The Impact of Body Weight on Blood Hemoglobin Level When Using Some Modern Family Planning Methods in Egypt

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The Impact of Body Weight on Blood Hemoglobin Level When Using Some Modern Family Planning Methods in Egypt

Dr. Rasha Aly Mohamed Aly

Abstract

Any abnormality in blood hemoglobin levels may result in serious complications leading to death. This study focuses on one of the important causes of these abnormalities, which is the impact of body weight on blood hemoglobin levels when women use some types of modern family planning methods. The statistical analysis in this study was conducted on 3450 currently married Egyptian women who are of reproductive age (15–49). These subjects were extracted from the 2014 EDHS sample. The methods of analysis used were the cluster analysis and the Kruskal-Wallis test as well as subsequent multiple pairwise comparisons. The cluster analysis classified the women into six groups, and the Kruskal-Wallis test showed significant differences in the blood hemoglobin levels among these six groups. The multiple pairwise comparisons revealed that using a hormonal method as opposed to a non-hormonal method shows significant differences in cases of overweight or obesity but not in cases of normal weight. On the other hand, when comparing women of the same weight who use two different hormonal methods or women of different weights who use the same method, the results do not reveal any significant differences. This study adds to the literature strong evidence that women's body weight impacts blood hemoglobin levels when using some types of modern family planning methods. As a result, doctors specializing in nutrition and obesity must be available in all governorates' family planning centers and units to provide advice, assistance, and guidance in selecting the appropriate family planning method for different weight statuses.

Keywords: Blood hemoglobin level - Body Mass Index - modern family planning methods - combined effect - Egypt.

Introduction

The cells of the human body constantly need oxygen and get rid of carbon dioxide. The protein in the red blood cells, known as hemoglobin, is responsible for carrying and transporting these molecules to and from the cells (Sinai, 2022). Any disorder in the level of hemoglobin in the blood, whether by increasing or decreasing, can cause very serious complications leading to death (Moawad, 2022).

An abnormal blood hemoglobin level is one of the causes of the most severe health crises, such as strokes (Al-Harbi et al., 2020; Chang et al., 2020; Guo et al., 2019; Naess et al., 2019; Yoshimura et al., 2020), severe cognitive impairment after a stroke (He et al., 2020), cardiovascular disorders and diseases and heart attacks (Houghton et al., 2020; Park et al., 2020; Rocha et al., 2018; Sabah et al., 2020; Zhang et al., 2019), Alzheimer's and dementia risks and

cognitive impairment (Kim et al., 2019; Kung et al., 2021; Shah et al., 2011; Wolters et al., 2019), blood clots (Faes et al., 2019; Gupta et al., 2019), blood diseases, such as sarcopenia leukemia (Hamamyh, and Yassin, 2020; Yoshimura et al., 2020), splenomegaly (Li et al., 2019; Majer et al., 2021; Wei et al., 2021), deterioration of kidney functions (Tsujita et al., 2019), thyroid disorders (Ahmed et al., 2021; Ghiya, and Ahmad, 2019; Islam et al., 2021), blood pressure disorders (ZHAO et al., 2023), dysphagia (Yoshimura et al., 2020), restless legs syndrome (Lyu et al., 2019; Olgun Yazar et al., 2019; Panvatvanich, and Lolekha, 2019), immunity disorders (Yang et al., 2019), risk of viral and bacterial infections, such as COVID-19 (Chowdhury, and Anwar, 2020), ulcers (Soodmand et al., 2019; Yammine et al., 2021), gout (Eun et al., 2019; Kichloo et al., 2022), muscle weakness, weakness in physical activity and job performance, exhaustion and fatigue (Benson et al., 2021; Dugan et al., 2021), and headache and dyspenea (Dugan et al., 2021; Moawad, 2022).

Reviewing the causes of abnormalities in blood hemoglobin levels, it was found that studies indicated many causes, such as malnutrition and lack of some minerals and vitamins, such as iron, vitamin B12, vitamin C, and folic acid (Bhadra, and Deb, 2020; Chaparro, and Suchdev, 2019; van Zutphen et al., 2021), chronic and infectious diseases, such as diabetes, tuberculosis, malaria, AIDS, parasitic infections and helicobacter pylori infection (Chaparro, and Suchdev, 2019; Galal et al., 2019; Organization, 2022), solid malignant tumors (Kifle et al., 2019), liver and kidney cancers (Moawad, 2022), genetic causes, such as thalassemia and sickle cell anemia (Angastiniotis, and Lobitz, 2019; Chaparro, and Suchdev, 2019), hypoxia (Tozoni et al., 2019), and smoking (Elisia et al., 2020; Pedersen et al., 2019; Vivek et al., 2022).

In spite of the preceding multiple causes, which studies have indicated as common causes of the abnormalities in blood hemoglobin levels, other studies have pointed out that there are other reasons that many do not pay attention to. These causes, such as the use of family planning methods and the type of methods used, are behind the occurrence of this abnormality in women of reproductive age. 66.4% of currently married Egyptian women of reproductive age use family planning methods while 64.7% use modern family planning methods (CAPMAS, 2022).

Studies have also indicated that women's weight plays an important role in the abnormality in blood hemoglobin levels. Overweight and obesity, which account for 84.6% of Egyptian women of reproductive age (Ministry of Health and Population et al., 2015), have been linked to the abnormality in blood hemoglobin levels. Thinness has also been linked to this abnormality (Chakraborty, and Mandal, 2019; Chaparro, and Suchdev, 2019; Lootah, 2021; Srivastava et al., 2022).

In view of the wide range of women using modern family planning methods and the increasing percentage of overweight and obese women in Egypt, this study focused on the combined effect of weight and the modern family planning methods used on the blood hemoglobin levels among women of reproductive age, aiming to provide a new and different vision from that presented by the previous studies conducted in the field, for those interested in family planning methods, the blood hemoglobin levels, and the causes of the abnormality in them.

The General Objective

This study aims to provide a new vision into the blood hemoglobin levels of Egyptian women of reproductive age at different weight statuses while using one of the most common modern family planning methods, by studying the combined effect of the type of family planning method and weight status.

Study Questions

(1) Does the concentration of the blood hemoglobin significantly differ among the classification categories under study?

(2) In case there are significant differences, does weight status influence the type of the modern family planning method used and vice versa?

Data Source

A total of 3450 women participated in this study. They were drawn from the 2014 Egypt Demographic and Health Survey (EDHS) sample of reproductive age (15-49) previously married women. That sample included 21762 women selected from all governorates of the Arab Republic of Egypt except women residing in the north and south of Sinai governorate.

Literature Review

The results of most recent studies regarding the relationship between hemoglobin concentration in the blood and family planning methods show that blood hemoglobin levels in women of reproductive age are better among those who use family planning methods as compared to non-users (Talukder et al., 2022), especially if these women use modern family planning (Liyew, and Teshale, 2020; Teshale et al., 2020) or hormonal methods (Talukder et al., 2022). The blood hemoglobin levels are also better among users of hormonal methods as compared to users of non-hormonal methods (Gebremedhin, and Asefa, 2019; Hakizimana et al., 2019; Rai et al., 2020; Stevens et al., 2022; Teshome et al., 2022).

As for the results of studies regarding the relationship between hemoglobin concentration in the blood and the body mass index, most of them indicate that thin women of reproductive age are more likely than obese or overweight women to suffer from blood hemoglobin levels that are below the normal limit(Gautam

et al., 2019; Hakizimana et al., 2019; Owais et al., 2021; Talukder et al., 2022; Teshome et al., 2022; Yamamoto et al., 2020). However, there are some countries that have places where this does not apply, such as Tokyo, Japan, where most girls strive to be thin while avoiding anemia (Yamamoto et al., 2020).

In other studies, the highest percentage of low hemoglobin concentration in the blood was among thin women, followed by women of normal weight and then overweight without significant differences between weight and low blood hemoglobin levels (ELMoslemany et al., 2019; Nainggolan et al., 2022). On the other hand, central obesity and anemia were found to be significantly correlated (Tesfaye et al., 2020).

Conceptual Framework

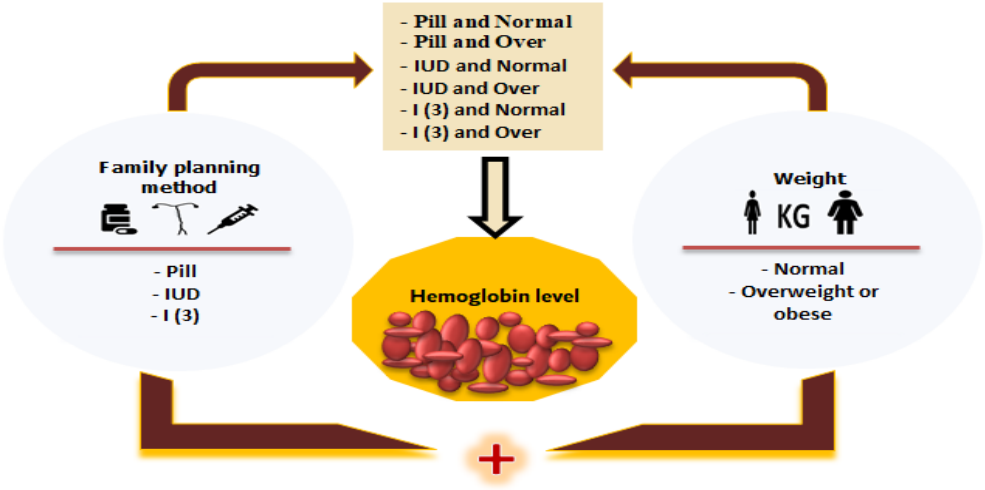

Figure 1. Study Variables in the Form of a Conceptual Framework
Source: Prepared by the author

Methodology

Sample Composition

- Women who were married are the only targeted category from the EDHS women sample (20,430 women) in this study. Since there was a need to use the BMI variable, pregnant women and those who conceived babies less than two months earlier were excluded. All missing cases were also ruled out, bringing the total to 16581 women.
- The study also requires the use of two variables: the blood hemoglobin level and the current use of modern family planning methods. Thus, only those who had data in the blood hemoglobin level variable (5,514 women) were retained. Women who do not use methods (1689 women) and those who use folkloric and traditional methods (102 women) were excluded, narrowing the total down to reach 3723 women.

- The statistical analysis requires women to be classified according to the variables of body mass index and the current use of modern family planning methods using the cluster analysis. Thus, a paired table was created for the three categories of body mass index (thin, normal, and overweight or obese) and the various types of modern methods (pill, IUD, foam, condom, F.S., implants, I.3, and I.1). According to the results of that table, the family planning methods showing fewer than five cases were deleted from the weight categories of "normal" and "overweight or obese". These methods are foam, condoms, and implants. In addition, cases were deleted belonging to the category "thinness" because all family planning methods in that category display fewer than five cases. Therefore, the sample size became 3,535 women.
- When the cluster analysis was applied to the sample, seven categories were produced. Each of the methods had two categories: women of normal weight and those who were overweight or obese, except for injections every month (I.1) which had one category containing both normal weight and overweight or obese women (85 women). This is due to the small number of women with normal weight who used this type of method, which did not exceed 17 women, so they were merged with the overweight or obese. However, this compact category will not be feasible for the study purpose of examining the significant differences between the normal-weight and overweight or obese women using that method. Accordingly, this method was excluded, limiting the number in the final sample to 3450 women.

Description of Variables

Dependent Variable: Blood Hemoglobin Level. This is a modified variable where the unit of measurement is (g/dL) if the data on smoking status and altitude are available (Ministry of Health and Population et al., 2015).

Independent Variables. ***Current Use of Family Planning Methods.*** Modern family planning methods are defined by the 2014 EDHS as "birth control pills, implants, condoms, female/male sterilization, injections, intrauterine contraceptives (IUDs), lactation due to menopause".

Body Mass Index (BMI). This index is calculated through a division formula whose numerator is weight and denominator is the square of height. Weight is measured in kilograms and height in meters. Three categories were formed out of the scores of this variable, which are thinness, normal weight, and overweight or obese with the degrees of (≤18.4), (18.5-24.9), and (≥25) respectively.

Methods of Analysis Used

Statistical data description methods were used to describe the women under study. Achieving the objectives of the study requires classifying women according to both the type of modern family planning method used and their weight status. This classification was performed using cluster analysis. Using

Kolmogorov-Smirnov (statistic =.056, p =.000) and Shapiro-Wilk tests (statistic =.983, p =.000), the data were examined for normality. The tests showed that the blood hemoglobin level variable was abnormally distributed. As for the significant differences in blood hemoglobin level scores among the classification variable categories, they were studied through the independent-samples Kruskal-Wallis Test. Pairwise comparisons identified groups with differences that affected the Kruskal-Wallis test significance value. SPSS-V25 was used to analyze the study data.

Analysis and Results

Description of the Study Sample

According to the percentages in Figure 2, the IUD is the most widely used method of family planning, whether among women of normal weight or those who are overweight or obese (approximately 50%), followed by tablets and then injections every three months. However, when comparing the usage ratios for each method separately, it was found that overweight or obese women use the IUD more frequently than those of normal weight with a difference of more than ten points. On the other hand, the use of tablets and injections every three months among the overweight or obese women was found to be lower than among those of normal weight with a difference of ten and two points, respectively.

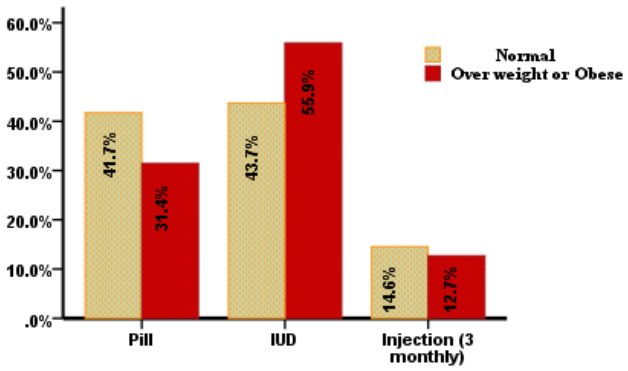

Figure 2. Modern Family Planning Methods Used According to Weight Status

Results of Cluster Analysis

By using the weight status and the current modern family planning method variables, cluster analysis was performed, yielding six groups with a cluster quality of 1, which is equivalent to a classification level of "good". One type of family planning method and one case of weight were included in each of the six categories. Table 1 presents the percentages of the extent to which the type categories of modern family planning method used and those of weight status variables contribute to all categories of the classification variable. The

percentages of women in the six classification categories indicate that normal-weight women who use injections every three months as a method of family planning have the lowest percentage (2.1%) of all the women in the classification variable categories. The highest percentage compared to the other percentages in the categories was found among women who are classified as overweight or obese and use IUDs (47.8%) and those who are of the same weight but use pills for family planning (26.9%).

Table 1. Relative Distribution of Weight Cases and Types of Modern Methods According to the Categories Resulting from the Classification and the Relative Distribution of the Women Sample.

Classification categories	Modern family planning method			Weight		Numbers of Cluster	
	Pill %	IUD %	I(3) %	Normal %	Overweight or obese %	Frequency	%
Pill and Normal	18.4			41. 7		209	6. 1
Pill and Overweight or obese	81.6				31. 4	927	26.9
IUD and Normal		11.7		43. 7		219	6.3
IUD and Overweight or obese		88.3			55. 9	1648	47. 8
I(3) and Normal			16.3	14. 6		73	2. 1
I(3) and Overweight or obese			83.7		12. 7	374	10. 8
Total	100	100	100	100	100	3450	100

Kruskal-Wallis Test Results

The Kruskal-Wallis test was conducted on the variable consisting of six categories, which resulted from the cluster analysis, in order to test whether or not there is a difference in the blood hemoglobin concentration degrees among these categories. It was found that there is a strong significant difference among those categories (Kruskal-Wallis = 29.814; df = 5; p =.000).

Results of Multiple Pairwise Comparisons

Different Weight Statuses and Similar Family Planning Methods. The results presented in Table 2 show that blood hemoglobin levels did not differ significantly across women of different weight statuses but used the same family planning method. This occurred in comparisons of all types of methods.

Different Family Planning Methods and Similar Weight Statuses. Looking at the comparisons in this case, it was found that significant differences appeared when comparing the use of pills with the IUD among overweight or obese women (z = 3.684, p =.003), while they did not appear among normal-weight women (z = 2.698, p =.105).

The same thing happened when comparing IUD use with injections (every three months) as significant differences appeared among overweight or obese women (z = -3.777, p =.002) but not among normal-weight women (z = -1.374, p = 1.000).

There were no significant differences among overweight or obese women (z = -1.062, p = 1.000) or among normal-weight women (z =.553, p = 1.000) when comparing using pills versus injections (every three months).

Table 2. Results of Pairwise Comparisons

Classes for classification	Pill with Normal				
Pill with Over	Z =.357 P = 1.000	Pill with Over			
IUD with Normal	Z = 2. 698 P =.105	Z = 3. 108 P =. 028*	IUD with Normal		
IUD with Over	Z = 2. 433 P = . 225	Z = 3. 684 P = .003*	Z = -1. 143 P = 1.000	IUD with Over	
I(3) with Normal	Z = . 553 P = 1.000	Z =. 394 P = 1.000	Z = -1. 374 P = 1.000	Z = -. 865 P = 1.000	I(3) with Normal
I(3) with Over	Z = -. 437 P = 1.000	Z = - 1. 062 P = 1.000	Z = -3. 509 P = .007*	Z = -3. 777 P = .002*	Z = -. 883 P = 1.000

Different weight with same family planning method

Different family planning method with same weight

* = significance at %5

Different Family Planning Methods and Different Weight Statuses. In these cases, comparisons show that significant differences emerged when overweight or obese women using pills were compared to normal-weight women using IUDs (z = 3.108, p =.028). Furthermore, significant differences appeared when comparing women who use injections and are overweight or obese to women who use IUDs and are normal weight (z = -3. 509, p =. 007).

Discussion

The method used to classify women which combined in one variable the type of modern method used and the women's weight statuses showed through statistical tests on all three types under study that significant differences in blood hemoglobin levels did not appear in the case of using the same type of method with a difference in weight. This means that among users of the same type of methods, weight status has no effect on blood hemoglobin levels.

Furthermore, significant differences in blood hemoglobin levels did not appear among women with the same weight status who used pills versus injections. This means that in the case of comparing women with the same weight status but using two different types of methods, there will be no significant difference if the two types compared are hormonal contraceptives.

When comparing a hormonal method, such as pills or injections, to a non-hormonal method, such as an IUD, it was found that using the IUD, versus pills or injections, does not show significant differences in normal-weight women.

On the other hand, the same comparisons show significant differences in overweight and obese women.

This means that body weight has an effect on the hemoglobin concentration in the blood in the case of the type of modern contraceptive method used whether hormonal or non-hormonal.

According to the available data, since no previous studies have examined the effect of body weight on blood hemoglobin concentration when using some modern family planning methods, it was not possible to access findings to be compared to the results of this study. However, concerning the separate effects of the variables under study on the blood hemoglobin level, it is evident that the results of this study are consistent with the previous studies conducted on the difference in the blood hemoglobin level when using hormonal and non-hormonal methods (Gebremedhin, and Asefa, 2019; Hakizimana et al., 2019; Rai et al., 2020; Stevens et al., 2022; Teshome et al., 2022). What is new in this study is that it indicates that this difference only occurs when using some methods among overweight or obese women and not among normal-weight women.

The strength of this study lies in the inclusion and consideration of body weight status (body mass index) in the study of the relationship between the use of modern family planning methods and the blood hemoglobin level. Moreover, the results obtained can provide evidence that body weight plays a role in the blood hemoglobin level when using some types of modern family planning methods.

Conclusion and Recommendations

Conclusion

Increased or decreased hemoglobin levels in the blood may result in complications that lead to diseases, most of which are described as very serious. Studying the combined effect of body weight and the type of modern family planning method used on the blood hemoglobin level, it was found that body weight plays a role in the hemoglobin concentration level in the blood in the case of the family planning method used whether hormonal or non-hormonal.

Recommendations

The following suggestions, when considered, may contribute to maintaining normal levels of blood hemoglobin for Egyptian women of reproductive age:

- The Ministry of Health and Population should provide doctors specialized in nutrition and treatment of obesity cases at nominal prices within the centers and units delivering family planning services in all governorates. This needs to be actioned with the aim of providing advice and assistance to women, who weigh more than normal, in reducing weight and choosing the appropriate family planning method for their weight statuses.

- The Ministry of Information and the Ministry of Health and Population should collaborate in preparing for an intensive advertising campaign through all means of communication and media that would raise awareness of the following:
  - The problem with being overweight or obese is not only in appearance. Rather, it marks the beginning of a series of the most dangerous life-threatening diseases.
  - The role that body weight plays when choosing a suitable family planning method to use.
  - Risks of lack of movement and regular exercise for women.
- Researchers, interested in population studies, should investigate the combined effects of variables associated with family planning methods on blood hemoglobin levels.

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الدور الذي يلعبه وزن الجسم في مستوى هيموجلوبين الدم عند استخدام بعض انواع وسائل تنظيم الأسرة الحديثة في مصر

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المستخلص

أي خلل يحدث في مستوى هيموجلوبين الدم قد ينجم عنه مضاعفات خطيرة تصل إلى حد الوفاة. تركز هذه الدراسة على أحد الأسباب الهامة المؤدية لهذا الخلل وهو الدور الذي يلعبه وزن الجسم في مستوى هيموجلوبين الدم عند استخدام المرأة لبعض أنواع وسائل تنظيم الأسرة الحديثة. تم إجراء التحليل الإحصائي في هذه الدراسة على عدد ٣٤٥٠ سيدة مصرية متزوجة حالياً وفي سن الإنجاب (١٥- ٤٩)تم إستخلاصهن من عينة الـ EDHS, 2014 ، وكانت الأساليب المستخدمة هي التحليل العنقودي واختبار Kruskall-Wallis و ما يتبعه من مقارنات متعددة. صنف التحليل العنقودي السيدات الى ست مجموعات وأظهر اختبار Kruskall-Wallis وجود اختلافات معنوية كبيرة في مستوى هيموجلوبين الدم بين تلك المجموعات الستة. أظهرت المقارنات المتعددة أن استخدام وسيلة هرمونية في مقابل وسيلة غير هرمونية يظهر فروق معنوية في حالة الوزن الزائد أو البدانة ولا يظهر تلك الفروق في حالة الوزن الطبيعي. وأن الاختلافات المعنوية لا تظهر عند مقارنة سيدات لهن نفس الوزن ويستخدمن نوعين مختلفين من الوسائل الهرمونية أو مقارنة سيدات مختلفات في الوزن ويستخدمن نفس الوسيلة. تضيف هذه الدراسة للأدبيات دليل قوي على أن وزن جسم المرأة يلعب دوراً في مستوى هيموجلوبين الدم عند استخدام بعض أنواع وسائل تنظيم الأسرة الحديثة. ولذلك يجب توفير أطباء متخصصين في التغذية والسمنة داخل مراكز ووحدات تقديم خدمات تنظيم الأسرة بكافة المحافظات لتقديم المشورة والمساعدة واختيار وسيلة تنظيم الأسرة المناسبة لحالة الوزن.

الكلمات المفتاحية: مستوى هيموجلوبين الدم – مؤشر كتلة الجسم – وسائل تنظيم الأسرة الحديثة – التأثير المشترك - مصر.