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For some time past this writer has been interested in the potassium content of muscle. When this interest was first aroused he became aware of the need for a satisfactory method for determining quantitatively the amounts of potassium in a given muscle. So there ensued a search of the literature. This yielded three fundamental methods, each of which had its advantages and disadvantages. The Perchlorate and the Chloroplatinate methods were not used because of the technical difficulties presented by them. Jacobs and Hoffman (1931) had used the Cobaltinitrite methods with muscle and had obtained good results. So their method was used for the problem at hand. This method required that the material to be analysed was ashed for several hours in a muffle furnace at extremely high temperatures to destroy the organic material. The ash that was left was then dissolved in distilled water. To this solution of ash then was added an excess of the sodium cobaltinitrite reagent. The resulting solution was allowed to stand five minutes and then centrifuged for 15 minutes. The supernatant fluid was then discarded and the precipitate was washed with a few c.c.'s of 70% alcohol. Then the ash was redissolved in 2 ml. of boiling water and allowed to cool. To it was added the 2 c.c.'s of 1% chlorine chloride solution and 2 c.c.'s of 2% sodium ferrocyanide solution. This solution was then diluted to 6 c.c.'s with distilled water. If there was potassium present the solution turned green immediately and the depth of this green color is proportional to the concentration of the potassium. The color of the solution was then compared with a standard potassium solution in a colorimeter.

One of the major difficulties in this method is the ashing of the muscle. If it is done too rapidly the inorganic material might volitilize and if it is not heated to a high enough temperature the organic material might not be completely destroyed. The process of ashing takes up to four hours allowing time for the material to cool after ashing. Another source of error in the above method is that the use of the colorimeter is too subjective: a color which might appear to match exactly at one moment might be found not to match at a later time. Furthermore the additional processes which the material must undergo must, by definition, introduce additional sources of error.

To avoid some of the above pitfalls, the following method has been adopted. The results obtained with it appear to be more accurate, and the results are more consistent within themselves.

The muscle is placed in a Waring Blender together with a small amount of distilled water where it is macerated. To the resulting fluid is added more distilled water and allowed to stand for a half hour, after which it is filtered. The filtrate is then placed in additional distilled water and allowed to stand for a half hour and again filtered. This is repeated once more. The distilled water leeches out the inorganic ions from the protein complexes. The collected liquid is then refiltered and treated with acetic acid in order to precipitate any protein which might be present and refiltered. To this acidified mixture is added an excess of the sodium cobaltinitrite reagent and is allowed to stand for 15 minutes. It is then filtered through a glass filter, dried and weighed. Since all quantitative methods are in the final analysis based on gravimetric techniques, it has been found advisable to make the direct weighings.

In this procedure the potassium is precipitated as the complex, potassium sodium cobaltous nitrite: $K_3NaCo(NO_2)$ 6, of which 17.93% is potassium, therefore 17.93% of the weight of the precipitate is potassium. When that is correlated with the weight of muscle used, one can then determine the milligram % of potassium in muscle.

This modification of the Cobaltinitrite Method has the following advantages:

1) requires approximately three hours less time
2) does not require as many steps, therefore avoiding additional sources of error
3) weighing is done directly with an analytical balance and thus inherently more accurate.

Bibliography

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