Using the Health Belief Model to Understand Anemia Preventive Behavior among Secondary School Female Students

Raad Kareem Faraj[1*]

Assisst Prof. Dr University of Baghdad, College of Nursing, Community Health Nursing Department

*Corresponding Author : Raad Kareem Faraj
*E-mail: dr.raad@conursing.uobaghdad.edu.iq

Abstract
Background: Anemia is one of the most important and most widespread public health topics in the world. Anemia has been negative effects on the health and heart Function and Activity of women and children in developing countries
Objectives: This study aims to identify the study variables and the Health Belief Model components that can predict subjects' Self-Efficacy of adopting anemia preventive e behaviors and investigate the differences in the Health Belief Model components between the groups of father's education, mother's education, family's monthly income, and body mass index.
Methods: A descriptive predictive design was used to guide this study. The study included a simple random sample of 300 female secondary school students. The data were collected using a self-reported instrument related to the HBM.
Results: The study results revealed that the Perceived Susceptibility and age positively predicted more students' Self-Efficacy respectively. On the other hand, the Perceived Benefits, BMI, and Cues-to-Action inversely predicted more students' Self-Efficacy respectively. Consistently, there is a statistically significant difference in the Cues-to-Action among father's level of education groups. There are statistically significant differences in the Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues-to-Action, and Self-Efficacy among mother's level of education groups.
Conclusion: The greater the Perceived Susceptibility, the greater the Self-Efficacy of adopting anemia-preventive behaviors.
Recommendations: Develop targeted educational programs that increase knowledge about anemia, particularly focusing on perceived susceptibility and severity. These programs should be tailored to address different educational levels of parents.

Introduction:
Anemia is now a widespread public health problem that affects people in both developing and wealthy countries. Two billion people (40 percent or more than a third of the world's population) are estimated to suffer from anemia, with 19 million of them living in the Eastern Mediterranean region, according to the World Health Organization. Anemia is found in 10.3 percent of 15-59-year-old women in industrialized countries and 42.3 percent of women in non-industrialized countries [1].
Anemia is one of the most important and widely discussed public health concerns in the world, and it affects nearly every country. Anemia has had a significant impact on the health of women and children

in developing countries, to the point where more than 30 percent of the world's population is affected by the condition [2].

Illnesses that damage red blood cells, interfere with red blood cell formation, increase blood loss, and/or deplete nutrient uptake are some of the causes of anemia in pregnancy. These include malaria, hookworm, HIV, diarrhea, and other infections that can cause anemia in pregnancy [3].

Anemia, which is defined as a decrease in hemoglobin concentration, red-cell count, or packed-cell volume below recognized cut-off limits, is a frequently publicized public health concern that India is currently confronting, according to the World Health Organization [4]. For non-pregnant women over the age of 15 years, anemia is defined as having a hemoglobin concentration of less than 120 g/L, and for pregnant women, a hemoglobin concentration less than 110 g/L. According to the World Health Organization (WHO), anemia among women is defined as having a hemoglobin concentration less than 110 g/L [5].

Iron deficiency is the most common cause of anemia, accounting for approximately 50 percent of all cases of anemia in the population. In pregnant women, iron deficiency anemia is associated with several negative consequences, including an increased risk of maternal mortality, preterm birth, low birth weight, infants with low iron stores, cognitive decline, decreased learning, and poor academic performance in school-age children [6].

Teenagers are particularly sensitive to malnutrition in impoverished nations, with adolescent girls being more vulnerable to the condition. Several studies have revealed that teenage anemia is the most common dietary condition found in underdeveloped nations. Adolescent females in India have a greater prevalence of anemia than in other developing countries, which appears to be higher when compared to the other developing countries [7,8].

Adolescents are defined as children and young people between the ages of 10 and 19 years old. There are about 1.2 billion teenagers in the globe, according to the United Nations. In low- and middle-income nations, adolescents constitute the overwhelming majority (90 percent). During the development surge of adolescence, it is possible to collect up to 37 percent of one's total bone mass. Despite the fact that nutrition has an impact on growth and development throughout infancy, childhood, and adolescence, data suggests that nutrient requirements, particularly for iron, are highest during the time of adolescents and young adulthood [9].

According to the World Health Organization (WHO), around 2.17 billion individuals worldwide are suffering from anemia at any given time. When hemoglobin concentrations are low, this is referred to as anemia in clinical terms [10].

Approximately two billion people, or approximately a quarter of the world's population, are believed to suffer from anemia, according to the World Health Organization (WHO). Anemia affects around 29.4 percent of women who are of reproductive age. South Asian adolescent females were anemic in the majority of cases; for example, anemia was found in 70, 51.8, and 67.7 percent of adolescent girls in Bangladesh, India, and Nepal, respectively [11,12].

Anemia is prevalent among teenagers in underdeveloped nations at a rate of 27 percent, compared to 6 percent in developed countries. In Turkey, the prevalence ranges from 1.5 percent to 12.5 percent, depending on the province [13].

Health promotion is the practice of empowering people to take greater responsibility over their health and to improve their overall well-being. A wide range of social and environmental interventions are considered in addition to an increased emphasis on individual behavior. Developed on the hypothesis that preventive health behavior includes personal beliefs that are used to understand health behavior as well as possible reasons for non-compliance with recommended health actions, the Health Belief Model (HBM) can provide guidelines for program development by allowing planners to understand and address the reasons for non-compliance with recommended health actions [14-15].

From the 1950s to the present, the Health Belief Model (HBM) has been the most extensively utilized framework for health-related studies, and it has mostly focused on disease prevention and prevention-related behaviors. The following are the physical dimensions of HBM: The perception that a person may be suffering from a sickness or illness as a result of a particular action is referred to as perceived susceptibility. When it comes to perceived severity, people assume that the degree of their losses is the result of contracting an illness or suffering from a traumatic situation as a result of a certain activity. Perceived barriers, such as ideas about the expense of pursuing a new activity, are important considerations. [16,17]

HBM is effective in the prevention of anemia in adolescents because it can increase their perceived susceptibility and severity regarding anemia preventive behaviors. As a result, the girls perceive that they are susceptible to anemia and learn about the severity and complications that can result from not adopting preventive behaviors, HBM is effective in the prevention of anemia in adolescents. [18,19]

Materials and Methods:
Ethics
The researcher handed informed consent to the study subjects and explained them the study objectives. The researcher informed the subjects that the data taken from this study would for the scientific research purposes only and they would be securely maintained and safeguarded throughout the research processes and after publication. A descriptive study was conducted at the period from October 1st, 2021 to February 19st, 2022.

Setting: The study carried out at 6 secondary schools in Baghdad city from the 2 district Al-Karkh and Al-Rusafa.

Sampling: The study included a simple random sample of 300 female students who were selected from six secondary schools, 50 students from each school. Based

on a margin of error of 5%, a confidence level of 90%, a population size of 28.000, and a response distribution of 50%, the recommended sample size would be 271. The final sample size is 300.

Instruments: the study tool is a questionnaire composed from 2 parts. first part related to the socio demographic characteristics of the students (age, father level of education, mother level of education, & monthly income). The second part is the health belief model scale. It is included of 36 questions related to structures of HBM that was determined by five Likert scale from strongly agree to strongly disagree and included 6 questions about perceived susceptibility (with a minimum score of 6 and a maximum score of 30), 6 questions about perceived severity (with a minimum score of 6 and a maximum score of 30), 6 questions about perceived benefits (with a minimum score of 6 and a maximum score of 30), 6 questions about perceived barriers (with a minimum score of 6 and a maximum score of 30), 6 questions about cues to action with low to high range (with a minimum score of 6 and a maximum score of 30) and 6 questions about self-efficacy in the field of prevention from iron deficiency anemia (with a minimum score of 6 and a maximum score of 30), respectively.

Rating and scoring: The instrument rating by determined by five Likert scale from 5 points for strongly agree, 4 points for agree, 3 points for neutral, 2 points for disagree, and 1 point for strongly disagree.

Validity: The validity of the instrument done by content validity, content validity of the instrument was determined by panel of experts who have had more than 5 years of experience in their field in relation to explore the lucidity, relevancy, and adequacy of the questionnaire in order to accomplish the goals of the present study.

Reliability: The HBM scale demonstrated good to very good internal consistency reliability. The Cronbach's alpha coefficient of the Perceived Susceptibility is 0.79, the Perceived Severity is 0.75, the Perceived Benefits is 0.78, the Perceived Barriers is 0.86, the Cues-to-Action is 0.79, and the Self-Efficacy is 0.80.

Data analyses: Data were analyzed using the SPSS, version 26. The descriptive statistical measures of frequency and percent were used. The inferential statistical measures of stepwise regression and one-way analysis of variance were also used.

Results:

Table 1. Participants' sociodemographic characteristics (N = 300)

Variables		Frequency	Percent
Age	11-13	64	21.3
	14-16	98	32.7
	17-19	138	46
	Total	300	100
Fathers' education	Read and write	45	15.0
	Primary school	60	20.0
	Secondary school	68	22.7
	Institute	65	21.7
	College	62	20.6
	Total	300	100.0
Mothers' education	Can read and write	31	10.3
	Primary	45	15.0
	Secondary	121	40.3
	Institute	53	17.7
	College	50	16.7
	Total	300	100.0
Monthly income	Not enough	74	24.6
	Barely enough	176	58.7
	Enough	50	16.7
	Total	300	100.0
BMI	Underweight	32	10.6
	Normal weight	182	60.7
	Overweight	44	14.7
	Obese	42	14.0
	Total	300	100.0

The study results display that less than a half age 17-19-years (*n = 138*; 46%), more than a fifth of fathers have secondary school education (*n = 68*; 22.7%), around two-fifth of mothers have secondary school education (*n = 121*; 40.3%), more than a half of families have barely enough (*n = 176*; 58.7%), and most have normal weight body mass index (*n = 182*; 60.7%).

Table 2. Stepwise regression for the study variables

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.767	.937		.818	.414	-1.078	2.611
	Age	.141	.029	.169	4.804	.000	.083	.199
	BMI	-.588	.092	-.278	-6.429	.000	-.768	-.408
	Perceived Susceptibility	.407	.081	.463	5.017	.000	.247	.567
	Perceived Severity	.035	.071	.028	.497	.620	-.104	.174
	Benefits	-.093	.057	-.151	-1.638	.102	-.205	.019
	Barriers	.065	.056	.056	1.148	.252	-.046	.176
	Cues-to-Action	.465	.042	.426	10.981	.000	.382	.548
2	(Constant)	.801	.933		.859	.391	-1.036	2.638
	Age	.145	.028	.173	5.099	.000	.089	.200
	BMI	-.581	.090	-.274	-6.446	.000	-.758	-.403
	Perceived Susceptibility	.416	.079	.473	5.278	.000	.261	.572
	Benefits	-.085	.054	-.138	-1.563	.119	-.192	.022
	Barriers	.063	.056	.054	1.126	.261	-.047	.174
	Cues-to-Action	.472	.040	.432	11.777	.000	.393	.551
3	(Constant)	1.251	.844		1.482	.139	-.410	2.912
	Age	.152	.028	.183	5.530	.000	.098	.206
	BMI	-.591	.090	-.280	-6.599	.000	-.768	-.415
	Perceived Susceptibility	.464	.067	.527	6.958	.000	.333	.595
	Benefits	-.126	.040	-.205	-3.143	.002	-.205	-.047
	Cues-to-Action	.489	.037	.448	13.220	.000	.416	.562

a. Dependent Variable: Self-Efficacy

The study results reveal that the Perceived Susceptibility and age positively predicted more students' Self-Efficacy (p-value = .000, .000) respectively. On the other hand, the Perceived Benefits, BMI, and Cues-to-Action inversely predicted more students' Self-Efficacy (p-value = .002, .000, .002) respectively.

Table 3. Difference in Health Belief Model components among father's level of education

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Perceived Susceptibility	Between Groups	6.916	4	1.729	.416	.797
	Within Groups	1226.564	295	4.158		
	Total	1233.480	299			
Perceived Severity	Between Groups	3.255	4	.814	.394	.813
	Within Groups	609.332	295	2.066		
	Total	612.587	299			
Benefits	Between Groups	12.782	4	3.195	.378	.825
	Within Groups	2496.498	295	8.463		
	Total	2509.280	299			
Barriers	Between Groups	18.269	4	4.567	1.968	.099
	Within Groups	684.478	295	2.320		
	Total	702.747	299			
Cues-to-Action	Between Groups	54.385	4	13.596	5.374	.000
	Within Groups	746.335	295	2.530		
	Total	800.720	299			
Self-Efficacy	Between Groups	8.916	4	2.229	.695	.596
	Within Groups	945.521	295	3.205		
	Total	954.437	299			

The study results display that there is a statistically significant difference in the Cues-to-Action among father's level of education groups (p-value = .000).

Table 4. Difference in Health Belief Model components among mother's level of education

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Perceived Susceptibility	Between Groups	186.489	4	46.622	13.136	.000
	Within Groups	1046.991	295	3.549		
	Total	1233.480	299			
Perceived Severity	Between Groups	103.971	4	25.993	15.076	.000
	Within Groups	508.616	295	1.724		
	Total	612.587	299			
Benefits	Between Groups	538.561	4	134.640	20.155	.000
	Within Groups	1970.719	295	6.680		
	Total	2509.280	299			
Barriers	Between Groups	47.300	4	11.825	5.322	.000
	Within Groups	655.446	295	2.222		
	Total	702.747	299			
Cues-to-Action	Between Groups	63.023	4	15.756	6.301	.000
	Within Groups	737.697	295	2.501		
	Total	800.720	299			
Self-Efficacy	Between Groups	91.395	4	22.849	7.810	.000
	Within Groups	863.042	295	2.926		
	Total	954.437	299			

The study results reveal that there are statistically significant differences in the Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues-to-Action, and Self-Efficacy among mother's level of education groups (p-value = .000, .000,. 000,. 000, .000) respectively.

Table 5. Difference in the Health Belief Model components among monthly income groups

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Perceived Susceptibility	Between Groups	915.352	2	457.676	427.281	.000
	Within Groups	318.128	297	1.071		
	Total	1233.480	299			
Perceived Severity	Between Groups	415.745	2	207.872	313.643	.000
	Within Groups	196.842	297	.663		
	Total	612.587	299			
Benefits	Between Groups	2419.675	2	1209.837	4010.063	.000
	Within Groups	89.605	297	.302		
	Total	2509.280	299			
Barriers	Between Groups	147.739	2	73.869	39.530	.000
	Within Groups	555.008	297	1.869		
	Total	702.747	299			
Cues-to-Action	Between Groups	329.667	2	164.834	103.928	.000
	Within Groups	471.053	297	1.586		
	Total	800.720	299			
Self-Efficacy	Between Groups	178.739	2	89.370	34.218	.000
	Within Groups	775.697	297	2.612		
	Total	954.437	299			

The study results reveal that there are statistically significant differences in the Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues-to-Action, and Self-Efficacy among monthly income groups (p-value = .000, .000,. 000,. 000, .000) respectively.

Table 6. Difference in the Health Belief Model components among body mass index groups

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Perceived Susceptibility	Between Groups	828.595	3	276.198	201.921	.000
	Within Groups	404.885	296	1.368		
	Total	1233.480	299			
Perceived Severity	Between Groups	371.600	3	123.867	152.143	.000
	Within Groups	240.987	296	.814		

	Total	612.587	299			
Benefits	Between Groups	1062.320	3	354.107	72.439	.000
	Within Groups	1446.960	296	4.888		
	Total	2509.280	299			
Barriers	Between Groups	148.766	3	49.589	26.496	.000
	Within Groups	553.980	296	1.872		
	Total	702.747	299			
Cues-to-Action	Between Groups	221.800	3	73.933	37.802	.000
	Within Groups	578.920	296	1.956		
	Total	800.720	299			
Self-Efficacy	Between Groups	521.584	3	173.861	118.892	.000
	Within Groups	432.853	296	1.462		
	Total	954.437	299			

The study results reveal that there are statistically significant differences in the Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues-to-Action,
and Self-Efficacy among BMI groups (p-value = .000, .000,. 000,. 000, .000) respectively.
Further post hoc analysis demonstrated that subjects who are underweight have greater Perceived Susceptibility of developing anemia, perceive anemia as more severe, and face greater barriers to adopt anemia-preventive behaviors.
Subjects who are within normal weight-to-height proportion have greater Perceived Benefits of adopting anemia-preventive behaviors, Cues-to-Action, and Self-Efficacy.

Discussion:
The Perceived Susceptibility and age positively predicted more students' Self-Efficacy. respectively. This finding implies that girls wo perceive themselves as more susceptible to develop anemia deemed to be more confident to adopt anemia-preventive behaviors. In the same line, the older the girls, the greater the Self-Efficacy of adopting anemia-preventive behavior.
On the other hand, the Perceived Benefits, BMI, and Cues-to-Action inversely predicted more students' Self-Efficacy. This finding implies that subjects who perceive that the anemia-preventive behaviors are valuable would have greater confidence in themselves to adopt such behaviors. According to the HBM assumptions, individuals who have vested beliefs in the benefits of a given behavior would be more likely to engage in that behavior [20].
Also, students who are within normal weight-to-height proportion perceive that the anemia-preventive behaviors are valuable would have greater confidence in themselves to adopt such behaviors. This finding could be explained as that students who are within normal weight-to-height proportion may believe that being so can impose greater likelihood of developing anemia. According to the local culture in Iraq, large number of people believe that being either overweight or obese implies sounder nutritional status which protect them from developing some health conditions including anemia.
Further post hoc analysis revealed that subjects whose fathers hold a bachelor's degree' have better Cues-t-Action than those of lower levels of education.

Individuals with higher levels of education have greater likelihood of learning about healthy behaviors [21].

The study results reveal that there are statistically significant differences in the Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues-to-Action,
and Self-Efficacy among mother's level of education groups. Further post hoc analysis demonstrated that subjects whose mothers are primary school graduates have greater Perceived Susceptibility of developing anemia, greater Perceived Severity of anemia, and greater Perceived Barriers to adopt anemia preventive behaviors. Education about health (i.e., health education) happens within schools and in many public health interventions; it is a central tool of public health [22].
On the other hand, subjects whose mother hold a bachelor's degree have greater Perceived Benefits of anemia preventive behaviors than those whose mothers of lower level of education, greater Cues-to-Action to adopt anemia preventive behaviors, and greater Self-Efficacy to adopt anemia preventive behaviors. Ross and Wu [23] argued that education is both a critical component of a person's health and a contributing cause of other elements of the person's concurrent and future health. Consistent with other definitions of health, a person who lacks basic elements of an education is not fully healthy.
There were statistically significant differences in the Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues-to-Action, and Self-Efficacy among monthly income groups. Further post hoc analysis exhibited that subjects whose families have not enough monthly income have greater Perceived Susceptibility of developing anemia, greater Perceived Severity of anemia, and lower Perceived Benefits of adopting anemia-preventive behaviors. The evidence confirms that socioeconomic status (SES) influences peoples' health outcomes and the health care they receive [24]. People of lower SES are more likely to have worse self-reported health [25], lower life expectancy [26], and suffer from more chronic conditions [27] when compared with those of higher SES.

On the other hand, subjects whose families have enough monthly income face lesser Perceived Barriers to adopt anemia-preventive behaviors, greater Cues-to-Action to

adopt anemia-preventive behaviors, and Self-Efficacy to adopt anemia-preventive behaviors. This finding can be explained as that families whose socioeconomic status is poor cannot secure the healthy foods that help them in preventing anaemia.

Conclusions:
The researcher concludes the following:
1. The higher the level of father's education, the greater the Cues-to-Action the students enjoy.
2. The higher the level of mother's education, the lesser the Perceived Susceptibility of developing anemia.
3. The higher the level of mother's education, the greater the Perceived Benefits of adopting anemia-preventive behaviors, the greater Cues-to-Action of adopting anemia-preventive behaviors, and greater Self-Efficacy adopting anemia-preventive behaviors.
4. The greater the Perceived Susceptibility, the greater the Self-Efficacy of adopting anemia-preventive behaviors.
5. The lesser the Perceived Susceptibility of developing anemia and Perceived Severity of anemia, the greater the Perceived Benefits of adopting anemia-preventive behaviors.
6. The poorer the family's monthly income, the greater the Perceived Susceptibility of developing anemia and greater Perceived Severity of anemia.
7. The better the family's monthly income, the greater the Perceived Barriers to adopt anemia-preventive behaviors, greater Cues-to-Action, and greater Self-Efficacy of adopting anemia-preventive behaviors.
8. Subjects who are overweight perceive themselves as more susceptible to develop anemia, perceived anemia as more severe, and encounter greater Perceived Barriers to adopt anemia-preventive behaviors.

Subjects who are within normal weight-to-height proportion have greater Perceived Benefits of adopting anemia-preventive behaviors, have greater Cues-to-Action, and greater Self-Efficacy of adopting anemia-preventive behaviors.

Recommendations
1. Develop targeted educational programs in schools to raise awareness about anemia, its causes, and preventive measures, focusing particularly on the vulnerabilities of adolescent girls.
2. Implement strategies to enhance perceived susceptibility and severity of anemia among adolescents by sharing personal stories, testimonials, and statistical data.
3. Engage parents in educational sessions to improve their understanding of anemia and its impact on their children's health, emphasizing nutrition and dietary choices.

Limitations
The study involves a number of limitations including the potential effects of some variables and/or concepts that can interfere with anemia-preventive behaviors including the family dietary pattern, the family climate, and school cafeteria that this study did not consider.

Conflicts of Interest
Dear editor-in-chief
Date 4/ 11/ 2024
- The authors declare that have no conflict of interest in relation to the research presented in this manuscript entitled "[Using the Health Belief Model to Understand Anemia Preventive Behavior among Secondary School Female Students]".
- the authors declare that they have no financial interests or personal relationships that could potentially bias my research or influence my interpretation of the results.
- all authors have been listed in the manuscript and have approved the submission for publication.
- All authors declare that the research presented in this manuscript is original and has not been published previously or submitted for publication elsewhere.
- All authors agree to disclose any potential conflicts of interest that may arise during the review process.

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