

THE MANAGEMENT OF ^{45}Ca UPTAKE IN SKELETAL, CARDIAC AND SMOOTH MUSCLE TISSUE IN RATS OF DIFFERENT AGES. THE IMPACT OF ACUTE AND LONG TERM TREATMENT WITH D3 VITAMIN

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Abstract

The aim of the present study was to investigate the effect of acute and long term treatment with D3 vitamin upon 40 Wistar rats aged between 6-24 months old. Significant modification in ^{45}Ca uptake in striated muscle from young rats with acute and long term treatment with D3 - vitamin has been noticed. Acute and long term treatment with D3 - vitamin in old rats determined an increase in ^{45}Ca at the level of heart and aorta. The results have an important clinical significance in administration of D3 - vitamin in aging people because of the Ca accumulation danger on cardiac muscle and aorta leading to acceleration of functional disorders of the cardiovascular system affected by atherosclerosis process.

Key words: vitamin D3, ^{45}Ca uptake, skeletal muscle, cardiac muscle, smooth vascular muscle, aging

INTRODUCTION

It has been well-established that vitamin D plays an essential role in the regulation of calcium and phosphate homeostasis and in bone development and maintenance (DeLuca, 2004). Classically, vitamin D is known to exert its actions on target organs, such as the intestine, the kidney, the parathyroid glands, and bone. Over the last two decades, however, there has been increasing evidence that vitamin D plays an important role in many other tissues including skeletal muscle. Early clinical descriptions of a reversible myopathy associated with vitamin D deficiency and/or chronic renal failure recognized a potential association between vitamin D and muscle (Boland, 1986). The identification of the vitamin D receptor (VDR) on muscle cells (Zanello et al., 1997; Bischoff et al., 2001) provided further support for a direct effect of vitamin D on muscle tissue.

The aim of study was to investigate the effect of acute and long term treatment with D3 vitamin upon Ca uptake in rat heart, skeletal and smooth vascular muscle.

MATERIAL AND METHOD

Animals groups: Our study has been conducted on 60 female Wistar rats divided into two groups: 30 young (6 months old) and 30 old (24 months old).

From these, 20 controls rats have been used (10 young & 10 old), 20 rats with acute treatment with D3 - vitamin, 20 with cronical treatment with D3 - vitamin. D3 vitamin (600.000 U) has been diluted 1/10, 0.1ml has been used for i.m. injection/animal according with the experimental model used in our laboratory.

For radioisotope studies of ^{45}Ca uptake experiments we have used fragments of skeletal, cardiac & smooth muscle from young & old rats wit acute and long term treatment with D3 - vitamin. The fragments have been incubated at 37⁰ C for an hour in IC₆₅. The tissue fragments have been incubated with ^{45}Ca with an overall activity of 1.79 mCi / ml. The working solution was of 90 uCi / ml using 10 ul / sample according to the described protocol (F. Revnic R.J.G.G 3,8,27 1987).

Radioactivity has been estimated using a Beta Berthold liqid scintillator counter.

RESULTS AND DISCUSSIONS

Long term treated rats with D3 vitamin have shown an increase in ^{45}Ca uptake in skeletal muscle which may represent two different processes:

- 1 - Ca binding to the extracellular compartment of the transport of calcium in cell;
- 2 - the sequestration of Ca in subcellular compartment.

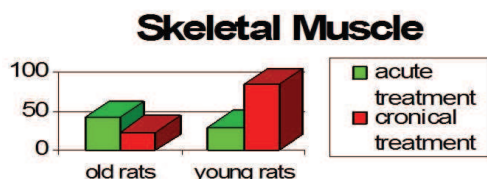


Fig. 1. ^{45}Ca uptake by skeletal muscle from young and old rats with acute and long term treatment with D3 - vitamin.

Fig. 2 presents ^{45}Ca uptake by the cardiac muscle histogram from young and old rats with acute and long term treatment with D3 vitamin. A reduction in ^{45}Ca uptake in young rats with acute and long term treatment versus old rats has been observed.

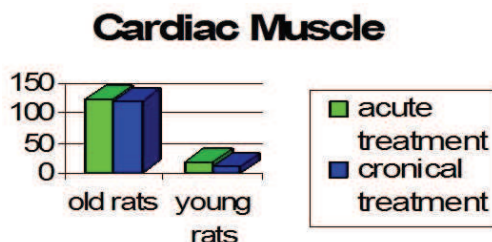


Fig. 2. ^{45}Ca uptake by cardiac muscle from young & old rats with acute and long term treatment with D3 vitamin.

The results have a clinical significance for D3 vitamin administration in elderly patients because of the Ca accumulation danger in cardiac cell, which leads to functional perturbations of the heart by deviation of mitochondrial activity of ATP synthesis towards the removal of Ca excess from mitochondria.

Fig. 3 presents the mean values of ^{45}Ca uptake from young and old rats with acute and long term treatment with D3 vitamin.

In young rats a reduction in Ca has been observed versus old rats accounting for the existence of a defencing mechanism at the aorta level towards accumulation of ^{45}Ca while, in old rats an increase has been observed.

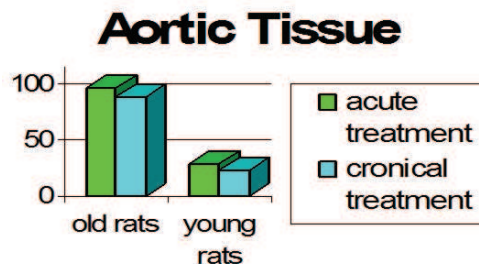


Fig. 3: ^{45}Ca uptake by rat aorta with acute and long term treatment with D3 vitamin.

CONCLUSIONS

Acute and long term treatment with D3 vitamin in young and old rats have revealed a different behaviour of skeletal muscle comparatively with cardiac muscle and aorta concerning ^{45}Ca uptake.

Heart and aorta from acute and long term treated old rats with D3 vitamin show an increase in ^{45}Ca uptake comparatively with treated young group. This means a stimulation of receptors affinity for ^{45}Ca under the effect of D3 vitamin treatment. In elderly patients where, because of atherosclerosis, the cardiovascular is affected, D3 vitamin administration must be done with very much precaution.

REFERENCES

- [1] F. Revnic, Rom. J. Gerontol. & Geriatrics 3,8,27, 1987. *Age related peculiarities of prostacyclin production in rat aorta*
- [2] Luca, H.F., 2004. *Overview of general physiologic features and functions of vitamin D*. Am. J. Clin. Nutr. 80 (Suppl. 6), 1689S–1696S.
- [3] Boland, R., 1986. *Role of vitamin D in skeletal muscle function*. Endocrinol. Rev. 7 (4), 434–448.
- [4] Zanello, S.B., Collins, E.D., Marinissen, M.J., Norman, A.W., Boland, R.L., 1997. *Vitamin D receptor expression in chicken muscle tissue and cultured myoblasts*. Hormone Metab. Res. 29 (5), 231–236.
- [5] Bischoff, H.A., Borchers, M., Gudat, F., et al, 2001. *In situ detection of 1,25-dihydroxyvitamin D3 receptor in human skeletal muscle tissue*. Histochem. J. 33 (1), 19–24.