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Anemia and Body Composition

Shadia Mohamed[1], Alhanouf Alhessain[2]

[1]University of Bahri
[1, 2]University of Hail/KSA

Abstract: ***Purpose: Anemia is considered a severe public health problem by World Health Organization when anemia prevalence is equal to or greater than 40% in the population. The purpose of this study to determine the relation between anemia and body composition on student at University of Hail/KSA. Objective -The aim of this study to determined the relation between Anemia and the composition of the body. According to the lack of information available on relation between the body composition and anemia at university of Hail/KSA, the present study was designed to fulfill this purpose. Material and Method: 150 questionnaires were submitted to collected information about dietary intake. In-body 720 was used to take body composition measurement; hemoglobin test was carried out for the study group. Results: The mean age of the students ranged 21.3, Height158.6, weight 61 ,1 BMI 24.1, Hb 12.5 and hematocrit 36.8. There is significant relationship between anemic group and body fat mass, body mass index, body fat, waist hip ratio (P-value 0.029, 0, 04, 0.001, 0.035 respectively). Conclusion. There is a relation between anemia and the body composition. There is significant relationship between, skin pallor, low RBC count and anemic and non-anemic group.***

Keyword: hemoglobin, anemia, body composition

1. Introduction

Anemia is a condition in which a deficiency in the size or number of erythrocytes or the amount of hemoglobin (composed of heme) limits the exchange of oxygen and carbon dioxide between the blood and the tissue cells. Classification is based on cell size-macrocytic (large), normocytic (normal), and microcytic (small)-and on hemoglobin content-by prochromic (pale color) and normochromic (normal color) [1]

1-1Body composition is used to describe the percentages of fat, bone, water and muscle in human bodies. Because muscular tissue takes up less space in our body than fat tissue, our body composition, as well as our weight, determines leanness. Two people of equal height and body weight may look completely different from each other because they have a different body composition [2]

Weight gains and losses tell us nothing about how the body's composition may have changed, yet weight is the measure most people use to judge their "fatness." For many people, overweight means over fat, but this is not always the case. Athletes with dense bones and well-developed muscles may be overweight by some standards but have little body fat. Conversely, inactive people may seem to have acceptable weights, when, in fact, they may have too much body fat [3]

1.2 Energy Balance and Body Composition

A healthy body contains enough lean tissue to support health and the right amount of fat to Meet body needs. The dissatisfaction of the body weight can lead to damaging behaviors, such as starvation diets, diet pill abuse, and health care avoidance. The first step toward making healthy changes may be ~self-acceptance. The most important criterion for determining how much a person should weigh and how much body fat a person needs are not appearance but good health and longevity. Ideally, a person has enough fat to meet basic needs but not so much as to incur health risks. This range of healthy body weights has been identified using a common measure of weight and height-the body mass index [4].

1.2.1Body Mass Index

The **body mass index (BMI)** describes relative weight for height: healthy weight falls between a BMI of 18.5 and 24.9, with **underweight** below 18.5, **overweight** above 25, and **obese** above 30. A BMI of 25 for adults represents a healthy target for overweight people to achieve or for others not to exceed. Obesity-related diseases and increased mortality become evident beyond a BMI of 25.Keep in mind that BMI reflects height and weight measures and not body composition [5]

1.2.2 Body Fat and its Distribution

The ideal amount of body fat depends partly on the person. A normal-weight man may have from 13 to 21 percent body fat; a woman, because of her greater quantity of essential fat, 23 to 31 percent. In general, health problems typically develop when body fat exceeds 22 percent in young men, 25 percent in men over age 40, 32 percent in young women, and 35 percent in women over age 40. Body fat may contribute as much as 70 percent in excessively obese adults. A woman starting a pregnancy needs sufficient body fat to support conception and fetal growth. Below a certain threshold for body fat, hormone synthesis falters, and individuals may become in fertile, develop depression, experience abnormal hunger regulation, or become unable to keep warm. These thresholds differ for each function and for each individual [6]

1.2.2.1 Fat Distribution.

The distribution of fat on the body may be more critical than the total amount of fat alone. **Intra-abdominal fat** that is stored around the organs of the abdomen is referred to as **central obesity** or upper-body fat Independently of BMI or total body fat, central obesity is associated with

increased risks of heart disease, stroke, diabetes, hypertension, gallstones, and some types of cancer Abdominal fat is most common in men and to a lesser extent in women, the risks of cardiovascular disease, diabetes, and mortality are increased for those with excessive abdominal fat. Interestingly, smokers tend to have more abdominal fat than nonsmokers even though they have lower BMI [7]

1.2.3 Waist Circumference

A person's waist circumference is the most practical indicator of fat distribution and central obesity. In general, women with a waist circumference of greater than 35 inches (88 centimeters) and men with a waist circumference of greater than 40 inches (102 centimeters) have a high risk of central obesity-related health problems, such as diabetes and cardiovascular disease. As waist circumference increases, disease risks Increase. Some researchers use the waist-to-hip ratio when studying disease risks. The ratio requires another step or two (measuring the hips and comparing that measure to the waist measure), but it does not provide any additional information. Therefore, waist circumference alone is the preferred method for assessing abdominal fat in a clinical setting [8]

Other Measures of Body Composition Health care professionals commonly use BMI and waist circumference measures because they are relatively easy and inexpensive. Together, these two measures prove most valuable in assessing a person's health risks and monitoring changes over time. Researchers needing more precise measures of body composition may choose any of several other techniques to estimate body fat and its distribution. Mastering these techniques requires proper instruction and practice to ensure reliability. Researchers sometimes estimate body composition using these methods: total body water, radioactive potassium count, near-infrared spectrophotometer, ultrasound, computed tomography, and magnetic resonance imaging. Each method has advantages and disadvantages with respect to cost, technical difficulty, and precision of estimating body fat [9]

1.3 Health Risks Associated with Body Weight and Body Fat

- Body weight and fat distribution correlate with disease risks and life expectancy.
- They indicate a greater likelihood of developing a chronic disease and shortening life
- Expectancy. Not all overweight and underweight people will get sick and die before
- Their time nor will all normal-weight people live long healthy lives. Correlations are
- Not *causes*. For the most part, people with a BMI between 18.5 and 24.9 have relatively
- Few health risks; risks increase as BMI falls below or rises above this range, indicating
- That both too little and too much body fat impair health [10]
- People who are extremely underweight or extremely obese carry higher risks of early deaths than those whose weights fall within the acceptable range; these mortality risks decline with age
- Independently of BMI, factors such as smoking habits and physical fitness lower that raise health risks [10][11]

1.3.1Health Risks of Underweight

Some underweight people enjoy an active, healthy life, but others are underweight because of malnutrition, smoking habits, substance abuse, or illnesses. Weight and fat measures alone would not reveal these underlying causes, but a complete assessment that includes a diet and medical history, physical examination, and biochemical analysis would. An underweight person, especially an older adult, may be unable to preserve lean tissue during the fight against a wasting disease such as cancer or a digestive disorder, especially when the disease is accompanied by malnutrition. Underweight women develop menstrual irregularities and become infertile [12]. Those who do conceive may give birth to unhealthy infants. An underweight woman can improve her chances of having a healthy infant by gaining weight prior to conception, during pregnancy, or both. Underweight and significant weight loss is also associated with osteoporosis and bone fractures. For all these reasons, underweight people may benefit from enough of a weight gain to provide an energy reserve and protective amounts of all the nutrients that can be stored **[**12][13]

1.3.2 Health Risks of Overweight

As for excessive body fat, the health risks are so many that it has been designated a disease-obesity. Among the health risks associated with obesity are diabetes, hypertension, cardiovascular disease, sleep apnea (abnormal ceasing of breathing during sleep), osteoarthritis, some cancers, gallbladder disease, kidney stones, respiratory problems (including Pickwick an syndrome, a breathing blockage linked with sudden death), and complications in pregnancy and surgery. In contrast, sustained weight loss improves physical well-being, reduces disease risks, and increases life expectancy [14]

1.3.3 Cardiovascular Disease

The relationship between obesity and cardiovascular disease risk is strong, with links to both elevated blood cholesterol and hypertension. Central obesity may raise the risk of heart attack and stroke as much as the three leading risk factors (high LDL cholesterol, hypertension, and smoking) In addition to body fat and its distribution, weight gain also increases the risk of cardiovascular disease. Weight loss, on the other hand, can effectively lower both blood cholesterol and blood pressure in obese people. Of course, normal-weight people may also have high blood cholesterol and blood pressure, and these factors are just as dangerous in lean people as in obese people [15][16]

1.3.4 Diabetes

Most adults with type 2 diabetes are overweight or obese. The Diabetes (type 2) is three times more likely to develop in an obese person than in a non obese person. Furthermore, the person with type 2 diabetes often has central obesity. Central-body fat cells appear to be larger and more insulin-resistant than lower-body fat cells." The association between **insulin resistance** and obesity is strong. Both are major risk factors for the development of type 2 diabetes. Diabetes appears to be influenced by weight gains as well as by body weight. A weight gain of more than 10 pounds (4.5 kilograms) after the age of 18 doubles the risk of developing diabetes, even in women of average weight. In contrast, weight loss is effective in improving glucose tolerance and insulin resistant'' [17] [18]

1.3.5 Inflammation and the Metabolic Syndrome

Chronic **inflammation** accompanies obesity, and inflammation contributes to chronic diseases. As a person grows fatter, lipids first fill the adipose tissue and then migrate into other tissues such as the muscles and liver." This accumulation of fat, especially in the abdominal region, changes the body's metabolism, resulting in insulin resistance, low HDL, high triglyceride
s, and high blood pressure'? This cluster of symptoms-collectively known as the metabolic syndrome- increases the risks for diabetes, hypertension, and atherosclerosis [19]

Fat accumulation, especially in the abdominal region, also activates genes that code for proteins. Involved in inflammations" Furthermore, although relatively few immune cells are commonly found in adipose tissue, weight gain significantly increases their number and their role in inflammation." Elevated blood lipids-whether due to obesity or to a high-fat diet-also promote Inflammation. Together, these factors help to explain why chronic inflammation accompanies obesity and how obesity contributes to the metabolic syndrome and the progression of chronic diseases." Even in healthy youngsters, body fat correlates positively with chronic inflammation." As might be expected, weight loss reduces the number of immune cells in adipose tissue and changes gene expression to reduce inflammation**."**[20]

1.3.6 Cancer

The risk of some cancers increases with both body weight and weight gain, but researchers do not fully understand the relationships. One possible explanation may be that obese people have elevated levels of hormones that could influence cancer development." For example, adipose tissue is the major site of estrogen synthesis in women, obese women have elevated levels of estrogen, and estrogen has been implicated in the development of cancers of the female reproductive system-cancers that account for half of all cancers in women [21]

1.3.7 Fit and Fat versus Sedentary and Slim

Importantly, BMI and weight gains and losses do not tell the whole story. Cardio-respiratory fitness also plays a major role in health and longevity, independently of BMI**[22]** .Normal-weight people who are fit have a lower risk of mortality than normal-weight people who are unfit. Furthermore, overweight but fit people have lower risks than normal-weight, unfit ones." Clearly, a healthy body weight is good, but it may not be good enough. Fitness, in and of itself, offers many health benefits **[23][24]**

2. Methodology

- Cross sectional survey was planned to determine the relation between Anemia and the composition of the body from random sampling of (**150)** female student at University of Hail.
- **(150)** questionnaire was submitted to collected information about dietary intake, Body composition measurements are taken by different instruments.
- The questionnaire was include the questions regarding the subject's (age weight, height, economic status, hemoglobin test, sign and symptom of anemia and some of food item such :diary product, protein food, some of vegetable, fruit, and snacks such chocolate, cheeps)
- **In-body 720** was used to take body composition measurement from study group
- Standing height was measured using a stediometre.
- Weight was measured by a standard personal weighing machine

3. Results and Discussion

Table 1: General Characteristics of the study population

Characteristic	*Respond*	*Frequency*	*%*
Economic Status	Middle Income Group	27	19.71
	High Income Group	110	80.29
Exercise	Yes	122	80.79
	No	29	19.21
Presence of other diseases	Yes	28	18.54
	No	123	81.46
Previous History of anemia	Yes	21	13.82
	No	131	86.18
Family History of Anemia	Yes	43	28.29
	No	109	71.71
Are you aware of causes of Anemia	Yes	31	20.39
	No	121	79.61
Anemia groups	Severe Anemia	0	0
	Moderate Anemia	18	11.8
	Mild Anemia	29	19.0
	Non Anemia	106	69.3

Table No. 1 Shows general characteristics of studying group. 80.29% have high income, 80.79 doing some sort of exercise, No previous history of anemia 86.18%, No family history of anemia 71.71%. The knowledge about anemia is poor 79.61%. Anemic group represent about 30.8% from the respondents. Moderate anemia (≥ 8-10.9 mg/dl)(N=18), Mild anemia (≥ 11-11.9mg/dl) (N=29), Non-Anemia (≥ 12 mg/dl)(N=106).

Table 2: Mean Age, Anthropometry and Hemoglobin of the study population

Variables	*Mean*	*Standard Deviation*
Age	21.33	3.26
Height	158.61	5.29
Weight	61.07	14.47
BMI	24.18	5.16
Hemoglobin	12.54	1.36
Hematocrit	36.86	4.04

Table No.2 Represents the mean age 21.33, height 1.58, 61 Weight61.07, BMI, 24.18, Hemoglobin, 12.54 and mean Hemtocrit for the respondent 36.86.

Table 3: ANOVA for Anemia groups and body composition in the study population

Body composition	Moderate anemia (≥ 8-10.9 mg/dl) (N=18)	Mild anemia (≥ 11-11.9 mg/dl) (N=29	Non-Anemia (≥ 12 mg/dl) (N=106)	F- Value (p value)
Body Fat Mass	17.50 ± 9.06	24.46 ± 10.40	24.41 ± 10.39	3.624 (p=0.029)*
Body Mass Index	21.34 ± 4.66	24.61 ± 5.20	24.55 ± 5.12	3.189 (p=0.044)*
Percent Body Fat	29.91 ± 9.23	38.13 ± 8.23	37.85 ± 8.01	7.586 (p=0.001)*
Waist Hip Ratio	0.84 ± 0.06	0.87 ± 0.06	0.88 ± 0.06	3.414 (p=0.035)*
Visceral Fat	72.77 ± 25.77	87.05 ± 35.96	92.12 ± 34.92	2.514 (p=0.084)
Protein	7.34 ± 1.03	7.19 ± 1.13	7.32 ± 0.92	0.214 (p=0.808)
Mineral	2.67 ± 0.40	2.66 ± 0.41	2.70 ± 0.35	0.243 (p=0.785)
Bone Mineral Content	2.22 ± 0.34	2.22 ± 0.34	2.26 ± 0.30	0.263 (p=0.769)

***Significant**

Table 3. Represents the relation between body composition and anemic and non-anemic group. These are significant relationship between body fat mass, body mass index, percent body fat, waist hip ratio and anemic and non-anemic group(p-value =0.029, 0.044, 0.001, 0.035 respectively).

Table 4: Anemia Groups and Signs and Symptoms

Signs and Symptoms		Moderate anemia (≥ 8-10.9 mg/dl) (N=18)	Mild anemia (≥ 11-11.9 mg/dl) (N=29)	Non-Anemia (≥ 12 mg/dl) (N=106)	Chi-Square (p value)
Skin Pallor	Yes	11 (64.7 %)	8 (27.6 %)	41 (40.2 %)	6.124*(p =0.046)
	No	6 (35.3 %)	21 (72.4 %)	61 (59.8 %)	
Fatigue	Yes	10 (58.8 %)	21 (72.4 %)	66 (64.1 %)	1.025 (p=0.599)
	No	7 (41.2 %)	10 (34.5 %)	39 (37.9 %)	
Palpitation	Yes	6 (35.3 %)	19 (65.5 %)	64 (62.1 %)	0.133 (p=0.936)
	No	11 (64.7 %)	21 (72.4 %)	61 (59.8 %)	
Numbness/Coldness in hands or feet	Yes	9 (52.9 %)	9 (31.0 %)	48 (46.6 %)	2.804 (p=0.246)
	No	8 (47.1 %)	20 (69.0 %)	55 (53.4 %)	
Low RBC Count history	Yes	11 (64.7 %)	9 (31.0 %)	32 (31.1 %)	7.504* (p=0.023)
	No	6 (35.3 %)	20 (69.0 %)	71 (68.9 %)	
Appetite	Good	10 (58.8 %)	22 (75.9 %)	79 (76.0 %)	2.265 (p=0.317)
	Poor	7 (41.2 %)	7 (24.1 %)	25 (24.0 %)	

*Significant

Table 4. Represents the relation between sign, symptoms of anemia and anemic and non-anemic group. Which indicates significant relationship between, skin pallor, low RBC count and anemic and non- anemic group(P value 0, 046 and p0.023 respectively).There is no relationship between, fatigue, palpitation, numbness/coldness in hand or feet and anemic group, non-anemic group.

Table 5: Anemia Groups and Protein Foods intake

		Anemia Groups					
Variables	Respond	Moderate Anemic Group		Mild Anemic Group		Non Anemic Group	
		Frequency	%	Frequency	%	Frequency	%
Meat/Egg	Daily	10	58.82	12	44.44	43	43.00
	Weekly	3	17.65	9	33.33	38	38.00
	Other	4	23.53	6	22.22	19	19.00
Milk and milk products	Daily	11	68.75	17	62.96	72	70.59
	Weekly	4	25.00	8	29.63	23	22.55
	Other	1	6.25	2	7.41	7	6.86
Fish	Daily	2	12.50	1	4.00	5	5.81
	Weekly	4	25.00	6	24.00	13	15.12
	Other	10	62.50	18	72.00	68	79.07
Beans	Daily	3	18.75	2	7.41	8	8.70
	Weekly	5	31.25	10	37.04	44	47.83
	Other	8	50.00	15	55.56	40	43.48
Chicken	Daily	6	40.00	10	41.67	38	41.76
	Weekly	6	40.00	6	25.00	27	29.67
	Other	3	20.00	8	33.33	26	28.57

Table 5. shows the relation between the intake of protein food and anemic and non-anemic group. There are no relation between protein intake and anemic group and non-anemic from the study group. The daily intake of meat and milk is high in the different groups, maybe due to high economic status of study group. The percent of meat 44.4% for non- anemic group and 43% for anemic group. Intake of milk and milk product equal 72% for non-anemic group and 70.5% for anemic group

Table 6: Anemia Groups and Honey, chocolates, Chips and Bakery Products intake

		Anemia Groups					
Variables	Respond	Moderate Anemic Group		Mild Anemic Group		Non Anemic Group	
		Frequency	%	Frequency	%	Frequency	%
Honey/Jam	Daily	5	33.33	6	24.00	21	22.83
	Weekly	5	33.33	13	52.00	37	40.22
	Fortnight	5	33.33	6	24.00	34	36.96
Chocolate	Daily	16	88.89	21	84.00	74	74.75
	Weekly	1	5.56	2	8.00	20	20.20
	Fortnight	1	5.56	2	8.00	5	5.05
Chips	Daily	13	76.47	12	46.15	63	64.95
	Weekly	3	17.65	8	30.77	28	28.87
	Fortnight	1	5.88	6	23.08	6	6.19
Cakes and Biscuits	Daily	14	82.35	12	48.00	57	58.76
	Weekly	3	17.65	7	28.00	30	30.93
	Fortnight	0	.00	6	24.00	10	10.31

Table 6. shows the relation between the intake of Honey, chocolates, Chips and Bakery Products and anemic and non-anemic group. There are no relation between Honey, chocolates, Chips and Bakery Products intake and anemic group and non-anemic from the study group.

The daily intake of Honey, chocolates, Chips and Bakery Products intake is high in the different groups, maybe due to high economic status of study group. The percent of honey 44.4% for non- anemic group and 43% for anemic group.

Table 7: Anemia Groups and Fruit and Vegetable intake

		Anemia Groups					
Variables	Respond	Moderate Anemic Group		Mild Anemic Group		Non Anemic Group	
		Frequency	%	Frequency	%	Frequency	%
Green Veg.	Daily	6	37.50	9	33.33	37	37.76
	Weekly	5	31.25	11	40.74	41	41.84
	Fortnight	5	31.25	7	25.93	20	20.41
Yellow Veg.	Daily	2	12.50	3	11.54	19	22.35
	Weekly	7	43.75	11	42.31	38	44.71
	Fortnight	7	43.75	12	46.15	28	32.94
Apple	Daily	4	25.00	8	30.77	21	21.43
	Weekly	9	56.25	8	30.77	39	39.80
	Fortnight	3	18.75	10	38.46	38	38.78
Orange	Daily	4	23.53	7	25.93	22	22.22
	Weekly	9	52.94	8	29.63	42	42.42
	Fortnight	4	23.53	12	44.44	35	35.35
Banana	Daily	3	17.65	7	26.92	11	11.70
	Weekly	9	52.94	6	23.08	44	46.81
	Fortnight	5	29.41	13	50.00	39	41.49
Juices	Daily	13	72.22	13	48.15	67	67.00
	Weekly	3	16.67	9	33.33	28	28.00
	Fortnight	2	11.11	5	18.52	5	5.00

Table 7 shows the relation between the Fruit and Vegetable intake and anemic and non-anemic group. There are no relation between Fruit and Vegetable intake and anemic group and non-anemic for the study group. The daily intake of Fruit and Vegetable is high in the different groups, maybe due to high economic status of study group.

4. Conclusion

There is a relation between anemia and the body composition. Body fat mass, body mass index, body fat, waist hip ratio have significant relation with anemic and non-anemic group. There is significant relationship between, skin pallor, low RBC count and anemic

5. Recommendation

Nutrition education programs should be conducted at university of Hail to highlight the risk factors of anemia and to maintain healthy body composition.

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Author profile

Shadia Mohamed Idris received the B.Sc., M.Sc. & PhD degrees in Family Science from Ahfad & Khartoum University in 1998, 1997 and 2000, respectively. During 1998-2011, she works at Ministry of health and University of Juba & University of Bahri. Now on secondment at University of Hail/ Saudi Arabia.

Alhanouf Alhassin is working with University of Hail, / KSA, B.Sc. in Clinical Nutrition.