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Original Research Article

Study of the effect of anemia on lipid levels in some patients in the city of Mosul

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ABSTRACT

Background: Many scientific studies indicated that there is no close correlation between the malnutrition and weight gain (obesity) with iron deficiency, which leads to anemia. This study was designed to find the nature of the relationship between fat accumulations in adults with anemia.

Materials and Methods: This study and tests were conducted in Mosul/Iraq, and random samples werecollected from adults in two clinical analysis laboratories accredited by the Department of Health. The samples were taken after fasting for 14 consecutive hours to check out the level of cholesterol, LDL, the lipase enzyme, and some chemical elements such as iron and copper, as well as measuring the HB% percentage. The results were analyzed statistically based on the t-test using SPSS statistical program, and a value of $p<0.05$ was considered a significant value within the results.

Results: The ages of the people targeted in this investigation were between (18-50) years, and after collecting the test results and analyzing them statistically, the samples were divided into three groups based on the severity of iron deficiency (anemia). The people included in the first group (group A) were with severe anemia, while people in the second group (group B) were for moderate to weak anemia, whereas the third group (group C) designed to be a control group (people who do not have anemia). A comparison was made between group A with the control group C, and the average cholesterol concentration in group A appeared to be higher than that in group C,-

With a significant difference, while the average lipase and LDL levels were slightly, higher in group A compared to the control group, but it was not significant. As for the chemical elements, the average Fe in group A was low, with a significant difference at $p<0.05$ compared with C, while the copper element, was low in the first group compared to the third group, but it was not significant. The average hemoglobin (Hb) concentration was different between the three mentioned groups, and it was low in the first group compared to the second and third group. There were a significant changes in Hb concentrations between group A compared to group C, while there was no significant difference between group B and group C.

Conclusion: The results of the study, after comparing the groups, showed a significant increase in cholesterol concentration in people with all groups of anemia and non-significant differences based on statistical significances in the concentration of lipase and low-density lipoprotein in people with anemia compared to the control group. As in copper element, it was non-significantly low in people with anemia, in contrast, the concentration of iron was low and significant in those with anemia, which is the significant cause of anemia in adults. The study results may agree with previous studies and/ or different from other studies. Therefore, it is suggested that more experiments and research have to be done to find the physiological causes for the extent of the effects of anemia on fat concentrations.

1. Introduction

Anemia, an old and modern disease that is included in the regulations of the World Health Organization (WHO),

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constitutes a risk factor for the Earth's population, as children are the most susceptible, followed by women, especially pregnant and breastfeeding ones. In men, one of the possible causes of anemia was due to lack of consumption of foods that contain the main components for synthesis red blood cells, such as: proteins, iron, vitamins B12, vitamin C, and folic acid. The reasons for this are due either to ignorance of what foods contain of these components, or as a result of poverty and economic issues. Both, malabsorption that affect the absorptive ability of small intestine and bone marrow dysfunction regarded as the major causes of anemia.[1–6]

This is why anemia is divided into several types, but the most common type is iron deficiency anemia (IDA). It represents 2.4% of people with iron deficiency anemia, and the World Health Organization (WHO) statistics indicate that about 800,000 people died annually[7] due to inability to recover from IDA.[8] The anemia is accompanied by symptoms that directly affect the affected individual, such as chest pain, shortness of breath, fatigue, and muscle fatigue as a result of lack of oxygen and indirectly such as mental weakness, inability to remember, and weak nervous response as a result of a lack of dopaminergic transmission, which will result in pathologic problems, represented by failure to respond, poor concentration, and behavioral disturbance. In addition, the immune system can be also severely affected.[9] The physiological function of the red blood cells is well-known, which is transferring oxygen from the respiratory system to various organs and tissues of living bodies. In order to participate in the process of cellular oxidation, here in people with anemia, level of hemoglobin will decrease, which will affect the amount of oxygen transported to the tissues and thus reduce the energy needed for the body's tissue cells to perform their biological functions.[10] The study was aimed to investigate the relationship between anemia and some lipid parameters in the blood of affected people and to determine the extent of the severity resulting from anemia[11] IDA. The process of digesting the fatty content present in the consumed foods begins through the gastric enzyme lipase, but this digestion is primary, that is, only the disassembly of molecules, then the food emulsion move to the duodenum (the first part of the intestine), and there complete digestion of occurs, via the pancreatic lipase enzyme.[7] after which the lymphatic system transports the digested and absorbed fats to the body's tissues so that they can participate in their biological roles. The recent studies have shown that there is a connection between fats and protein found on the membranes of red blood cells, which gives an indication for the changes in fat concentrations in people who suffer from a deficiency or increase in the number of red blood cells.[12] Human erythrocytes also contain active monomeric lipase (MEL), which is closely associated with the membrane and its active site is extrinsic and has demonstrated the ability of healthy cells to hydrolyze an exogenously added lipid substrate.[13] It is clear that there is a relationship between low levels of red blood cells due to iron deficiency and the significant role of the lipase enzyme and thus the levels of fats and lipoproteins will be affected, and this is what this investigation focus on.

2. Materials and Methods

Sixty samples were collected from adults who do not suffer from chronic diseases in two diagnostic laboratories in Mosul city. After 14 hours of fasting, the sample subjects, who were between the ages of 18-50, the majority of whom were women, their agreement of using the samples in conducting the research was obtained. Then, the samples were taken under optimal laboratory conditions and part of the analysis was completed. The other tests were conducted in the research laboratory at the College of Basic Education at the University of Mosul, and the samples were divided as follows:

1. (a) The first group: - It included (19) samples of people suffering from anemia due to severe iron deficiency.
   (b) The second group: - It included (20) samples of patients with moderate to severe anemia.
   (c) The third group: - It consisted of (21) samples from people who did not have anemia and it was considered as the control group.

2.1. Tests

1. *Hematology tests:* Hemoglobin levels were measured using a German-made Sysmex xp-300 device
2. *Biochemistry tests:* The levels of total cholesterol and LDL were measured using the enzymatic method using reagents from the French company Biolabo, and also using the Japanese UV1800. The lipase enzyme concentration was measured using a Japanese Fuji System DRLCHEM NX500 device. The elements iron and copper levels were measured by absorption in blood serum after the necessary dilution was carried out using an atomic absorption device.

Groups Mean ± SD were calculated for each analysis and a significant change between means was evaluated using a t test, where $P < 0.05$ had a statistic denotation.

3. Results

After collecting the samples and performing the required tests on, then dividing them into the three aforementioned groups, also, after obtaining the arithmetic averages for the results of all tests, a comparison was made between group A and group C, and the statistical value ($p<0.05$) was used as the basis for the significant differences, as shown in the Table 1

Table 1: The differences in variables between the severe IDA group and the control group

Categories	N	Mean ± SD					
		HB %	Lipase U/L	Cholesterol Mg/dl	LDL Mg/dl	Fe Ppm	Cu Ppm
(A)	19	7.94±0.68*	37.15±5.90	194.75±35.45 *	121.15±90.2	3.16±4.02*	3.09±5.96
(c)	21	15.2±0.94	33±4.74	108±42.1	105.6±93.92	8.53±12.009	6.42±2.58

* Significant level at p<0.05

The first table shows the results of the arithmetic mean for all tests and the comparison between group A for those with severe IDA and group C, which is the control group. The average HB% concentration for the first group was low compared to group C with a significant difference (at p<0.05), and this decrease coincided with a significant increase in the cholesterol level (at p<0.05). For group A compared with the control group.

The first table shows the results of the arithmetic mean for all tests and the comparison between group A for those with severe IDA and group C, which is the control group. The average HB% concentration for the first group was low compared to group C with a significant difference, and this decrease coincided with a significant increase in the cholesterol level of group A compared with the control group.

Considering the average estimate of the iron element, the decrease was clear and with a significant effect (p<0.05) in group A compared to group C. As far as the copper element is concerned, it did not decrease significantly and did not constitute a significant difference between the group of people with severe anemia and the control group.

The second table shows the comparison between group B, which represents the group of people with moderate IDA, and group C, which represents the control group. We also notice here that the average HB% concentration in group B is low compared to control group C. Whereas the average cholesterol in the second group is significantly high compared to Control group (at p<0.05). Also, the average lipase did not cause any significant difference between group B and the control group (C) at the significant level (p<0.05).

The average iron concentration in the second group was 5.09±4.71, which is significantly lower than the iron concentration) 11(In the third group, 12.009±8.53.As for copper, the non-significant difference between group B compared to C is similar, and this is also the case when comparing the copper concentration between A and C; As for low-density protein, its concentration in group B was 90.2±130.12, while it was in group C 93.92±105.6. It was high in group B compared to group C, but without significant statistical differences at.

Table 3 shows a comparison between two groups affected by iron deficiency anemia, but the first group A had severe cases of disease, and the second group B had cases ranging from moderate to mild. As the table here shows, the HB% concentration (0.68 ± 7.94) is significantly lower than what was found in the second group (0.56 ± 11.28). As for the rest of the averages, they came in approximate concentrations and there was no significant significance, as it was noted that the decrease in cholesterol in group A compared to B was insignificant, and the difference in the average of lipase and LDL between the first and second groups was also insignificant. The same applies to the iron element, with an average of (4.02±3.16) in Group A and (5.09±4.71) in Group B, and a great convergence in the concentration of the copper element between the two groups. Although the results are almost similar between the two groups and there is no statistically significant difference, it may give an indication of the possibility of people in Group B turning to Group A if they do not comply with treatment.

4. Discussion

The results of the study showed the relationship between severe and moderate anemia, the levels of cholesterol and LDL, and the enzyme responsible for digesting fats, pancreatic lipase, as well. After classified the results into three groups and made a comparison through the results of the arithmetic averages between the groups for all variables, the study was concluded that there was significant differences between the first groups and the third one, the control group, in the percentage of HB%, while the difference was also present and significant when making a comparison between the groups. The second one had the feature of those with intermediate IDA with the control group; This difference was evident in the course of measuring the iron element in the blood serum, and the first group topped the list in terms of low iron levels, followed by the second group, then the control group, whose iron level was within normal limits.

In the figure, the proportions of the variables in the three groups and the amount of variation between them in some variables and convergence in others appear.

Through the results table that shows the comparison between the first group with severe anemia and the control group, it was found that cholesterol was high in the first group compared to the third group, and the condition was also identical between the second group and the control group. This is due to the fact that those suffering from

Table 2: The differences in variables between the moderate IDA infection group and the control group

Categories	N	Mean ± SD					
		HB %	Lipase U/L	Cholesterol Mg/dl	LDL Mg/dl	Fe Ppm	Cu Ppm
(B)	20	0.56 ±11.28	5.35±32	31.36*±201.31	90.2±130.12	5.09*±4.71	3.04±5.12
(c)	21	0.94±15.2	4.74±33	42.1±108	93.92±105.6	12.009±8.53	2.58±6.42

Table 3: The differences in variables between the severe ID A group and the moderate injury group B

Categories	N	Mean ± SD					
		HB %	Lipase U/L	Cholesterol Mg/dl	LDL Mg/dl	Fe Ppm	Cu Ppm
(B)	20	0.56 ±11.28	5.35±32	31.36*±201.31	90.2±130.12	5.09*±4.71	3.04±5.12
(c)	21	0.94±15.2	4.74±33	42.1±108	93.92±105.6	12.009±8.53	2.58±6.42

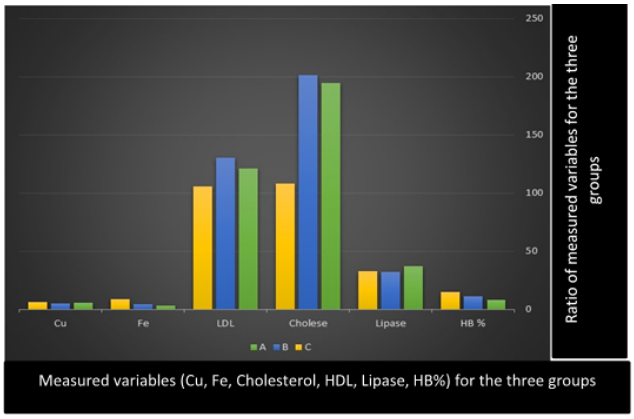

Figure 1:

anemia due to iron deficiency may suffer from a defect in the fat metabolism, which is the result of a defect in hepatic synthesis on one hand, or a change in plasma levels on the other hand, or due to a physiological defect in the functioning of the liver during the period of anemia. This finding is in harmony with other studies in this regard, whereas it may be different from the other studies.

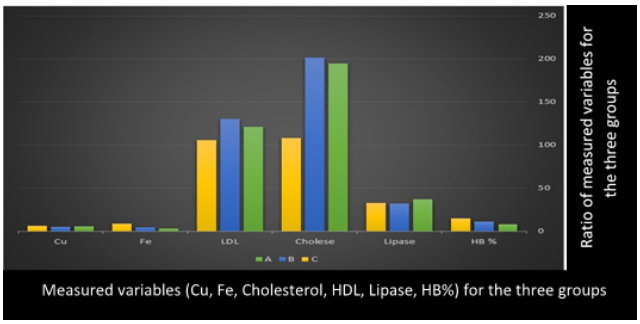

Figure 2:

This significant increase in the two groups suffering from anemia compared separately with the control group showed that there was a slight, non-significant increase in LDL levels, due to the existence of a direct relationship between the TC level and LDL, and this is in accordance with and it differs with.

As for lipase, it was not affected, and there was no significant difference between the groups included in the comparison, but it is possible that the concentration of lipase will be affected if the anemia continues without treatment, and this is what it was mentioned previously.

There is a relationship between red blood cells and lipase in the membrane of red blood cells. Any changes in the rates of red blood cells can affects the level of lipase.

Although the results of the study did not show a significant difference in the levels of copper in the three groups, which could be that copper was not affected by anemia, when checking the results of each group.

It has been noticed that the lower cholesterol level is associated with higher copper level, and this finding is consistent with other world studies. This issue confirms that when copper increases, lead to decrease in the fat accumulation and it increases the muscle mass. Finally, this study reported that a reduced number of blood cells and the blood hemoglobin can cause a major physiological defect in various organs of the body, including the digestive system represented by the intestine, liver, and pancreas, which are responsible for metabolizing fats in the body. There are also many studies on iron deficiency anemia and the differences it causes. In the concentrations of blood parameters and body tissues, this requires further studies on IDA.

5. Conclusion

The results of the study, after comparing the groups, showed a significant increase in cholesterol concentration in people with all groups of anemia and non-significant differences based on statistical significances in the concentration of lipase and low-density lipoprotein in people with anemia compared to the control group. As in copper element, it was non-significantly low in people with anemia, in contrast, the concentration of iron was low and significant in those with

anemia, which is the significant cause of anemia in adults. The study results may agree with previous studies and/ or different from other studies. Therefore, it is suggested that more experiments and research have to be done to find the physiological causes for the extent of the effects of anemia on fat concentrations.

6. Source of Funding

None.

7. Conflict of Interest

None.

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