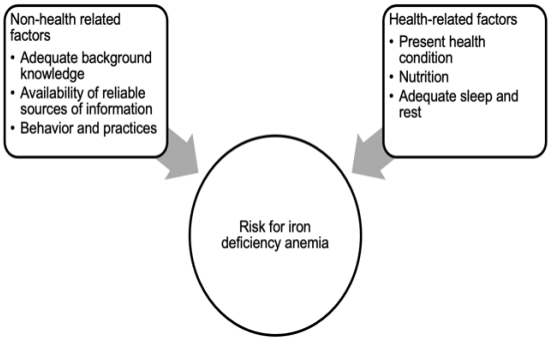

Fig.1. Factors influencing the risk for iron deficiency anemia

III. METHODOLOGY

A. Study Design

The design of the study is descriptive which seeks to assess the levels of awareness and knowledge of college students in Metro Manila concerning iron deficiency anemia (IDA).

B. Preparation of the Survey Material

A standardized survey questionnaire that was developed and prepared by the researchers served as the major sampling tool utilized in the study. The survey questionnaire was adapted from existing studies and divided into different sections to assess the levels of awareness and knowledge on IDA among the respondents.

C. Subjects and Study site

A purposive sampling approach was utilized by the researchers to generate the study sample which is part of the non-probability sampling techniques group. Participants were gathered based on the following criteria:

- Respondent must be an enrolled college student
- Respondent must be studying in Metro Manila, Philippines
- Age limit: 18 to 25 years old
- Has access to internet connection

Consequently, there were 408 respondents who participated in this study electronically.

D. Data Gathering Procedure

Data on socio-demographic, lifestyle, awareness on IDA and its risk factors were gathered through a structured questionnaire. Data gathering was done electronically, and survey forms were prepared through Google Forms. The link for the survey form was shared primarily by the researchers among college groups/organizations on various social media platforms with known potential respondents who fit the criteria. Upon the selection and validation of the prospective participants, the researchers included a brief introduction of the objectives, purpose, and procedure of the study. Subsequently, consent forms were given to interested participants and a more detailed explanation on the rationale and course of study was indicated in the form provided. Following the approval of the respondents to participate in the study, their email was required in answering the form. The survey consisted of different parts, ranging from questions about their personal information to knowledge on IDA. After accomplishing the survey, a prompt message was displayed on their screen that indicated the participants' completion of the survey. A copy of their responses or the receipt of their participation was sent automatically to the email account they used in completing the questionnaire.

E. Data Analysis

A statistical software, SPSS® was used for data analysis. Descriptive statistics using the measures of central tendency were applied to identify and characterize frequencies manifested by the accomplished survey forms. The researchers described the distribution and average responses based on mean and percentages. Moreover, the researchers presented the findings through the use of graphs and figures which summarized the results of the statistical assessment

IV. RESULTS

A. Socio-demographic Profile

Most of the college students were made up of females wherein 85% were anemic and 71% were non-anemic. As per the age range, the majority lies in the ages 20-24 years old. Generally, the respondents fall under a normal Body Mass Index and all of them are single in status, Asian in ethnicity, and are Roman Catholic by religion. It was also noted that most of the respondents belong to low-income and immediate families. As a student, allowances were mostly given weekly or monthly and are supported financially by their parents.

Table 1. Socio-demographic characteristics of the respondents

Variable	Anemic (n=61)	%	Non-anemic (n=347)	%
Sex				
Male	9	15 %	102	29 %
Female	52	85 %	245	71 %
Age				
18-19	8	13 %	51	14.7 %
20-24	52	85 %	294	84.7 %
25 and above	1	2%	2	0.6 %
BMI				
<18.5	18	29.5 %	55	15.9 %
18.5-24.9	30	49.2 %	205	59.1 %
25-29.9	10	16.4 %	57	16.4 %
30-34.9	2	3.3 %	20	5.8 %
35-39.9	0	0%	4	1.2 %
>40	1	1.6 %	6	1.7 %
Marital Status				
Single	60	98.4 %	347	100 %
Married	1	1.6 %	0	0%
Ethnicity				
Asian	61	100 %	346	100 %
White	0	0%	1	0%
Religion				
Roman Catholic	46	75.4 %	277	79.8 %
Protestant	3	4.9 %	17	4.9 %
Islam	1	1.6 %	0	0%
Other Christians (e.g. Aglipayan, INC,Orthodox Church)	10	16.4 %	33	9.5 %
No religion	1	1.6 %	20	5.8 %
Average Annual Income				
Under ₱40,000	7	11.5 %	41	11.8 %
₱40,000 - ₱ 59,999	7	11.5 %	44	12.7 %
₱ 60,000- ₱99,999	9	14.8 %	44	12.7 %
₱100,000- ₱249,999	14	23.0 %	65	18.7 %
₱ 250,000- ₱499,999	8	13.1 %	59	17.0 %
₱ 500,000 and over	16	26.2 %	94	27.1 %
Source of Allowance				
Parents/Immediate family	53	86.9 %	319	91.9 %
Scholarships	5	8.2 %	12	3.5 %
Part-time jobs	2	3.3 %	8	2.3 %
Relatives	0	0%	2	0.6 %
Small busines/ Investments	1	1.6 %	1	0.3 %
N/A	0	0%	5	1.4 %
Basis of Receiving Allowans				
Daily	5	8.2 %	49	14.1 %
Weekly	24	39.3 %	129	37.2 %
Monthly	1	1.6 %	8	2.3 %
Quarterly	20	32.8 %	90	25.9 %
Annual	2	3.3 %	8	2.3 %
N/A	9	14.8 %	69	19.9 %

		3.3 %		0.6 %
		14.8 %		19.6 %
Living Set-up				
Lives alone	7	11.5 %	34	9.8 %
Lives with immediate family	39 4 11	63.9 %	238 29 46	68.6 %
Lives with extended family		6.6 %		8.4 %
Lives with other people or with dormmates		18.0 %		13.3 %

B. Medical History and Health Status

Among the observed parameters in the medical history of both groups were their blood group, frequency of multivitamin intake, history of disease, and frequency of skipped classes due to hospitalization. For respondents with anemia, their diagnosis and age when they were diagnosed, along with their medication and frequency of stress, and symptoms such as dizziness, tiredness or weakness and skin paleness were also inquired among the respondents (Table 2).

The study showed that the most prevalent blood type was O+ with 30% (n=104) and 34% (n=21) of the non-anemic and anemic respondents respectively. This was followed by A+, B+, AB+, and O-. Regarding the multivitamin intake of respondents, the majority of anemic respondents take multivitamins. When asked about their medical history, diabetes mellitus, hypertension, stroke, and coronary artery diseases were found to be prevalent among anemic respondents. Over 60% of this group had a history of hypertension (n=38) and diabetes (n=37) followed by stroke and CAD with 34% (n=21) and 16% (n=10), respectively. Seven percent (n=4) had a family history of cancer while asthma was seen in 5% (n=3) of the anemic group.

Similarly, the same diseases were most common among non-anemic respondents with a percentage of 61% (n=212) for hypertension, 57% (n=196) for diabetes, 28% (n=96) for stroke, 15% (n=51) for CAD and less than one percent of the non-anemic population had a family history of cancer, asthma and other diseases. Furthermore, 47% (n=190) of respondents had a history of inpatient care. Out of this group, 59% (n=36) of respondents belong to the anemic population and 44% (n=154) account for the non-anemic. From the total number of respondents who never had a history of hospital confinement, 41% (n=25) of individuals were anemic while 56% (n=193) were non-anemic.

Table.2. Medical History/Health Status of the Respondents

Variable	**nemic n=61)**	**%**	**Non-anemic (n=347)**	**%**
Blood group				
A+	10	16%	65	19%
A-	0	0%	5	1%
B+	5	8%	50	14%
B-	0	0%	4	1%
AB+	4	7%	25	7%
AB-	1	2%	1	0%
O+	21	34%	104	30%
O-	5	8%	22	6%
No Idea	15	25%	71	20%
Do you have a family history of any of these diseases?	6	9.8%	47	13.5
None	37	60.7	196	%
Diabetes	38	%	212	56.5
Hypertension	10	62.3	51	%
Coronary Artery	21	%	96	61.1
Disease	5	16.4	15	%
Stroke	4	%	4	14.7
No idea	3	34.4	3	%
Cancer	1	%	2	27.7
Asthma		8.2%		%
Others		6.6%		4.3%
		4.9%		1.2%
		1.6%		0.9%
				0.6%
Do you take multivitamins?	2	3%	40	12%
Never	8	13%	64	18%
Rarely	18	30%	80	23%
Sometimes	18	30%	66	19%
Often	15	25%	97	28%
Always				
Have you ever skipped classes due to hospitalizations or other medical issues that required medical attention?	36	59%	154	44%
Yes	25	41%	193	56%
No				

For Respondents with Anemia:

The age of diagnosis among anemic respondents varies (Table 3). Fifty-four percent (n=33) of them were diagnosed between 16-20 years of age while the rest were diagnosed between 0-5 years old (10%, n=6), 6-10 years old (8%, n=5), 11-15 years old (25%, n=15) and 21-25 years old (3%, n=2). Among the respondents, 28% had no knowledge of what type of anemia they have and out of the 61, 50 (82%) respondents have taken drug medication or iron supplements to treat anemia. Stress was also common among the respondents with 86.6% (n=53) answered that they were under a lot of stress.

Tiredness, dizziness and skin paleness were common among anemic respondents. Sixty-six percent experienced tiredness or weakness often or three to four times a week and at least 10% (n=6) experience it once every two weeks. Comparably, 11% (n=7) experience dizziness at least once every two weeks, 39% (n=24) experience it 3-4 times a week and 13% (n=8) experience dizziness every day. Regarding the dull or pale appearance of their skin, almost 96% of the respondents observe this.

Table 3. Medical History/Health Status of the Anemic Respondents

Variable	Anemic (n=61)	%	Variable	Anemic (n=61)	%
When were you diagnosed with anemia? (Years old)			**How often do you feel tired and/or weak and don't know why?**		
0 - 5	6	10%	Never	0	0%
6 - 10	5	8%	Rarely	3	5%
11 - 15	15	25%	Sometimes	6	10%
16 – 20	33	54%	Often	40	66%
21 - 25	2	3%	Always	12	20%
Do you know what type of anemia you have?			**Are you under a lot of stress?**		
Yes	44	72%	Yes	44	72%
No	17	28%	No	17	28%
Specific Anemia Diagnosis of who answered 'Yes' in the previous question			**Have you ever taken drug medication or iron supplements to treat anemia?**		
IDA	42	95%	Yes	50	82%
Thalassemia	2	5%	No	11	18%
Does your skin look unusually pale or dull?			**How often do you feel dizzy?**		
Never	2	3%	Never	0	0
Rarely	3	5%	Rarely	7	11%
Sometimes	21	34%	Sometimes	22	36%
Often	25	41%	Often	24	39%
Always	10	16%	Always	8	13%

C. Lifestyle and Practices

Lifestyle and practices of the respondents are presented in Table 4. 60.7% (n=37) of anemic and 59.7% (n=207) of non-anemic respondents eat home-cooked meals always, while 44.3% (n=27) anemic and 55.3% (n=192) non-anemic respondents eat fast-food sometimes. 44.3% (n=27) of anemic respondents rarely exercise, while 34.3% (n=119) of non-anemic respondents exercise sometimes. In terms of their smoking habits, 75.4% (n=46) of anemic and 81% (n=281) of non-anemic students never smoke, but 24.5% (n=15) of anemic respondents do smoke. Most of the respondents, however, are meat consumers. Majority or 50.8% (n=31) of anemic and 46.7% (n=162) of non-anemic respondents eat red meat often, while on the other hand, 37.7% (n=23) of anemic and 49.8% (n=138) of non-anemic respondents eat vegetables often. With regards to tea and coffee consumption, the majority of the anemic (86.9%, n=53) and non-anemic (88.2% n=306) drink coffee or cocoa after meals, whereas most of them (n=256) only drink tea rarely after meals. Moreover, most of the non-anemic respondents (27.1%, n=94) eat breakfast every day, while most anemic respondents (31.2%, n=19) only eat breakfast rarely. Lastly, in terms of the respondents' number of hours sleeping, most of them get the recommended sleep every night. However, 23% (n=14) of anemic and 16% (n=55) of non-anemic respondents are sleep deprived, with only less than 5 hours of sleep.

Table.4. Lifestyles and Practices of the Respondents

Variable	Anemic (n=61)	%	Non-anemic (n=347)	%

Eat home-cooked meals	0	0%	0	0%
Never	0	0%	5	1.4%
Rarely	10	16.3%	27	7.8%
Sometimes	14	23.0%	108	31.1%
Often	37	60.7%	207	59.7%
Always				
Eat fast food				
Never	0	0%	2	0.6%
Rarely	11	18.0%	65	18.7%
Sometimes	27	44.3%	192	55.3%
Often	22	36.1%	81	23.3%
Always	1	1.6%	7	2.0%
Exercise				
Never	1	1.6%	9	2.6%
Rarely	27	44.3%	117	33.7%
Sometimes	19	31.1%	119	34.3%
Often	10	16.4%	61	17.6%
Always	4	6.6%	41	11.8%
Smoke				
Never	46	75.4%	281	81.0%
Rarely	6	9.8%	44	12.7%
Sometimes	2	3.3%	14	4.0%
Often	6	9.8%	5	1.4%
Always	1	1.6%	3	0.9%
Eat red meat				
Never	2	3.3%	8	2.3%
Rarely	4	6.6%	21	6.1%
Sometimes	16	26.2%	112	32.3%
Often	31	50.8%	162	46.7%
Always	8	13.1%	44	12.7%
Eat vegetables				
Never	0	0%	3	0.9%
Rarely	6	9.8%	24	6.9%
Sometimes	19	31.1%	113	32.6%
Often	23	37.7%	138	49.8%
Always	13	21.3%	69	19.9%
Drink coffee or cocoa after meal	8	13.1%	41	11.8%
Never	15	24.6%	95	27.4%
Rarely	16	26.2%	81	23.3%
Sometimes	4	6.6%	71	20.5%
Often	18	29.5%	59	17.0%
Always				
Drink tea				
Never	9	14.8%	71	20.5%
Rarely	19	31.1%	126	36.3%
Sometimes	15	24.6%	83	23.9%
Often	13	21.3%	38	11.0%
Always	5	8.2%	29	8.4%
Tea Frequency				
Within	4	6.6%	30	8.6%
meal	40	65.5%	216	62.3%
After meal	17	27.9%	101	29.1%
Not applicable				
Eat Breakfast				
Never	2	3.3%	15	4.4%
Rarely	19	31.2%	64	18.4%
Sometimes	18	29.5%	89	25.6%
Often	11	18.0%	85	24.5%
Always	11	18.0%	94	27.1%
Hours of sleep				
Less than 5	14	23.0%	55	16.0%
hours	43	70.5%	272	78.0%
5-8 hours	4	6.5%	20	6.0%
Greater than 8 hours				

As for the female respondents, 42% (n=102) of non-anemic and 33% (n=17) of anemic respondents were identified to have an irregular menstrual pattern. 54% (n=28) of anemic and 69% (n=169) of non-anemic respondents answered that their menstruation lasts for three to five days. Furthermore, 23% of both anemic (n=12) and non-anemic (56) female respondents experience high menstrual blood loss.

D. Knowledge Regarding Iron Deficiency Anemia

Majority of students who are anemic (n=40, 65%) and non-anemic (n=279, 80%) know at least three of six factors (lifestyle habits, physiological factors, pathological factors, intensive exercise, genetics, and stress) that can lead to anemia (Table 5). As for knowledge on symptoms associated with anemia, 86% (n=52) of anemic and 76% (n=265) of non-anemic students know at least three of five symptoms (decreased appetite, fatigue, irritability, shortness of breath, and pale skin color).

In relation to screening for anemia, most anemic (n=30, 49%) and non-anemic (n=187, 54%) respondents know that complete blood count (CBC) is the laboratory test used, but more non-anemic students answered correctly. The majority of students also know that blood is the specimen of choice [anemic: (n=56, 92%); non-anemic: (n=319, 92%)], a medical technologist conducts laboratory testing [anemic: (n=33, 54%); non-anemic: (n=198, 57%)], and RBC is the blood component viewed under the microscope [anemic: (n=34, 56%); non-anemic: (n=208, 60%)].

When tested on anemia treatment and prevention, results show that less than half of anemic (n=23, 38%) and non-anemic (n=130, 37%) respondents know that increasing intake of both dietary iron and vitamin C can prevent anemia, while the majority of anemic (n=39, 64%) and non-anemic (n=217, 63%) students answered that taking multivitamins and iron and folic acid (IFA) are ways to treat anemia.

Table.5. Knowledge of Anemic and Non-anemic Respondents

Variable	Anemic (n=61)	%	Non-anemic (n=347)	%
Which of the following factors leads to anemia?				
Got no correct answer	0	0%	7	2%
One correct answer	3	5%	18	5%
Two correct answers	18	30%	43	12%
Three correct answers	13	21%	88	25%
Four correct answers	13	21%	93	27%
Five correct answers	10	16%	67	19%
Got all of the correct answers	4	7%	31	9%
What are the symptoms of anemia?	0	0%	2	1%
Got no correct answer	1	2%	20	6%
One correct answer	8	13%	60	17%
Two correct answers	26	43%	116	33%
Three correct answers	20	33%	132	38%
Four correct answers	6	10%	17	5
Got all of the correct answers				
What type of test is used to diagnose anemia?				
Incorrect answer	31	51%	160	46%
Correct answer	30	49%	187	54%
Which among the specimens is used in anemia screening?	5	8%	28	8%
Incorrect answer	56	92%	319	92%
Correct answer				
Which among the listed medical personnel is tasked to conduct laboratory testing for anemia?	28	46%	149	43%
Incorrect answer	33	54%	198	57%
Correct answer				
Which blood component is viewed under the microscope for anemia diagnosis?	27	44%	139	40%
Incorrect answer	34	56%	208	60%
Correct answer				
How do you prevent anemia?	0	0%	7	2%
Got no correct answer	38	62%	212	61%
One correct answer	23	38%	128	37%
Got all of the correct answers				
How can you treat anemia? Please select all that apply.	0	0%	0	0%
Got no correct answer	22	36%	128	37%
One correct answer	39	64%	219	63%
Got all of the correct answers				

E. Awareness Regarding Iron Deficiency Anemia

The anemic and non-anemic college students have a good awareness level regarding anemia (Table 5). Findings on level of awareness revealed that 27.9% (n=17) anemic and 35.4% (n=123) non-anemic were aware that anemia is a serious problem. 22.5% (n=78) non-anemic and 29.5% (n=18) anemic respondents answered they were extremely aware that anemia may be due to nutrient deficiency. Most respondents among both groups were aware that it is essential to seek medical attention if symptoms of anemia are suspected; Only <2% in each group were not aware of it.

Table 6. Awareness of Anemic and Non-anemic Respondents

Variable	Anemic (n=61)	%	Non-anemic (n=347)	%
Anemia is a health problem	0	0.0%	1	0.3%
Not Aware	5	8.2%	30	8.6%
Slightly Aware	17	27.9%	123	35.4%
Aware	16	26.2%	78	22.5%
Very Aware	12	37.7%	115	33.1%
Extremely Aware				
Nutrient Deficiency	2	3.3%	12	3.5%
Not Aware	7	11.5%	47	13.5%

Slightly Aware	22	36.1%	106	30.5%
Aware	12	19.7%	104	30.0%
Very Aware	18	29.5%	78	22.5%
Extremely Aware				
Medical Attention				
Not Aware	1	1.6%	4	1.2%
Slightly Aware	1	1.6%	20	5.8%
Aware	24	39.3%	91	26.2%
Very Aware	19	31.1%	108	31.1%
Extremely Aware	16	26.2%	124	35.7%
Sources of Iron				
Not Aware	0	0.0%	6	1.7%
Slightly Aware	7	11.5%	42	12.1%
Aware	13	23.0%	100	28.8%
Very Aware	16	26.2%	89	25.6%
Extremely Aware	24	39.3%	110	31.7%
Anemia can be prevented				
Not Aware	3	4.9%	20	5.8%
Slightly Aware	10	16.4%	62	17.9%
Aware	21	34.4%	98	28.2%
Very Aware	13	21.3%	95	27.4%
Extremely Aware	14	23.0%	72	20.7%
Severe anemia is life-threatening				
Not Aware	2	3.3%	15	4.3%
Slightly Aware	4	6.6%	36	10.4%
Aware	19	31.1%	89	25.6%
Very Aware	12	19.7%	79	22.8%
Extremely Aware	24	39.3%	128	36.9%
Treated by Iron				
Not Aware	2	3.3%	22	6.3%
Slightly Aware	7	11.5%	65	18.7%
Aware	17	27.9%	117	33.7%
Very Aware	13	21.3%	79	22.8%
Extremely Aware	22	36.1%	64	18.4%
Vitamin C helps in Iron absorption				
Not Aware	2	3.3%	40	11.5%
Slightly Aware	13	21.3%	76	21.9%
Aware	21	34.4%	102	29.4%
Very Aware	13	21.3%	70	20.2%
Extremely Aware	12	19.7%	59	17.0%
Regular Exercise prevent anemia				
Not Aware	2	3.3%	32	9.2%
Slightly Aware	19	31.1%	94	27.1%
Aware	19	31.1%	122	35.2%
Very Aware	11	18.0%	61	17.6%
Extremely Aware	10	16.4%	38	11.0%
Sterile Syringe				
Not Aware	2	3.3%	28	8.1%
Slightly Aware	3	4.9%	38	11.0%
Aware	19	31.1%	81	23.3%
Very Aware	10	16.4%	55	15.9%
Extremely Aware	27	44.3%	145	41.8%

It is also evident that most of the respondents were aware that red meat, vegetables, beans, and nuts, among others, are great sources of iron. 39% (n=24) anemic respondents and 32% (n=110) non-anemic respondents were extremely aware of this, while the rest had at least heard about it. 34.4% (n=21) were anemic and 28.2% (n=98) were non-anemic respondents that answered that they were aware of anemia prevention. On top of that, 36.9% (n=128) non-anemic and 39.3% (n=24) anemic respondents were extremely aware of severe anemia being a dangerous and life-threatening condition. When asked if they were aware that iron tablets could treat some types of anemia, 36.1% (n=22) of anemic and 33.7% (n=117) non-anemic respondents were extremely aware.

On the other hand, the role of vitamin C in iron absorption was not known to 11.5% of non-anemic respondents and 3.3% of anemic respondents. 21.9% (n=13) of anemic respondents and 21.3% (n=76) of non-anemic respondents were only slightly aware of the role of vitamin C in iron absorption, while the rest were either very aware or extremely aware. Only 3.3% (n=2) anemic and 9.2% (n=32) non-anemic respondents were not aware that regular exercise could prevent anemia. Lastly, the findings of this study show that 41.8% (n=145) non-anemic and 44.3% (n=27) anemic respondents were extremely aware that a sterile syringe is used during blood collection.

V. DISCUSSION

A. Socio-demographic Profile

Anemia is frequently present in female respondents which was supported by the World Health Organization [7], wherein prevalence was mostly present in 15–49-year-old women, within are college students. Female physiology also contributes to the risk of developing anemic conditions such as menstrual or gynecological issues for non-pregnant women.

Age is also present as a risk factor for females who are much older, compared to males. In terms of financial statuses, most respondents belonged to the low-income group which inhibits them from acquiring the proper medical needs and nutrition to combat or avoid iron deficiency anemia than higher income groups.

Since most students live with their immediate families or parents, they are able to share resources, participate in decision-making, obtain emotional support, and modeling of health habits which improves the mental and overall health of the respondents [8]. These findings contrast with the study that the risk of developing anemia is more prevalent in individuals who live alone [9].

No prevalence can be inferred to the marital status, ethnicity, and religion of the respondents due to all of them having the same status -- single, Filipino, and Roman Catholic, respectively.

B. Medical History/Health Status

This study revealed that O+ has was the most prevalent blood group among anemic respondents and such finding is critical in the diagnosis of iron deficiency anemia. Past studies have reported that individuals with blood group O+ have the lowest hemoglobin levels and the lowest serum iron and transferrin saturation, contributing to the risk of manifesting symptoms of anemia [10, 11].

A history of hypertension and diabetes were most common among both groups of respondents with a prevalence of 61% (n=250) and 57% (n=233), respectively. Stroke and coronary artery diseases were also prevalent among the population. However, there were only a few studies that prove the relationship between these comorbidities and anemia. In a study conducted in the United Kingdom, it was found that mortality risk was higher among diabetic patients with anemia [12]. Contrary to the findings of the present study, the same UK study concluded that diabetic patients without cardiovascular disease but were diagnosed with anemia face similar mortality risks as those cardiovascular disease survivors with diabetes without anemia [12].

Subsequently, the majority of the respondents, both anemic and non-anemic, take multivitamins on a regular basis. Studies show that multivitamins intake is effective in preventing and controlling anemia, providing essential vitamins such as Vitamins A, B12, folate, C, D and E [13]. Nevertheless, it should be noted that aside from taking multivitamins, a healthy eating is still considered the best way to address vitamin deficiencies.

In the present study, it was revealed that the majority of anemic respondents have experienced hospital confinement due to their condition, resulting in missing classes. Supporting this finding, various publications found that having anemia can increase the possibility of hospitalization and may constrain the academic responsibilities of anemic college students [14].

For respondents with anemia:

Most studies were focused on the diagnosis of anemia in preschool-age children falling between the 0-5-year-old age group. Recent data from the World Health Organization (WHO) claim that this age group has the highest prevalence of anemia. However, in the present study, it was revealed that more than half (54%) of the respondents with anemia were diagnosed during early adolescence, while the least respondents were diagnosed during late adolescence or early adulthood. This finding is explained by the age-related changes in laboratory values such as the decrease in hemoglobin levels in older age groups which affect the diagnosis of anemia [15].

Findings revealed that 82% of the anemic respondents have taken drug medication or iron supplements to treat anemia. This is helpful to minimize iron loss and even reverse IDA. In almost all cases, the proper administration of iron supplements is a significant aspect of anemia control programs, and it should be considered as one of the several strategies to combat iron deficiency anemia [16]. In contrast to this, stress is a significant issue that leads to the worsening of health problems and is commonly experienced by the respondents. It may cause decreased serum iron and it affects the vitamin metabolism in the body [17]. In addition, excessive stress hinders the production of hydrochloric acid in the body which is important for the integration of iron and proteins thus constant stress may contribute to manifestation of signs and symptoms of anemia.

Constant feeling of tiredness was common among anemic respondents.

This is brought about by the lack of iron in their system which is used as a building block for red blood cells that transport oxygen around the body. In addition, dizziness is also expected in anemic individuals due to decreased blood flow to the brain. In that event, frequent manifestation of these symptoms may hinder the learning process and diminish the ability of students to concentrate. Furthermore, skin paleness is considered as a direct cause of low red blood cell amount in an anemic person explaining its increased prevalence among the anemic respondents.

C. Lifestyle and Practices

Anemia, specifically IDA, is a global nutrition-related issue caused by lack of iron in the diet. Since home-cooked meals are taken with iron supplements to reduce incidence of IDA among populations at risk, it may contribute to the prevention of anemia [18]. For lifestyle and practices, most of the respondents eat home-cooked meals every day and fast food 1-2 times a week. Even so, the majority (99.4%) of the anemic and non-anemic respondents were consumers of fast-food meals that are deficient in nutrients and virtually entirely devoid of fruits, vegetables, and fiber [6]. Most non-anemic students exercise more frequently than anemic students. Exercise promotes blood cell formation that may increase levels of hemoglobin. Majority of respondents are also non-smokers, but 24.5% who are anemic do smoke which affects hematopoiesis and induce anemia by negatively affecting hematopoiesis [19]. Most of the anemic and non-anemic respondents or 96.7% and 97.7% respectively, consume red meat either occasionally or on a daily basis. Consumption of red meat is important in acquiring heme-iron, making it an important source of iron [20]. Moreover, this study found that vegetable consumption was commonly practiced among anemic and non-anemic respondents. Habitual consumption of vegetables rich in amino acids enhances the bioavailability of iron and lessens the burden of IDA [21]. Regarding beverage consumption among the respondents, correlations between usually drinking coffee or cocoa in acquiring IDA are significant. The majority of respondents drink coffee or cocoa after meals, whereas most only drink tea rarely after meals. It was reported that individuals who usually drink coffee were 1.7 times more likely to suffer from IDA than those who do not [22]. Moreover, tea suppresses iron absorption and when consumed in great quantities, can cause iron deficiency anemia [23]. Most respondents with anemia only eat breakfast rarely, but most who are non-anemic always eat breakfast. People who often skip breakfast are unable to meet the nutrients needed for hemoglobin production [24]. Lastly, the majority of students in both groups get 5-8 hours of sleep and only some are sleep-deprived, but it is in contrast with other studies that have reported that sleep quality is worse in patients with IDA since it is associated with long-lasting alteration in the temporal organization of sleeping patterns [25].

Results revealed that although the majority of female respondents have a regular menstruation and moderate menstrual blood volume, 42% (n=102) of non-anemic and 33% (n=17) of anemic female respondents were still identified to have irregular menstrual patterns and 23% of both anemic and non-anemic females experience high menstrual blood loss. Irregular menstrual pattern accompanied by heavy menstrual bleeding increases the risk for anemia among females at age of fertility [26]. Furthermore, 42% (n=22) of anemic respondents and 27% (n=66) of non-anemic respondents have a menstruation flow greater than 5 days wherein in the study among 10-19 years old girls in north West Ethiopia, duration of menstruation flow was observed to be a risk factor in developing anemia [27].

D. Knowledge Regarding Iron Deficiency Anemia

The knowledge of anemic and non-anemic college students on iron deficiency anemia (IDA) in terms of the diagnosis, treatment and prevention was evaluated using an 8-item questionnaire. Two questions assessed knowledge on factors and symptoms of IDA, four questions are related to anemia screening, and the last two questions pertain to anemia prevention and treatment.

Results show that most anemic (65%) and non-anemic (80%) college students know at least three of six factors leading to anemia. Factors that may contribute to IDA include lifestyle habits such as intensive exercise or smoking, physiological factors like pregnancy, and pathological factors including chronic illness or parasitic infections. Genetics may also lead to iron-refractory IDA [28], while stress has been found to lead to a decrease in serum iron and inhibition of erythropoiesis [17]. Meanwhile, the majority of anemic (86%) and non-anemic (76%) students know at least three of five common symptoms of IDA reported in other studies, including decreased appetite, irritability, pallor of the skin, fatigue and shortness of breath [18, 29].

Regarding anemia screening, the majority are knowledgeable on the laboratory test (49% anemic, 54% non-anemic), specimen of choice (SOC) (92% anemic, 92% non-anemic), blood component analyzed (56% anemic, 60% non-anemic), and medical personnel conducting the screening test (54% anemic, 57% non-anemic). Complete blood count (CBC) is the screening test for anemia and not stool culture, which only aids in identifying GI bleeding as a cause of anemia [30]. The SOC for CBC is blood because it allows examination of hematologic components and determination of serum iron level and iron stores [31], and the sole blood component viewed is the RBC, as decreased levels indicate low iron stores in the body [32]. Since medical technologists are specifically trained and licensed to perform laboratory tests, only they can perform CBC for anemia screening.

On knowledge of anemia treatment and prevention, results show that most anemic (62%) and non-anemic (61%) students know only one of two ways to prevent anemia, but 64% of anemic and 63% of non-anemic students know two ways to treat anemia. Anemia prevention includes eating vitamin C-rich fruits and taking vitamin C, as it enhances absorption of iron from food and influences the kinetics of iron metabolism and usage of iron for RBC production [33]. If anemia can be prevented, it can also be treated with intake of multivitamins and supplementation of iron and folic acid, which are often prescribed for IDA and megaloblastic anemia [34].

E. Awareness Regarding Iron Deficiency Anemia

A 10-item questionnaire was used to assess the level of awareness of anemic and non-anemic college students. It was seen that most of the respondents were "aware" to "extremely aware" regarding the causes and treatment of IDA as well as the risks and preventive measures associated with anemia.

The findings of this study show that most anemic (100%) and non-anemic (99.6%) respondents are well aware of the fact stated by WHO that anemia is a serious global public health problem. Anemia requires a thorough examination to determine its underlying etiology as there are many forms of anemia each with its own cause. This study reported that 96.5% of anemic and 96.7% of non-anemic respondents respectively knew that some types of anemia can be inherited, and severe anemia is life-threatening (95.7% anemic, 96.7% non-anemic).

In general, non-anemic respondents have a basic understanding of the risks and prevention of IDA. However, a small percentage of both groups were unaware of the following variables; 5% (n=3) anemic and 6% (n=20) non-anemic were not aware that anemia can be prevented. Consistently, 3% (n=2) anemic and 11.5% (n=40) non-anemic said that they were not aware of the role of vitamin C in iron absorption as well as the benefit of regular exercise wherein 3% (n=2) anemic and 9.2% (n=32) non-anemic had no idea about it.

The human diet requires iron-rich food such as red meat and vegetables among others as a source of bioavailable heme iron. In our study, it was fortunate to note that only 2% (n=6) of non-anemic respondents claimed that they had no idea about it while the rest were extremely aware of it. Regular consumption of red meat and vegetables was associated with better iron status than those who had inadequate portions of such [4].

In terms of their awareness on laboratory examination, compared to the 3% (n=2) anemic respondents, 8% (n=28) of non-anemic respondents were not aware of the use of sterile syringes in blood collection taking into consideration that these non-anemic respondents have not been able to go to a laboratory for anemia diagnosis. The majority of the respondents have a good level of awareness regarding anemia. However, it was also revealed that there was no difference in the level of awareness between anemic and non-anemic respondents.

VI. CONCLUSION

From the analysis of data gathered and as shown by the findings of this study in which scores of both groups in most questions regarding anemia are adjacent to each other, the following conclusions are drawn. First, there was no difference in the lifestyle choices and health-related practices of anemic and non-anemic college students in Metro Manila. Additionally, both groups of respondents have sufficient knowledge and awareness regarding Iron Deficiency Anemia especially on its risk factors, symptoms, causes, diagnosis, treatment, and prevention.

The current findings of this study shall serve as a reference for future endeavors which will focus on the prevalence of anemia among college students, the impacts of behavior and medical knowledge on its occurrence and other associated factors. The researchers recommend utilizing a different sampling approach and a larger sample size to further understand the distribution and characteristics of the target population.

Ethical Considerations

The research protocol of this study was approved by the Research Ethics Committee of the Faculty of Pharmacy, University of Santo Tomas.

Conflict of Interest

The authors of this study declare that the research was conducted without any conflict of interest.

REFERENCES

[1]. Keohane, E. M., Otto, C. N., & Walenga, J. M. (2019). *Rodak's Hematology-E-Book: Clinical Principles and Applications*. New York, USA: Elsevier Health Sciences.

[2]. Gardner, W., & Kassebaum, N. (2020). Global, Regional, and National Prevalence of Anemia and Its Causes in 204 Countries and Territories, 1990–2019. *Current Developments in Nutrition*, *4*(Supplement 2), 830-830.

[3]. Angeles-Agdeppa, I., Sun, Y., Denney, L., Tanda, K. V., Octavio, R. A. D., Carriquiry, A., & Capanzana, M. V. (2019). Food sources, energy and nutrient intakes of adults:

2013 Philippines National Nutrition Survey. *Nutrition journal*, *18*(1), 1-12.

[4]. [Al-alimi, A. A., Bashanfer, S., & Morish, M. A. (2018). Prevalence of Iron Deficiency Anemia among University Students in Hodeida Province, Yemen. *Anemia*, *2018*, 1–7.

[5]. Timilsina, S., Yadav, R. L., Bhusal, P., Khatri, N., & Islam, M. N. (2020). Status of Anemia among Undergraduate Students of a Medical College of Central Nepal. Journal of College of Medical Sciences-Nepal, 16(2), 103–106.

[6]. Mohamed, A. A., Ali, A. A. A., Ali, N. I., Abusalama, E. H., Elbashir, M. I., & Adam, I. (2011). Zinc, Parity, Infection, and Severe Anemia among Pregnant Women in Kassla, Eastern Sudan. Biological Trace Element Research, 140(3), 284–290.

[7]. Sheikh, A. B., Javed, N., Ijaz, Z., Barlas, V., Shekhar, R., & Rukov, B. (2021). Iron deficiency anemia in males: a dosing dilemma? *Journal of Community Hospital Internal Medicine Perspectives*, *11*(1), 46–52.

[8]. Gyasi, R.M., Abass, K. & Adu-Gyamfi, S. How do lifestyle choices affect the link between living alone and psychological distress in older age? Results from the AgeHeaPsyWel-HeaSeeB study. *BMC Public Health* 20, 859 (2020).

[9]. Styszynski, A., Mossakowska, M., Chudek, J., Puzianowska-Kuznicka, M., Klich-Raczka, A., Neumann-Podczaska, A., Szybalska, A., & Wieczorowska-Tobis, K. (2018). Prevalence of anemia in relation to socio-economic factors in elderly Polish population: the results of PolSenior study. *Journal of physiology and pharmacology: an official journal of the Polish Physiological Society*, *69*(1), 75–81.

[10]. [Bermejo, F., & García-López, S. (2009). A guide to diagnosis of iron deficiency and iron deficiency anemia in digestive diseases. *World journal of gastroenterology*, *15*(37), 4638–4643.

[11]. Hoque, M. M., Adnan, S. D., Karim, S., Al-Mamun, M. A., Faruki, M. A., Islam, K., & Nandy, S. (2016). Relationship between Serum Iron Profile and Blood Groups among the Voluntary Blood Donors of Bangladesh. Mymensingh medical journal: *MMJ*, *25*(2), 340–348.

[12]. Kengne, A. P., Czernichow, S., Hamer, M., Batty, G. D., & Stamatakis, E. (2012). Anaemia, haemoglobin level and cause-specific mortality in people with and without diabetes. *PLoS One*, *7*(8), e41875.

[13]. Fishman, S. M., Christian, P., & West, K. P. (2000). The role of vitamins in the prevention and control of anaemia. *Public health nutrition*, *3*(2), 125-150.

[14]. Ashok, D. V., Kumar, D. A., & Kiran Singh, D. R. S. A. (2017). Depression, anxiety, stress and cognition in females with Iron deficiency anemia. *Tropical Journal of Pathology and Microbiology*, *3*(2), 201–205.

[15]. Gonzales, G. F., Fano, D., & Vásquez-Velásquez, C. (2017). [Diagnosis of anemia in populations at high altitudes]. *Revista Peruana de Medicina Experimental y Salud Pública*, *34*(4), 699–708.

[16]. Jimenez, K., Kulnigg-Dabsch, S., & Gasche, C. (2015). Management of Iron Deficiency Anemia. *Gastroenterology & hepatology*, *11*(4), 241–250.

[17]. Wei, C., Zhou, J., Huang, X., & Li, M. (2008). Effects of psychological stress on serum iron and erythropoiesis. *International Journal of Hematology*, *88*(1), 52–56.

[18]. Miller J. L. (2013). Iron deficiency anemia: a common and curable disease. *Cold Spring Harbor perspectives in medicine*, *3*(7), a011866.

[19]. Sarfaraz, M., Archana, A. S., Kalwa, B., Mathew, M. A., Kuriakose, S. A., & H., D. (2018). Prescribing pattern and awareness about anemia among in-patients in a tertiary care teaching hospital. *International Journal of Community Medicine and Public Health*, *5*(9), 4000.

[20]. Buzala, M., Slomka, A., & Janicki, B. (2016). Heme iron in meat as the main source of iron in the human diet. *Journal of Elementology*, *21*(1).

[21]. Nair, M. K., Augustine, L. F., & Konapur, A. (2016). Food-based interventions to modify diet quality and diversity to address multiple micronutrient deficiency. *Frontiers in public health*, 3, 277.

[22]. Jamnok, J., Sanchaisuriya, K., Sanchaisuriya, P., Fucharoen, G., Fucharoen, S., & Ahmed, F. (2020). Factors associated with anaemia and iron deficiency among women of reproductive age in Northeast Thailand: a cross-sectional study. *BMC Public Health*, *20*(1), 1-8.

[23]. Fan F. S. (2016). Iron deficiency anemia due to excessive green tea drinking. *Clinical case reports*, *4*(11), 1053–1056.

[24]. Andiarna F. (2018). Analysis of Breakfast Habits on the Incidence of Anemia. *International Conference on Sustainable Health Promotion, 1*, 25-29.

[25]. Semiz, M., Uslu, A., Korkmaz, S., Demir, S., Parlak, I., Sencan, M., Aydin, B., & Uncu, T. (2015). Assessment of subjective sleep quality in iron deficiency anaemia. *African Health Sciences*, *15*(2), 621.

[26]. Kocaoz, S., Cirpan, R., & Degirmencioglu, A. Z. (2019). The prevalence and impacts heavy menstrual bleeding on anemia, fatigue and quality of life in women of reproductive age. *Pakistan Journal of Medical Sciences*, *35*(2).

[27]. Mengistu, G., Azage, M., & Gutema, H. (2019). Iron deficiency anemia among in-school adolescent girls in rural area of bahir dar city administration, North West Ethiopia.

[28]. De Falco, L., Sanchez, M., Silvestri, L., Kannengiesser, C., Muckenthaler, M. U., Iolascon, A., Gouya, L., Camaschella, C., & Beaumont, C. (2013). Iron refractory iron deficiency anemia. *Haematologica*, *98*(6), 845–853.

[29]. Al-Sayes, F., Gari, M., Qusti, S., Bagatian, N., & Abuzenadah, A. (2011). Prevalence of iron deficiency and iron deficiency anemia among females at university

stage. *Journal of Medical Laboratory and Diagnosis*, *2*(1), 5-11.

[30]. Válka, J., & Čermák, J. (2018). Differential diagnosis of anemia. Diferenciální diagnostika anémií. *Vnitrni lekarstvi*, *64*(5), 468–475.

[31]. Neufeld, L. M., Larson, L. M., Kurpad, A., Mburu, S., Martorell, R., & Brown, K. H. (2019). Hemoglobin concentration and anemia diagnosis in venous and capillary blood: biological basis and policy implications. *Annals of the New York Academy of Sciences*, *1450*(1), 172.

[32]. Short, M. W., & Domagalski, J. E. (2013). Iron Deficiency Anemia: Evaluation and Management. *American Family Physician*, *87*(2), 98–104.

[33]. Finkelstein, Fredric & Juergensen, Peter & Wang, Suxin & Santacroce, Sally & Levine, Mark & Kotanko, Peter & Levin, Nathan & Handelman, Garry. (2010). Hemoglobin and Plasma Vitamin C Levels in Patients on Peritoneal Dialysis. Peritoneal dialysis international: *Journal of the International Society for Peritoneal Dialysis*. 31. 74-9.

[34]. Moll, R., & Davis, B. (2017). Iron, vitamin B12 and folate. *Medicine*, *45*(4), 198-203.