Iron-Deficient Diet: Effects in Rats and Humans

By Richard M. Kaufman, Simeon Pollack and William H. Crosby

Under normal circumstances the absorption of iron by the intestinal mucosa appears to be controlled chiefly by body iron stores and by the level of erythropoietic activity of the bone marrow.1 In a preliminary communication we have reported the existence of an additional factor which potently influences iron absorption in the rat—lack of dietary iron.2 When normal rats are fed a diet deficient in iron, the absorption of this metal is increased 100 per cent within 5 days. This degree of enhancement of iron absorption is about as great as that which follows brisk hemorrhage.3 Since our initial report we have undertaken a series of experiments in an attempt to define this phenomenon more precisely. In addition, we have extended our studies to human subjects to determine whether or not lack of iron in the diet plays a significant role in the control of iron absorption in man.

METHODS

Animals. Walter Reed Carworth Farm male rats, 200–350 Gm. in weight, were used exclusively. The principles of laboratory animal care as promulgated by the National Society for Medical Research were observed.

Animal Diets. (1) Iron deficient. A dry, powdered diet (containing all nutrients except iron) composed of sucrose, casein, a salt mix, and both fat and water-soluble vitamins was used. The iron content is 3.9 µg./Gm. of diet. A rat eats about 10 Gm. of this diet per day. (2) Standard diet. This commercially available laboratory animal food in biscuit form is composed of protein, carbohydrate, fat, minerals, and vitamins.† Its iron content is approximately 186 µg./Gm., about 48 times the amount of iron that is contained in the iron-deficient diet. A rat eats approximately 10 to 15 Gm. per day.

Determination of Iron Absorption in Animals. Iron absorption was determined in each rat by measuring total body radioactivity utilizing a Packard liquid-scintillation small-animal counter. The dosing solution employed consisted of 250 µg. of FeCl₃ Fe⁵⁹Cl₃ tracer and 1.6 mg. of ascorbic acid dissolved in 0.5 ml. of distilled water. Animals were dosed under light ether anesthesia after a 24-hour fast (water was not withheld). The dosing solution was injected through the esophagus directly into the stomach through a 3-inch, 17-gauge blunted needle. Four hours after dosing and again 8 days later, the total body radioactivity of each rat was determined. A standard solution of Fe⁵⁹Cl₃ in 250 ml. was counted to measure isotopic decay and variations in counter sensitivity. The percentage of iron absorbed was derived thus.

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*See Appendix.
†D & C Dog Foods and Laboratory Animal Foods, Frederick, Maryland.
IRON-DEFICIENT DIET

Count/min. 8 days after dosing (corrected for decay) × 100

Count/min. 4 hours after dosing

equals percentage of iron absorbed.

Determination of Plasma Iron Clearance. Each rat was anesthetized with 15 to 20 mg. of sodium pentobarbital administered intraperitoneally; 0.12 µc. of Fe59 (0.32 µg. Fe59Cl3) was then given intravenously in a lingual vein or the dorsal vein of the penis. Ten minutes after the isotope was injected, a tail vein was incised with a clean scalpel blade and 0.02 ml. of blood drawn up into a Sahli pipette. The blood was transferred into a test tube containing 2 ml. of distilled water. Additional blood samples were obtained in similar fashion at approximately 10 to 20 minute intervals for 1 hour. Bleeding from the tail vein was readily controlled by light pressure applied to the wound.

The radioactivity of each sample was measured in a Packard autogammar scintillation counter. Enough counts were obtained to allow a maximum counting error of ±2 per cent. The counts obtained were corrected for background, the results plotted on a semi-log graph, and the half-life of the plasma Fe59 determined.

Serum iron determinations were made on a group of rats deprived of iron for 14 days and control rats. The daily iron turnover was computed as follows:

\[
\frac{[\text{plasma iron (µg./ml.)}] [\text{plasma volume}] [0.693] [\text{No. min. in day (1440)}]}{\text{plasma iron59 half-life (minutes)}}
\]

equals 24-hour plasma iron turnover.

Controlled Phlebotomy Technic. A 75 mm. heparinized glass capillary tube, outside diameter 1.55 mm., was inserted 2 mm. into one end of a 30–35 cm. length of #200 polyethylene tubing and calibrated with 0.3 ml. fluid; the point in the tubing where the column of fluid ended was marked. Weight determinations revealed a volume error of less than 2 per cent. With the free end of the polyethylene tubing held in the mouth, the glass capillary tube was inserted into the orbital sinus of an anesthetized rat. Suction was then applied gently as blood entered the capillary tube and was drawn up to the 0.3 ml. mark. The rate of bleeding was controlled by the amount of suction applied, in most cases. As soon as the appropriate amount of blood was removed, the capillary tube was quickly withdrawn from the eye socket and digital pressure applied to the orbit.

Human Studies. Human subjects consumed an iron-deficient diet consisting of the following foods (See Appendix for iron content): cottage cheese, ice cream, egg white, sugar, marshmallows, grape jelly, gelatin (Jello), beer, milk and Pepsi Cola. This diet contained approximately 10 per cent of the iron present in the diet normally consumed. Both subjects selected their daily diet from the above list ad lib. Two injections of a vitamin mixture (Berroca C) were given during the course of the diet to prevent vitamin depletion.

Iron absorption was determined in a whole-body liquid scintillation detector with 4π geometry. After an overnight fast, subjects were dosed with a solution consisting of 0.15 µc. Fe59 ferrous citrate tracer and 1.0 mg. of ferrous sulfate carrier in 50 ml. distilled water. Food was withheld for an additional 2 hours. Four hours after dosing, total body radioactivity was measured. Counting was repeated 10 days later to determine the percentage of radioactivity retained in the body. An Fe59 standard was counted on each occasion.

Prior to the second dosing each subject was “precounted” to determine residual body radioactivity remaining from the first absorption study, and appropriate corrections were made for the residual radioactivity in computing the amount of iron absorbed in the second study. Counting error was ±5 per cent or less. Counts were corrected for isotopic decay and iron absorption was computed as follows:

\[
\frac{\text{Counts/minute (corrected for decay) present 10 days after dosing}}{\text{Counts/minute present 4 hours after dosing}} \times 100
\]

equals percentage of iron absorbed.
Experiments and Results

Experiment 1. Effect of Iron-Deficient Diet on Iron Absorption

Rats were divided into 12 groups, 6 experimental and 6 control, each containing 10 to 12 rats. Experimental groups (E) were fed iron-deficient diet and control groups (C) were fed standard diet.

Group 1E and 1C received their respective diets for 1 day, were fasted 1 day, and dosed with FeSO₄ as outlined above.

Group 2E and 2C received their respective diets for 2 days, were fasted 1 day, and dosed.

Group 3E and 3C received their respective diets for 3 days, were fasted 1 day, and dosed.

Group 4E and 4C received their respective diets for 4 days, were fasted 1 day, and dosed.

Group 5E and 5C received their respective diets for 13 days, were fasted 1 day, and dosed.

Group 6E and 6C received their respective diets for 29 days, were fasted 1 day, and dosed.

As depicted in Figure 1, iron absorption was not significantly affected by the iron-deficient diet until the rats had received the diet for 4 days, at which time absorption suddenly doubled. After 13 days iron absorption was increased more than fourfold; by 30 days, fivefold. Note that since all animals were fasted 24 hours prior to dosing, the total period of iron deprivation was 1 day more than the number of days of diet feeding.

The variation in the iron absorption of control animals in different experiments requires comment. Each single experiment began with a new batch of rats separated into control and experimental groups with careful attention to randomization. The control rats of different experiments came from different litters and comparison is hazardous because non-random selection was not precluded. Also, the fifth and sixth groups were more mature than groups 1 through 4, and this undoubtedly contributed to the difference in absorption of control animals.

Experiment 2

From the results of Experiment 1 it appeared that a rat must be deprived of iron for a minimum of 5 days before iron absorption is increased. However, it is known that iron absorption will not change until 4 days after a potent stimulus, such as bleeding¹,₆,⁷ or hemolysis.⁸ If a period of iron lack of fewer than 4 days is capable of stimulating iron absorption, it might not be revealed in the 1, 2 and 3 days of iron deprivation of Experiment 1. To determine further the minimum period of iron deprivation capable of affecting iron absorption the following experiment was performed:

Fifty rats were divided into 5 groups and maintained on a feeding schedule that allowed for 1, 2 and 4 days of iron deprivation followed by an appropriate time on regular diet before testing iron absorption (Table 1). As shown in the
last column in Table 1, iron absorption was not significantly altered by iron-deficient feedings for 1- or 2-day periods, but was increased twofold after 4 days of such feedings. We conclude that it takes a minimum of 5 days of dietary iron lack to provoke increased iron absorption.

Experiment 3. Effect of Adding Iron to Iron-Deficient Diet

In order to ascertain that it was the lack of iron and not some other factor in the diet which was responsible for enhancing iron absorption, finely powdered FeSO₄ was added to the iron-deficient diet in amounts equal to that in the standard diet. This diet was fed to a group of 12 rats for 7 days, after which they were fasted and dosed with Fe⁵⁹. A control group of 12 rats received the standard diet simultaneously for 7 days, was fasted, and dosed.

No enhancement of iron absorption was observed in rats fed the iron-augmented diet for 7 days. Control rats absorbed 18.9 ± 7.9 per cent of the administered dose of iron, while experimental rats absorbed 17.8 ± 6.1 per cent.
Table 1.—**Determination of the Minimum Period of Iron Deprivation Capable of Affecting Iron Absorption**

<table>
<thead>
<tr>
<th>Group</th>
<th>No. Days of Iron-deficient Diet</th>
<th>No. Days of Standard Diet*</th>
<th>Per Cent Mean Iron Absorption</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>3</td>
<td>18.0 ± 9.2</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>2</td>
<td>17.2 ± 7.3</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>0</td>
<td>28.5 ± 8.6</td>
</tr>
<tr>
<td>D (Control)</td>
<td>0</td>
<td>4</td>
<td>15.0 ± 2.1</td>
</tr>
<tr>
<td>E</td>
<td>Fasted 1 day instead of diet</td>
<td>3</td>
<td>18.9 ± 5.6</td>
</tr>
</tbody>
</table>

*At the completion of the feeding schedule all rats were fasted for 24 hours and then dosed with Fe**59.**

**Experiment 4. Effect of Different Protein Source in Iron-Deficient Diet**

To evaluate the possibility that casein might be unique in its effect on iron absorption the iron-deficient diet with egg albumin substituted for casein was fed a group of 10 rats for 6 days. The animals were then fasted and dosed as usual. Nine control animals received the standard diet in parallel.

When egg albumin was substituted for casein in the iron-deficient diet, iron absorption was still enhanced. Rats receiving this diet for 6 days absorbed 25.7 ± 4.2 per cent of the dose of iron as compared to 18.4 ± 10.3 per cent for controls. This difference is significant at the 1 per cent level. The increase in iron absorption produced by the egg-white diet was of less magnitude, however, than that produced by the casein diet. This may be attributable to the fact that egg albumin is a nutritionally less adequate protein than casein. Despite its nutritional inadequacies, egg albumin was utilized for comparison with casein because other commercially available proteins were found to be contaminated with relatively large amounts of iron and were unsuitable for an iron-deficient diet.

**Experiment 5. Persistence of the Effect of Dietary Iron Deprivation**

The persistence of increased iron absorption after dietary iron deprivation was investigated. Rats were fed the iron-deficient diet or regular diet for 13 days. At the end of the 13-day interval, one day of fast was imposed.

Group 1E, 1C were then fed standard diet for 1 day, fasted 24 hours, and dosed.

Group 3E, 3C were fed standard diet for 3 days, fasted 24 hours, and dosed.

Group 5E, 5C were fed standard diet for 5 days, fasted 24 hours, and dosed.

The effect on iron absorption of an iron-poor diet was short-lived; absorption, which is augmented more than fourfold after 14 days of iron deprivation, returned to control levels after 3 days exposure to the standard diet (Table 2). Iron absorption was also normal when tested after 5 days exposure.


Twenty rats were injected intramuscularly with 50 mg. of iron as iron-
Iron-Deficient Diet

Table 2.—Persistence of Effect of Iron Deficient Diet on Iron Absorption after Return to Standard Diet

<table>
<thead>
<tr>
<th>Duration</th>
<th>Per Cent Iron Absorption</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fed standard diet 1 day</td>
<td></td>
<td>30.3 ± 8.8</td>
<td>16.8 ± 6.2</td>
</tr>
<tr>
<td>Experimental* (14)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control† (11)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fed standard diet 3 days</td>
<td></td>
<td>15.8 ± 8.0</td>
<td>16.4 ± 5.9</td>
</tr>
<tr>
<td>Experimental* (12)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control† (12)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fed standard diet 5 days</td>
<td></td>
<td>15.2 ± 5.9</td>
<td>14.9 ± 5.8</td>
</tr>
<tr>
<td>Experimental* (12)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control† (11)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Experimental rats were deprived of dietary iron for 13 days, fasted 24 hours, and then returned to standard diet as indicated.
†Control rats were maintained on the same feeding schedule, receiving only the standard diet. The number of animals in each group is given in parentheses.

dextran complex (Imferon) and maintained on a standard diet. Twenty-two days later the rats were divided into 2 equal groups. The experimental group was fed iron-deficient diet for 6 days, fasted 24 hours and dosed. The control group was fed the standard diet for 6 days, fasted 24 hours and dosed.

The iron-deficient diet had no effect on the absorption of iron in iron-loaded rats. The experimental group absorbed 7.4 ± 1.3 per cent of the test dose while the control group absorbed 6.5 ± 1.1 per cent.

Experiment 7. Effect of Iron-Deficient Diet on Plasma Clearance of Fe$^{59}$

The plasma clearance of Fe$^{59}$ was determined in 3 groups of rats maintained as follows:

Group A, 10 rats fed iron-deficient diet for 6 days, then fasted 24 hours.
Group B, 14 rats fed iron-deficient diet for 13 days, then fasted 24 hours.
Group C, 15 control rats maintained on the standard diet and fasted 24 hours prior to testing.

Plasma iron$^{59}$ clearance was unaffected by an iron-deficient diet. The average plasma T/2 of injected iron$^{59}$ in the 2 groups of rats fed iron-deficient diet for 6 and 13 days, respectively, was 72 minutes; the average T/2 for controls was 65 minutes (Figure 2). There is no significant difference between these figures.

Serum iron values of rats deprived of iron for 14 days were unchanged from the normal (Table 3). Daily plasma iron turnover was similarly unaffected by the iron-deficient feedings, averaging 111 µg. of iron per day in iron-deprived rats and 119 µg. per day in controls.

Experiment 8. Effect on Iron Absorption of Comparable Iron Loss by Bleeding

In an effort to reduce body iron by an amount equivalent to that which would be lost during 5 days of iron deprivation, rats were bled a total of 6.2 per cent their body iron over a 4-day period and iron absorption measured 24 hours later.
Fig. 2.—Plasma Fe$^{19}$ Clearance of Rats Fed Iron-Deficient Diet for 6 and 13 Days (Experimental Groups) and of Rats Fed Standard Diet (Control Groups). No significant difference in the half-life of Fe$^{19}$ was observed from one group to the other.

The figure 6.2 per cent of body iron was arrived at in the following manner. The rat loses 0.23 per cent of his body iron per day, and almost 1.15 per cent in 5 days. Since rats of the size used in this study gain weight at approximately 1 per cent per day, after 5 days they are 5 per cent heavier. If body iron is linearly related to body weight, then body iron should also be increased 5 per cent during this period. We assume that no iron is absorbed during the administration of the iron-deficient diet and, therefore, rats deprived of iron for 5 days suffer a maximum net body iron deficit of 5.0 per cent plus 1.15 per cent = 6.2 per cent.

Table 3.—Serum Iron Concentrations of Rats Deprived of Dietary Iron for 14 Days (Experimental) and Rats Fed a Standard Diet During that Time (Controls)

<table>
<thead>
<tr>
<th></th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 µg./100 ml.</td>
<td>99</td>
<td>115</td>
</tr>
<tr>
<td>149</td>
<td>134</td>
<td>149</td>
</tr>
<tr>
<td>93</td>
<td>111</td>
<td>113</td>
</tr>
<tr>
<td>131</td>
<td>149</td>
<td>158</td>
</tr>
<tr>
<td>181</td>
<td>115</td>
<td>137</td>
</tr>
<tr>
<td>164</td>
<td>164</td>
<td>134</td>
</tr>
</tbody>
</table>

Mean = 129       Mean = 123
Table 4.—The Effect of Iron-Deficient Diet on Iron Absorption in Human Subjects

<table>
<thead>
<tr>
<th></th>
<th>Per Cent Iron Absorbed at Start of Test Diet</th>
<th>Per Cent Iron Absorbed at End of Test Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 1</td>
<td>24.5</td>
<td>17.8</td>
</tr>
<tr>
<td>Subject 2</td>
<td>3.8</td>
<td>6.1</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject 1</td>
<td>8.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Subject 2</td>
<td>21.0</td>
<td>24.3</td>
</tr>
</tbody>
</table>

Body iron is 4.2 mg. per 100 Gm. body weight for the rat;10 a 230 Gm. rat contains 9.7 mg. of iron. The amount of iron lost during 5 days of iron deprivation would be 6.2 per cent of 9.7 mg. = 0.60 mg. Based on the average values of a hematocrit of 50 and a hemoglobin concentration of 15 Gm. per 100 ml. for healthy rats, the amount of whole blood containing 0.60 mg. iron is 1.20 ml.

Thirty rats, average weight 230 Gm., were chosen for study. Twenty were bled under light ether anesthesia of 0.3 ml. of whole blood daily for 4 days, fasted 24 hours, and dosed. Control rats were not bled but were anesthetized at the time of each phlebotomy. Both groups of rats were fed standard diet. Seven of the experimental rats were discarded in the course of the repeated phlebotomies because of difficulties encountered during the bleeding.

Loss of at least 1.2 ml. of blood over a 4-day period did not significantly alter iron absorption. Bled rats retained 17.4 ± 6.5 per cent of the dose of iron, while control rats retained 14.8 ± 3.9 per cent. This was not a significant difference. When an equivalent loss of iron is imposed by a single phlebotomy, absorption is known to increase.12


Four healthy adult men, ranging in age from 25 to 37 years, were studied. The iron absorption of each man was measured at the beginning of the experiment. Two subjects were then fed an iron-poor diet for 13 days; the other 2 continued their normal diet. At the completion of the test period all subjects were fasted overnight and iron absorption was again measured.

The iron absorption of the experimental and control subjects was not significantly altered (Table 4). Thus, ingestion of an iron-poor diet for 13 days did not enhance the absorption of iron in man as it did in the rat.

**DISCUSSION**

Iron in the diet appears to play a significant role in the control of iron absorption of the normal rat. When this metal is lacking in otherwise nutritious diets, its absorption is progressively enhanced. This enhancement of absorption is not observed until rats have been deprived of iron for 5 days, at which time absorption is doubled. After 14 days of iron deprivation, absorption is increased more than fourfold (Figure 1). This increase is truly related to iron lack per se and is not due to an effect of any of the constituents of the iron-
deficient diet because iron absorption is not enhanced when iron is added to the iron-deficient diet. Moreover, substitution of the protein source in the iron-poor diet does not prevent an increase in iron absorption from occurring.

The effect of the iron deficient diet on iron absorption is short-lived. Exposure to the ordinary amounts of dietary iron in the standard diet after a 2-week period of iron deprivation reduces iron absorption to normal levels in 3 days. Even when dietary iron deficiency is extended over a period of 3 to 10 months, as in Bannerman’s studies, iron absorption returns to control levels after 5 days feeding of an iron-replete diet.

How then does a severe decrease in dietary iron stimulate the gut to absorb more iron? It does not appear that the erythropoietic activity of the bone marrow is involved, for erythropoiesis, as measured by plasma iron clearance and plasma iron turnover, is unaffected by an iron-deficient diet. Is body iron loss involved? Certainly it is possible that a sufficient deficit of total body iron might accrue during iron-deficient diet feedings to provoke an increase in iron absorption. But a gradual loss of 6.2 per cent of body iron from the red cell mass does not measurably affect iron absorption; nor does an equivalent loss of hepatic iron. These findings suggest that total body iron depletion is of less importance in regulating iron absorption than is specific or localized iron pool depletion. Thus, if the increased iron absorption resulting from iron deficient diet is related to iron loss, as seems likely, the iron must be lost from a pool which is exclusive of the hepatic and erythrocytic pools, and which is many times more sensitive than either to changes in its iron content.

It has been suggested that this specific pool resides in the intestinal mucosa and that the concentration of epithelial iron regulates iron absorption; our results are consistent with this hypothesis. But, the gut epithelium is renewed three times over in the 5-day interval that necessarily precedes the increased iron absorption induced by dietary iron deprivation. This obligatory lag suggests that there may be more to the control of iron absorption than simple depletion of epithelial iron.

The lack of dietary iron appears to be of little importance in the control of iron absorption of humans, in contrast to the rat. As demonstrated in Experiment 9, no significant alteration in iron absorption developed in 2 human subjects fed an iron-poor diet for 13 days. It is possible that the difference between rats and men is linked to the disparity in the daily requirement for iron and in the fractional excretion rates of the two species. It is assumed that adult humans are in iron balance. Rats are continuously growing and are presumably in positive iron balance; thus, their need for iron is comparatively greater than man’s. Further, rats excrete iron much more rapidly than do humans: rats lose 0.23 per cent of their body iron per day; humans lose 0.10 per cent per day. Thus, it takes man 23 days to excrete the same proportion of body iron the rat loses in 1 day. Extrapolation would indicate that man would thus have to be deprived of iron for 115 days to acquire a net iron deficit comparable to that which the rat acquires in 5 days of iron-deficient feeding.
IRON-DEFICIENT DIET

APPENDIX

1. Iron-Deficient Diet for Rats

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sucrose</td>
<td>72.0</td>
</tr>
<tr>
<td>Casein</td>
<td>20.0</td>
</tr>
<tr>
<td>Salt mix</td>
<td>4.0</td>
</tr>
<tr>
<td>Wesson Oil mix</td>
<td>3.0</td>
</tr>
<tr>
<td>Vitamin mix</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Salt Mix Contents

CaCO₃ 55.350
K₂PO₄ 21.750
KCl 11.400
NaCl 7.050
MgCO₃ 2.550
MgSO₄·7H₂O 1.650
NaF 0.100
CuSO₄ 0.090
MnSO₄ 0.035
AIK (SO₄)₂ 0.017
KI 0.008

2. Iron-Deficient Diet for Humans: Iron Contents

<table>
<thead>
<tr>
<th>Food</th>
<th>µg Fe/Gm. Wet Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg albumin</td>
<td>2.42</td>
</tr>
<tr>
<td>Grape jelly</td>
<td>2.53</td>
</tr>
<tr>
<td>Cottage cheese</td>
<td>0.59</td>
</tr>
<tr>
<td>Vanilla ice cream</td>
<td>0.89</td>
</tr>
<tr>
<td>Gelatin (Jello)</td>
<td>0.65</td>
</tr>
<tr>
<td>Marshmallow</td>
<td>7.75</td>
</tr>
<tr>
<td>Sugar</td>
<td>0.000</td>
</tr>
<tr>
<td>Milk</td>
<td>0.52</td>
</tr>
<tr>
<td>Beer</td>
<td>1.59</td>
</tr>
<tr>
<td>Pepsi Cola</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Foods were digested in HNO₃, H₂SO₄ and H₂O₂ and iron concentrations determined by Ramsay’s method.

SUMMARY

1. Iron absorption in rats is increased by dietary iron deprivation.
2. Erythropoiesis in the rat is unaffected by dietary iron deprivation that increases iron absorption by more than a factor of four.
3. Iron absorption is not increased in rats bled of an amount of iron equivalent to that lost in 5 days of iron deprivation.
4. These findings are compatible with the concept that iron-absorption is controlled by depletion of iron from a specific pool, separate from the hepatic and erythrocytic iron pools.
5. Iron absorption in human subjects was unaffected by dietary iron deprivation for 13 days. Reasons for differences between human and rat results are discussed.
SUMMARIO IN INTERLINGUA

1. Le absorption de ferro in rattos es augmentate per un privation de ferro in le dieta.

2. Le erythropoiese in le ratto non es afficite per un privation de ferro in le dieta le qual resulta in un augmento del absorption de ferro per plus que un factor de quatro.

3. Le absorption de ferro non es augmentate in rattos qui ha perdite per exsanguination un quantitate de ferro equivalente a illo perdite in 5 dies de privation de ferro.

4. Iste constatationes es compatible con le conception que le absorption de ferro es regulate per le depletion del ferro proveniente ab un pool specific que es separate ab le pools de ferro in le hepate e le erythrocytos.

5. Le absorption de ferro in subjectos human non esseva afficite per un privation de ferro in le dieta durante 13 dies. Es commentate le rationes possibilemente explicatori del differentias inter le resultatos in humanos e in rattos.

REFERENCES


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Iron-Deficient Diet: Effects in Rats and Humans

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