Section: Human Body Structure and Function

Original Research Article

EVALUATION OF CALCIUM, ZINC AND COPPER LEVELS IN CLAVICLES OF HUMAN FOETUSES: A TEACHING HOSPITAL BASED STUDY

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Received : 05/07/2023
Received in revised form : 15/08/2023
Accepted : 29/08/2023

Keywords:
Calcium, Copper, Zinc and clavicles of human foetuses.

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DOI: 10.47009/jamp.2023.5.5.17

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5(5); 79-81

Abstract

Background: Minerals like calcium, zinc, and copper are necessary for growth. Micronutrients and trace elements are essential for maintaining tissue function and metabolism. Many antioxidants contain trace elements as key components. As a result, they are a crucial component of a powerful antioxidant that shields the cell from damage. **Materials and Methods:** Twenty human foetuses were collected from museum of Department of Human body structures and function, Medical University of Americas, Nevis, West Indies. **Result:** The concentration of the essential minerals in each clavicle was independently determined using the forty clavicles that were recovered after being dissected. The deposition of calcium held pace with matrix formation in the clavicles of the other groups, with the exception of a considerable increase in calcium levels in clavicles of 15-20 age groups in weeks compared to those of less than 15 age groups in weeks ones. **Conclusion:** The uniform content of zinc and copper and their constant ratio throughout the development of the clavicles were novel findings in the current investigation.

INTRODUCTION

It is helpful to measure fetal growth and identify genetic problems early by knowing the dimensions of the fetal long bones. In general, prenatal clavicle anomalies are uncommon and may signify conditions such cleidocranial dysplasia, Holt-Oram syndrome, Goltz syndrome, and Melnick-Needles syndrome.[1] The ossification of the clavicle occurs first among all long bones. It starts at the end of the sixth week of pregnancy, which regulates the early growth of the upper limb and ensures its proper mobility.[2,3] On day 45,[4] the clavicle's two major ossification centers merge in the middle of the bone. The sternal end of the clavicle ossifies as the last of all bones since it develops the least quickly. Clinicians from various specialities can benefit from the information provided by developmental anatomy and morphometric data. The clavicular model is useful in archeology research to clarify various mechanisms of evolution, and in forensic medicine it helps to identify sex, age, ethnic differences, and body posture.[5] The developmental anatomy is becoming more important since it forms the fundamental framework for numerous clinical specialties with a foetal, neonatal, or pediatric focus. Minerals are crucial for healthy fetal development.[6] The mineral calcium is most prevalent in fetal body stores. The earlier literature on body calcium is based on research done on lower mammals.[7,8] The majority of studies on the calcium content of human bones are based on data from the postnatal period.[9,10] If taken into account at various phases of development, its concentration in human fetal tissue will have merit.[11,12] Copper and zinc are trace elements that, if insufficient, may have an adverse effect on embryonic development.[13,14] Studies on lower mammals provide the basis for information on the concentrations of the aforementioned components in tissues of growing fetuses.Givens and Macy provided a thorough description of total calcium in growing human fetal bodies in.[15,16] Ca, Cu, and Zn levels in the sacrum of pregnant women during the third trimester and their babies were reported by Tabrizi and Pakdel in.[17] Such investigations focused on the fetus' nutritional state rather than its developmental elements. There are sketchy data demonstrating the concentrations of minerals, namely in bone, at various stages of the development of human fetuses. Clavicle, an unusually long bone, was selected for this. Only calcium has been detected in growing human bone in prior studies.[18,19] To broaden the scope of the investigation, we also considered copper and zinc in addition to calcium.

MATERIALS AND METHODS

Twenty human fetuses were taken from the Medical University of the Americas' Department of Human Body Structure and Function Museum in Nevis, West Indies. These fetuses are already the subject of research projects for which the institution's ethical committee has given its approval. The fetuses were classified into five groups, each consisting of four fetuses, as shown in [Table 1] age groups in weeks (15 wks), age groups in weeks (15-20 wks), age groups in weeks (20-25 wks), age groups in weeks (25-30 wks), and age groups in weeks (> 30 wks).

Table1: Shows the age groups in weeks of human fetuses.

Age groups in weeks	Clavicles	
	Left	Right
<15	04	04
15-20	04	04
20-25	04	04
25-30	04	04
>30	04	04
Total	20	20

Eight clavicles were obtained from each group after clavicles were dissected out and disarticulated to remove them. Three sections of each clavicle were separated to identify the minerals calcium, copper, and zinc. Weighing and dissolving each clavicular fragment in 7ml of strong nitric acid. The resulting solutions were then filtered via Whatmann number 42 filter paper. Calcium was measured using the Henry and Dryer method and zinc and copper using atomic absorption spectroscopy.[20-22] One-way ANOVA was used to evaluate the data, and then the post hoc Bonferroni test.

RESULTS

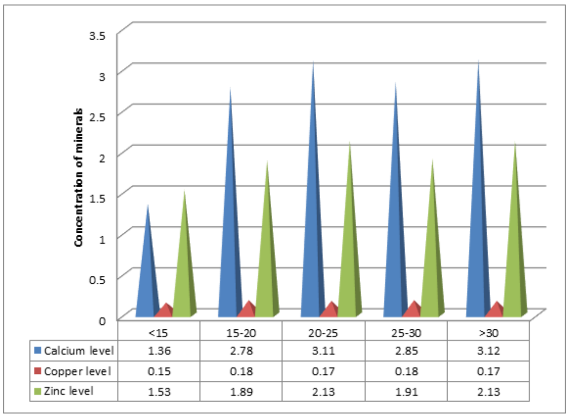

Figure 1: Shows the calcium (mg/g dry bone), zinc (ppm), and copper (ppm) concentrations in developing human fetuses at five different gestational ages have been compared.

This current study was carried out in the Department of Human body structure and functions, Medical University of Americas, Nevis, West Indies. Detailing the levels of clavicular minerals in various age groups is shown in [Figure 1]. Calcium levels in the clavicle were 1.36 mg/g of bone in age groups under 15 while they were 2.78, 3.11, 2.85, and 3.12 mg/g in age groups between 15 - 20, 20 - 25, and more than 30. The final four groups did not differ statistically significantly from one another. The calcium concentration was significantly low in 15 age groups of weeks' worth of fetuses, which is the most significant finding. Copper values ranged from 0.15 ppm to 0.17 ppm, while zinc values ranged from 1.53 ppm to 2.13 ppm, however neither indicated a statistically significant difference from the rest of the groups.

DISCUSSION

Both the organic matrix material and the inorganic calcium component work together to give bone strength. While the latter gives it resilience, the former makes it inflexible and hard.[23] The first bone to ossify is the clavicle, and the ossification center can be seen as early as six weeks into intrauterine life.[24] This is in charge of the calcium level rising rapidly, resulting in a value of 2.78 mg/g in group 15-20 as opposed to 1.36 mg/g in group 15. It's interesting to observe that the other groups' clavicles' calcium levels remained unchanged. This demonstrates unequivocally that calcium deposition matched matrix formation in speed to preserve consistent strength in the remaining groups. A prominent indication of zinc's significance in the development of the body's hard tissue is the high concentration of zinc in fetal bone compared to soft tissue.[25] A zinc deficit will hinder growth since zinc is an essential component of hormone systems.[26] It is commonly known that copper and zinc work together to promote healthy bodily growth. Clinically, the concentration of each of these trace elements is less significant than their ratio of copper to zinc.[27] Elevated copper and low zinc concentrations are among the most prevalent trace metal abnormalities. Our study's increased zinc concentration compared to copper level is consistent with other research on the concentration of zinc in various fetal tissues.

CONCLUSION

The importance of the zinc-to-copper ratio in the growth process is supported by the current study's finding that growing clavicles have a constant concentration of both zinc and copper throughout fetal life. To draw any conclusions about the relevance of the growing bones in experimental animals after manipulating the mineral content artificially, more research is required.

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ISSN(O): 2687-5365; ISSN(P): 2753-6556

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