

## MANGANESE DISTRIBUTION IN THE TISSUES OF SHEEP AND POULTRY

*By*

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### Summary

Six fat tailed Ossimi rams and thirty six Fayoumi cocks were experimented on to study the manganese distribution in sheep and poultry fed on different dietary levels of the mineral. Three months after the beginning of the experiment, rams and cocks were sacrificed and samples were taken from most tissues for chemical determination of manganese.

The results indicate that manganese level in the diet had a large effect on its concentration in the soft tissues of both sheep and poultry. The kidney and liver contained the high amounts of manganese, while spleen, brain, heart, muscles, and blood contained low levels. The data cleared out that bones can be considered as a manganese storage place in the body while the bile is a pathway for manganese excretion in both rams and cocks.

### Introduction

The distribution of manganese among the organs of the body has been studied in great details in the rabbit by Fore and Morton (6) and in man by Tipton and Cook (13). It was found that the bones, liver, kidney, pancreas, and pituitary gland normally carry high concentrations than do other organs and that the skeletal muscles are among the lowest in manganese of the tissues of the body. In some of these organs, notably the liver and bones, the levels can be raised or lowered by varying the manganese intake of the animal. This has been demonstrated in the rat (10), rabbit (4), pig (9), and chick (8).

This study was carried out to determine the distribution of manganese in the body of rams and cocks fed on different dietary levels of manganese.

### Materials and Methods

Six Ossimi rams and thirty-six Fayoumi cocks (Native Egyptian breed) were experimented on. Rams were divided into groups of three pairs. The daily rams, rations were as shown in table 1

TABLE 1  
Daily rations of rams in different treatments.

Item	Normal ration	Supplemented ration	Deficient ration
Clover hay (g.) . . . . .	1250	1250	—
White corn (g.) . . . . .	—	—	800
Mn sulfate (mg.) . . . . .	—	100	—
Mn in the ration (P.P.M.) .	87.4	117.0	7.2

Water was offered ad libitum for each group.

The cocks were housed in groups of twelve. Feed and water were supplied ad libitum. The per cent composition of the diet of the three groups are given in Table 2.

TABLE 2  
Different ingredients in diets of the three groups.

Ingredients	Group I *	Group II **	Group III
Rice bran . . . . .	50	50	—
Barley grains . . . . .	30	30	—
Corn grains . . . . .	20	20	100
Mn sulfate (g/kg) . . . . .	—	0.1	—
Mn in the ration (P.P.M.)	54.1	90.5	6.5

(\*) It contained the normal level of manganese (50-80 P.P.M.) according to Morrison (11), and Ewing (5).

(\*\*) It was preferable to use a purified diet, but this was not available.

Three months after the beginning of the experiment, rams and cocks were sacrificed and samples were taken from most tissues for chemical determination of manganese. The A.O.A.C (2) periodate method for colorimetric estimation of manganese in animal tissues was applied.

### Results and Discussion

The manganese distribution data obtained expressed as p.p.m. per gram of fresh tissue are presented in Fig. 1 for rams and Figure 2 for cocks. In rams, it is apparent that there are tremendous differences in tissue distribution of the manganese, the lung containing the least amount of any tissue tested followed by the biceps and gastrocnemius muscles

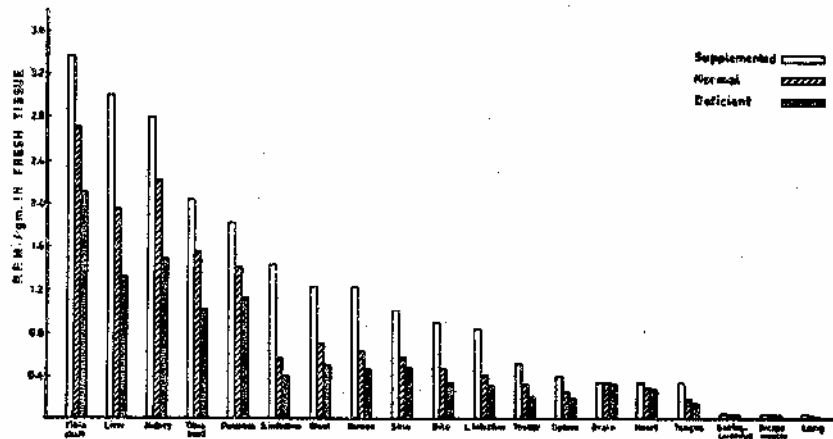


Fig. (1) Manganese distribution in the tissues of rams fed on different levels of the mineral.

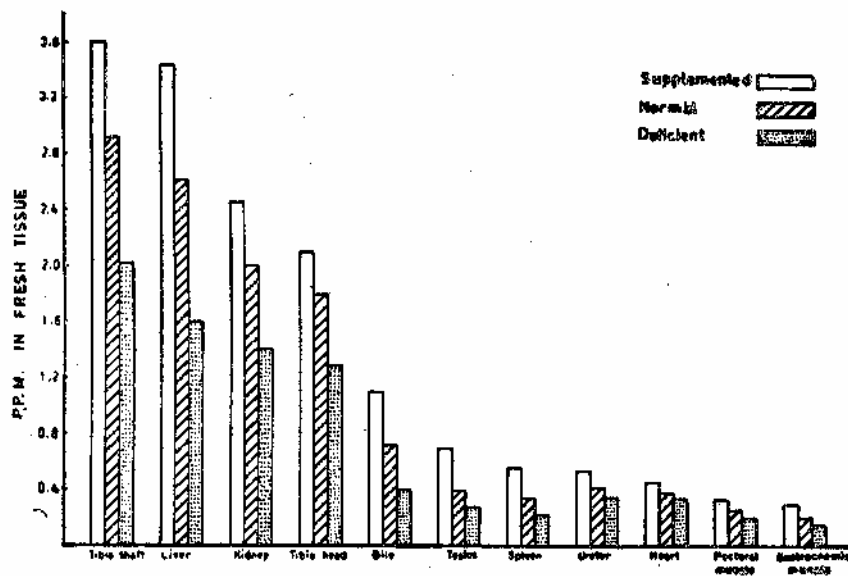


Fig. (2) Manganese distribution in the tissues of cocks fed on different levels of the mineral.

respectively. The kidney and liver appeared to contain large amounts of manganese. Of the soft tissues tested in cocks, the liver contained the greatest amount of manganese followed by the kidney, bile, and others with the muscles and blood containing very small amounts.

The results indicate that bones can be considered as a manganese storage place in the body. This is in good agreement with the findings of Greenberg *et al.* (7), Fore and Morton (6), and Underwood (14). The high level of manganese found in the bile of the supplemented group in both rams and cocks points out that the bile is a pathway for manganese excretion. In this connection, Cotzias (3) has pointed out that manganese may be excreted in the bile as a choline complex, as well as bilirubinate, since choline is excreted in the bile and has a structure which should permit the ready formation of a coordination compound with this metal.

The data obtained clarify that the dietary manganese level in the ration greatly influences the concentration of manganese in different tissues. Manganese content was the least in the tissues of deficient rams and cocks, while it was the highest in the supplemented ones. It was of significance that rams' brains were the least affected by deficiency, while tibia head, lung, tibia shaft and blood were severely affected.

It is interesting to note that during dissection for preparing the analyzed tissues the deficient group appeared to contain more fat than the normal one, while the supplemented group in either rams or cocks were nearly free of fat. This is in good agreement with that found by Plumlee *et al.* (12) with pigs. In this connection Amdur *et al.* (1) showed that manganese supplements and choline supplements were both capable of reducing reducing liver and bone fat in manganese deficient rats. However, further investigations should be carried out to study the lipotropic action of manganese.

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## دراسة تأثير مستوى المنجنيز فى الغذاء على كميته فى الانسجة المختلفة للاغنام والطيور

### الملخص

استخدمت التجربة ستة كباش أوسيمى وستة وثلاثون ديكا فيوميا وقسمت الى ثلاث مجاميع متساوية. غذيت المجموعة الاولى على غذاء به مستوى عادى من المنجنيز، والثانية على مستوى مرتفع ، أما المجموعة الثالثة فقد غذيت على مستوى فقير . ولقد استمرت التغذية على هذه العلائق لمدة ثلاثة أشهر . وفى نهاية فترة التغذية ذبحت الكباش والديوك واخذت عينات من معظم الانسجة لتقدير المنجنيز فيها .

ولقد أوضحت النتائج ان مستوى المنجنيز فى العليقة له تأثير كبير على مستواه فى الانسجة المختلفة وكانت فى كل الاحوال أعلى ما يمكن فى أنسجة المجموعة التى أعطيت غذاء غنيا فى المنجنيز وأقلها فى الانسجة المقابلة فى المجموعة التى تناولت عليقة فقيرة فى المنجنيز . ولقد وجد أن الكليتين والكبد تحتوى على أعلى نسبة من المنجنيز بينما احتوت الرئتان والقلب والعضلات والدم على أقل نسبة منه . كما بينت النتائج ان العظام يمكن اعتبارها مخزن المنجنيز فى الجسم بينما المرارة هى طريق لايخراج المنجنيز من الجسم .