IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 4, Issue 2 Ver. I (Mar.-Apr. 2015), PP 74-80
www.iosrjournals.org

Iron Deficiency Anemia among Pregnant Women in Hail Kingdom of Saudi Arabia

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Abstract: *This study was conducted to determine the prevalence of iron deficiency anemia among pregnant women in Hail, Kingdom of Saudi Arabia. Blood samples of the participants were tested for hemoglobin, red cell indices and iron level. Survey questionnaires were distributed to gather information on the factors associated with iron deficiency anemia and the responses on the signs manifested by the participants. Mean and percentage count were the statistical tools used. The participants were pregnant women ranging from age twenty (20) to forty (40) years old. The results showed that the mean hemoglobin, MCV and MCH were below the normal range and the MCHC and iron were within the normal range. However, further analysis on the data showed that fifty eight (58 %) have iron deficiency anemia, have not been diagnosed with anemia, taking iron supplements and eat food rich in iron, often feel fatigue, weak, pale skin and show signs and symptoms of anemia. The data on red cell indices also showed the characteristic morphology of microcytic and hypochromic red blood cells indicating the prevalence of iron deficiency anemia among pregnant women in Hail.*

Keywords: *Iron deficiency anemia, Iron, Hemoglobin, Pregnant women, Red Cell Indices (MCV, MCH, MCHC)*

I. Introduction

Iron Deficiency Anemia (also called IDA) is a condition where a person has inadequate amounts of iron to meet body demands. Having too little iron in your blood causes a decrease in the amount of red cells in the blood. Red blood cells deliver oxygen to all the cells of your body. Without oxygen, your organs and tissues do not function as well as they should. Iron deficiency anemia is the most common form of anemia. About 20% of women, and up to 50% of pregnant women are iron deficient. Iron deficiency anemia is a serious health issue, yet it often goes undiagnosed and untreated.(1)

Iron deficiency is the most common and widespread nutritional disorder in the world. There are no current global figures for iron deficiency, but using anaemia as an indirect indicator it can be estimated that most preschool children and pregnant women in non-industrialized countries, and at least 30-40% in industrialized countries, are iron deficient. Nearly half of the pregnant women in the world are estimated to be anaemic: 52% in non-industrialized - as compared with 23% in industrialized – countries.(2)

According to World Health Organization (WHO) report, 32.3% nonpregnant women of child bearing age are suffering from anemia in Saudi Arabia. AlQuaiz conducted a hospital-based study and found 37% of women suffering from anemia in Riyadh, Saudi Arabia.(3)

A study on the prevalence of iron deficiency anemia among female elementary school children in Northern Jeddah, Saudi Arabia conducted by Mamdooh A. Gari, PhD showed that the prevalence of iron deficiency and iron deficiency anemia in this study was 23.0%. Data showed that the majority of anemia cases in this study were normocytic type. Anemia was more prevalent among students of age 10-12 years as compared to younger age group (4).

Anaemia in pregnancy is defined as an Hb <110 g/L in the first and last trimester, and a Hb <105 g/L in the second trimester. Women with anaemia in pregnancy may experience fatigue, reduced energy levels, reduced mental performances, and in cases of severe anaemia it is associated with preterm birth, low birth weights, and a small for gestational age fetus. In the postpartum period anaemia has been found to be linked to depression, emotional instability, stress and lower cognitive performance tests (5).

Iron deficiency anemia has many causes. These causes fall into two main categories: increased iron needs and decreased iron intake and absorption. Increased iron needs includes the rapid growth, pregnancy, blood loss due to heavy menstrual periods, frequent blood donation and some stomach and intestinal conditions such as food sensitivity and hookworms. On the other hand, decreased iron intake and absorption includes lack of heme iron sources in the diet (e.g, vegetarian diets) and low absorption such as in taking antacids beyond

recommended dose or medicine used to treat peptic ulcer disease and acid reflux can reduce the amount of iron absorbed in the stomach (6).

The most common causes of anaemia in pregnancy include iron deficiency, folate deficiency vitamin B12 deficiency , haemolytic diseases, bone marrow suppression, chronic blood loss and underlying malignancies. 30-50% of woman become anaemic during pregnancy, with iron deficiency being the most common form of anaemia in more than 90% of the cases (5).

Targeted iron supplementation, an iron-rich diet, or both, can improve iron deficiency. However, the variability of bioavailable iron compounds limits its value against nutritional iron deficiency. Therefore, laboratory measures of iron stores should be utilized to determine iron deficiency and monitor therapy.(7)

According to the World Health Organization (WHO), the worldwide prevalence of anemia in pregnant women is 41.8% (95% CI 39.9-43.8); there are only few exception countries in the world where anemia is not at least a mild public health problem . Supplementation of diet with iron compounds during pregnancy has been recommended by international and local organizations for quite some time; intake of folic acid as a dietary supplement might have additional benefits (reduced risk of serious neural tube defects in the infant) for women of reproductive age(8).

Traditionally, women have been prescribed dietary supplements during pregnancy as a daily regimen. In recently times intermittent supplementation has been suggested, since it takes advantage of the turnover time of intestinal mucosal cells favouring iron absorption regulation and is more economical and safer from the public health perspective(8).

The gastrointestinal tract increases iron absorption when the body's iron stores are low, and it reduces the absorption when there are sufficient stores. Requirement for absorbed iron ranges from 0.8mg/day in the first trimester to 7.5 mg/day in the second trimester, averaging approximately 4.4 mg/day in pregnancy. Iron requirements increase rapidly in the second and third trimester due to fetal growth, however iron absorption in the gut is not sufficient to meet this increased demand. Thus iron balance depends on maternal iron stores during this period (5)

A trial of oral iron should be considered as a diagnostic test for all pregnant women with suspected iron deficiency anaemia (IDA). The haemoglobin should increase within 2 weeks, otherwise further tests are required. Oral iron supplementation is the primary treatment option. A high iron diet should be recommended, including red meats (if possible), fortified cereals and drinks. Intravenous iron should only be used in severe cases of iron deficiency, if the woman is unresponsive to oral iron treatment, or when rapid repletion of iron is required (5).

Targeted iron supplementation, an iron-rich diet, or both, can improve iron deficiency. However, the variability of bioavailable iron compounds limits its value against nutritional iron deficiency. Therefore, laboratory measures of iron stores should be utilized to determine iron deficiency and monitor therapy . Because of the magnitude and consequences of iron deficiency anemia in the world, especially in women in their childbearing period, several international conferences on nutrition have addressed this issue in order to reduce the prevalence of iron deficiency in women of childbearing age without major success . The consequences of IDA have been widely studied . However, there remains a lack of data about its effects on patient's wellbeing (7).

Hence, this study was conducted to determine the prevalence of iron deficiency anemia among pregnant women in Hail, Kingdom of Saudi Arabia.

II. Objectives

The general purpose of this study was to determine prevalence of iron deficiency anemia among pregnant women in Hail, Kingdom of Saudi Arabia.

1. To determine the hemoglobin, red blood cell indices and iron level of pregnant women in Hail, Kingdom of Saudi Arabia.
2. To determine the percentage of pregnant women who have iron deficiency anemia in Hail, Kingdom of Saudi Arabia.
3. To determine the factors that are associated with iron deficiency anemia among pregnant women in Hail, Kingdom of Saudi Arabia.

Statement of the Problem:

1. What is the hemoglobin, red blood cell indices and iron level of pregnant women in Hail, Kingdom of Saudi Arabia?
2. How many percent of the pregnant women have iron deficiency anemia?
3. What are the factors associated with iron deficiency anemia among pregnant women in Hail, Kingdom of Saudi Arabia?

III. Research Methodology

The participants of the study were the pregnant women in Hail, Saudi Arabia who underwent laboratory tests such as complete blood count, red cell indices and iron. The pregnant Saudi females of age ranging from twenty (20) to forty (40) years old were taken as participants of the study. The data were treated statistically using mean and percentage count.

A structured researcher-made questionnaire was used as an interview guide in order to gather data on the factors that were associated with iron deficiency anemia among the pregnant women in Hail, Kingdom of Saudi Arabia. On the other hand, the hemoglobin and red blood cell indices of the pregnant women were analyzed using automated hematology analyzer.

The materials and or instruments used for the determination of iron in the blood sample of the pregnant participants were the reagents for iron determination which includes the following: Kit 2×100ml (ref.99 11 83); IRON – CAB standard and reagent. The storage and stability of the reagent when stored at room temperature (15-25c) , the components of this kit will remain until the expiration date stated on the label . Once opened the CAB reagent is stable for 6 weeks at 15-25c. The instruments used were the automated hematology analyzer (Sysmex), spectrophotometer, laboratory timer, centrifuge, micropipettes, test tube rack and glass wares such as test tubes. A non-hemolyzed serum or plasma was used in iron determination. Three test tubes were prepared; the first tube was marked blank, the second tube was marked standard and the third tube was marked sample. A 0.05 ml of the participant's sample was delivered to the tube marked sample, 0.05 ml to the tube marked standard. Then a 1 ml of the reagent was added to each of the tubes marked blank, sample and standard. The solution in each tube was mixed well then incubated for ten (10) to fifteen (15) minutes at room temperature (20-25c). Reading of the test results was done using the spectrophotometer at wavelength 623/ 620 nm. The data obtained after reading was calculated to determine the serum iron result of the patient. The normal value for serum iron is from thirty seven (37) to one hundred forty five (145) µg/dl.

IV. Results

Table 1: Mean Result on Hemoglobin and Red Blood Cell Indices of the Participants

Test Parameters	Normal Range	Mean	Minimum Value	Maximum Value
Hemoglobin	11.5 – 15.5 g/dL	11.2	3.7	14.2
MCV	80 – 100 fL	78	66.6	92.5
MCH	28 – 34 pg	25	12.1	30.5
MCHC	32-36 g/dL	32	21	35
Iron	6.6 - 26	12.7	2.6	58.4

Table 1 presents the mean result on hemoglobin and red blood cell indices parameters of the participants. This tells us that the mean hemoglobin of the participants was 11.2 g/dL, the Mean Corpuscular Volume (MCH) was 78 fL, Mean Corpuscular Hemoglobin (MCH) was 25 pg, Mean Corpuscular Hemoglobin Concentration (MCHC) was 32 g/dl and the iron was 12.7. This means that the hemoglobin level was slightly below the normal range, the Mean Corpuscular Volume (MCV) and Mean Corpuscular Hemoglobin (MCH) results of the participants were below the normal range, however, the Mean Corpuscular Hemoglobin Concentration (MCHC) and iron mean results were within the normal range.

This implies that the red blood cells of the participants can be classified as microcytic and hypochromic although the hemoglobin is slightly normal and the Mean Corpuscular Hemoglobin Concentration (MCHC) and iron level are normal which may indicate the possibility of iron deficiency anemia.

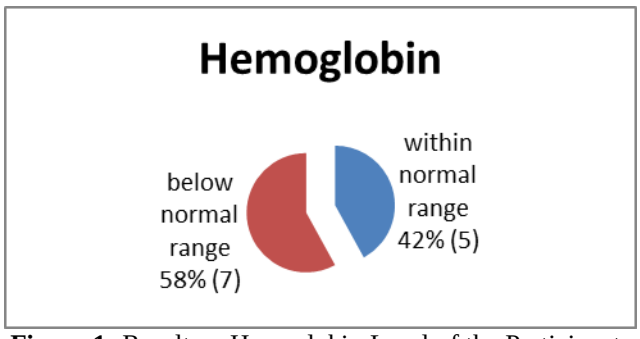

Figure 1: Result on Hemoglobin Level of the Participants

Figure 1 presents the hemoglobin results of the participants. This tells us that fifty eight percent (58%) of the participants hemoglobin level were below the normal range (11.5 – 15.5 g/dL) and forty two (42%) percent of the participants had hemoglobin level within the normal range. This means that the hemoglobin level

of most of the participants are below 11.5 g/dl. This implies that majority of the participants manifest the laboratory findings indicating the presence of anemia.

Figure 2 shows the result on red blood cell indices for mean corpuscular volume (MCV) of the participants. This tells us that there were fifty eight (58%) percent of the participants whose mean corpuscular volume (MCV) were within the normal range (80 – 100 femtoliter), while, forty two (42%) percent of the participants had a mean corpuscular volume (MCV) below the normal range. This means that most of the participants' red blood cell index for mean corpuscular volume (MCV) fall within 80 – 100 femtoliter. This implies that the morphology of the red blood cells for most of the participants are normal in size or normocyte, however, there are also participants whose red blood cells are microcytic.

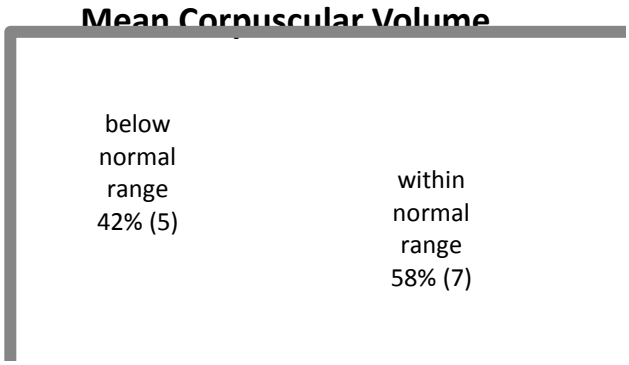

Figure 2: Result on Red Cell Indices (Mean Corpuscular Volume) of the Participants

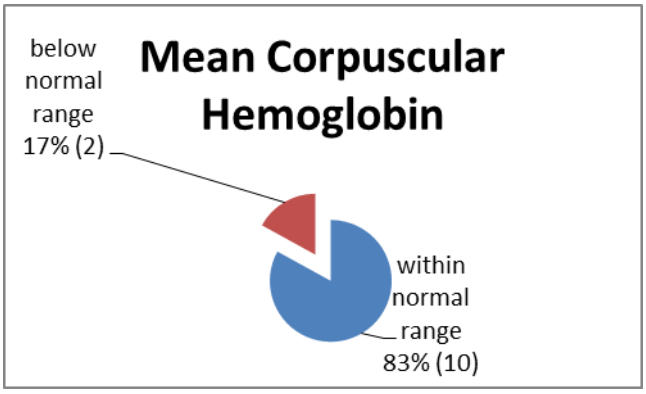

Figure 3: Result on Red Cell Indices (Mean Corpuscular Hemoglobin) of the Participants

Figure 3 presents the result on red cell indices for mean corpuscular hemoglobin (MCH) of the participants. This tells us that eighty three percent (83%) of the participants had a mean corpuscular hemoglobin (MCH) are within normal range (28 – 34 picogram) while seventeen percent (17%) of the participants had a mean corpuscular hemoglobin (MCH) result below the normal range. This means that most of the participants red cell index for Mean Corpuscular Hemoglobin (MCH) are within the 28 – 34 picogram. This implies that the average weight of hemoglobin in the individual red blood cells of most of the participants are normal.

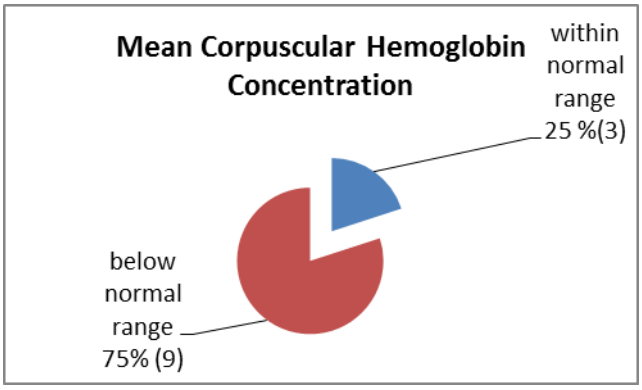

Figure 4: Result on Red Cell Indices (Mean Corpuscular Hemoglobin Concentration) of the Participants

Figure 4 presents the result on red cell indices for mean corpuscular hemoglobin concentration of the participants. This tells us that seventy five percent (75%) of the participants had a mean corpuscular hemoglobin concentration (MCHC) below the normal range while twenty five percent (25%) had a mean corpuscular hemoglobin concentration (MCHC) within normal range (32-36 g/dL). This means that most of the results on the red cell index for mean corpuscular hemoglobin concentration (MCHC) of the participants are lower than 32 – 36 g/dL. This implies that there is a decrease in the ratio of hemoglobin mass to volume in which it is contained or the average concentration of hemoglobin in a deciliter of erythrocytes for most of the participants.

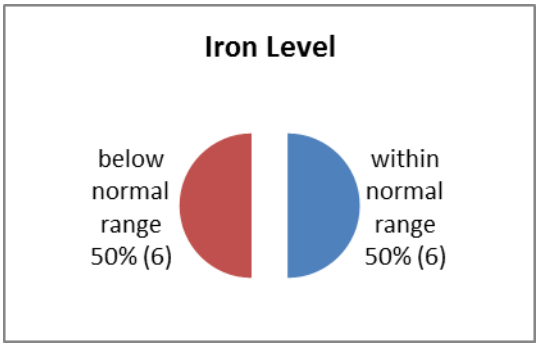

Figure 5: Result on the Iron Level of the Participants

Figure 5 presents the result on the iron level of the participants. This tells us that fifty percent (50%) of the participants had iron level below normal range and fifty (50%) percent also had iron level within normal range. This means that the iron level of the participants falls within and below the normal range (6.6 – 26 g/dL). This implies that there are participants that manifest low iron content in the blood which indicates iron deficiency anemia.

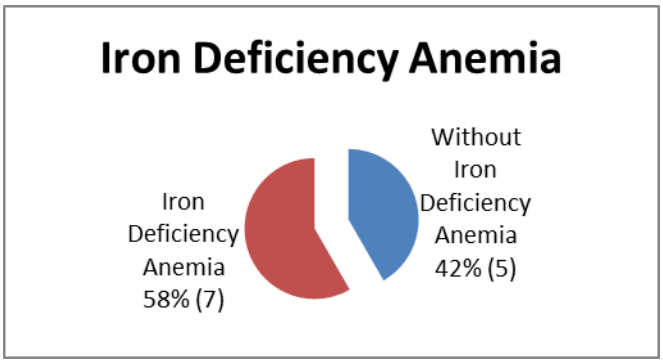

Figure 6: Percentage Result on Iron Deficiency Anemia among Pregnant Women

Figure 6 presents the percentage result on the prevalence of iron deficiency anemia among pregnant women in Hail. This tells us that fifty eight percent (58%) of the pregnant women had iron deficiency anemia while forty two (42%) of the pregnant women had no iron deficiency anemia. This means that most of the pregnant women had iron deficiency anemia. This implies that there is a need for iron supplement for pregnant women in order to prevent the occurrence of iron deficiency anemia.

Table 2: Percentage Result on the Factors Associated with Iron Deficiency Anemia

Statement	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Have you ever been told that you were anemic?	3	25 %	9	75 %
Are you pregnant?	12	100 %	0	0%
Do you take iron supplement?	9	75 %	3	25 %
Have you been diagnosed previously with iron deficiency anemia?	3	25%	9	75%
Do you eat food rich in iron?	10	83%	2	17%

Table 2 presents the result on percentage of the factors associated with iron deficiency anemia. It tells us that twenty five percent (25%) have been told that they were anemic, whereas, seventy five percent (75%) were not told that they were anemic. One hundred percent (100%) of the participants were pregnant.

Seventy five percent (75%) took iron supplement, whereas, twenty five percent (25%) did not take iron supplement. Seventy five percent (75%) were diagnosed previously with iron deficiency anemia, whereas, twenty five (25%) percent were not diagnosed with iron deficiency anemia. Eighty three percent (83%) of the participants ate food rich in iron while seventeen percent (17%) did not eat food rich in iron.

This means that most of the respondents had not been told that they were anemic, they are pregnant, took iron supplement, not been diagnosed with iron deficiency anemia and ate food rich in iron. This implies that most of the participants are not aware about the possibility of having iron deficiency anemia especially during pregnancy. The participants are taking iron supplements as prescribed by the physician since they are pregnant and at the same time eat food rich in iron.

Table 3: Result on Mean Responses of the Participants on Iron Deficiency Anemia

Statement	Mean	Interpretation
Do you feel tired or fatigue?	2.6	Often
Do you feel weak?	2.6	Often
Does your skin look pale?	3.1	Often
Do you get short of breathe?	2.0	Sometimes
Do you get dizzy?	2.3	Sometimes

Table 3 presents the result on mean responses of the participants on iron deficiency anemia. This means that most of the participants's skin often look pale, felt weak and felt tired or fatigue. On the other hand, most the participants sometimes got dizzy and short of breathe. This implies that the participants show signs and symptoms of anemia.

V. Discussion

According to Turgeon (2011) all iron-deficiency anemias produce changes in erythrocyte morphology. The RBCs are microcytic, and the MCV is decreased, the amount of hemoglobin within each RBC is significantly decreased, such cells are hypochromic (13). The MCV reflects the size of red blood cells. The MCH and MCHC reflect the hemoglobin content of red blood cells. These RBC measures are used to diagnose types of anemia. Anemias are defined based on cell size (MCV) and amount of Hgb (MCH), MCV less than lower limit of normal: microcytic anemia, MCV within normal range: normocytic anemia, MCV greater than upper limit of normal: macrocytic anemia(10).

MCH can be used to determine if an anemia is hypo-, normo-, or hyperchromic, the mean corpuscular volume (MCV) has to be considered along with the MCH since cell volume (MCV) affects the content of hemoglobin present per cell (MCH), and MCH can decrease or increase in parallel to the MCV. Thus, MCHC in the past has been thought to be a better parameter than MCH to determine hypochromasia.(11). MCH less than lower limit of normal: hypochromic anemia, MCH within normal range: normochromic anemia, MCH greater than upper limit of normal: hyperchromic anemia(10)

Serum iron is a test that measures how much iron is in your blood. Lower-than-normal levels may mean: Chronic gastrointestinal blood loss, Chronic heavy menstrual bleeding, Poor absorption of iron, Not enough dietary iron, Pregnancy (12). The women and newborn health service (2013) mentioned that the most common form of anemia during pregnancy is iron deficiency anemia (5).

Turgeon (2011) said that iron deficiency anemia may result from increased iron requirements in infancy, pregnancy and lactation. He also mentioned that the primary complaints of patients with anemia are fatigue and shortness of breath. Other common complaints are faintness, dizziness, heart palpitation, and headache. (13).

Iron deficiency in pregnant women increases maternal mortality (51%) prenatal and perinatal infant loss, and prematurity . Forty percent of all maternal perinatal deaths are linked to anaemia. Favourable pregnancy outcomes occur 30-45% less often in anaemic mothers, and their infants have less than one-half of normal iron reserves. Moreover, if pregnancy-induced iron deficiency is not corrected, women and their infants suffer all the consequences described above .

VI. Conclusion

The study showed that the participants who are pregnant women had a mean hemoglobin level of 11.2 g/dL that was slightly below the normal range and the red blood cells can be classified as microcytic and hypochromic (MCV= 78 fL; MCH= 25 pg; MCHC = 32 g/dL). The mean iron level (12.7) was within the normal range, however, there are participants that show low levels of iron in the blood. Most of the participants had iron deficiency anemia (58%) , had not been told that they were anemic, took iron supplements, had not

been previously diagnosed with iron deficiency anemia and they eat food rich in iron. They often felt tired and weak and their skin look pale. Sometimes they had short breath and felt dizzy.

The participants in this study manifest signs and symptoms of iron deficiency anemia . They eat food rich in iron yet they are anemic, hence, further medical examinations should be undertaken so as to find other causes that leads to iron deficiency anemia such as the possible cause of poor absorption of iron in the body. Awareness on iron deficiency anemia may be helpful in order to seek early diagnosis and treatment of the condition.

Recommendation to improve community nutrition and provide related education on the effects of iron deficiency anemia especially among pregnant women in Hail, Kingdom of Saudi Arabia. Conduct a study on the use of iron cooking pots as a non-dietary source of iron. Continue research to determine the factors that affects the absorption of the non-haem iron pool. Assess relative effectiveness of weekly supplements of iron in various vulnerable populations such as the pregnant women and children. Undertake operational research on the availability of community-based infrastructures for the distribution of iron and folic acid to pregnant women, and monitoring its effects among them. And to conduct another research on iron deficiency anemia and categorize as iron deficiency without anemia, iron deficiency with mild anemia and iron deficiency with severe anemia.

Acknowledgements

Sincerest thanks to the staff of the laboratory and medical records department of Maternity and Children's Hospital at Hail, Kingdom of Saudi Arabia, the Department Heads and the research supervisors of University of Hail, Kingdom of Saudi Arabia.

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