Republic of Albania
Sports University of Tirana
Faculty of Movement Sciences
Third Level of Doctoral Studies

Doctoral Thesis Summary

Field of Study:

“PHYSIOLOGY APPLIED IN SPORT”

TOPIC:

“THE EFFECTS OF PHYSICAL ACTIVITY ON BONE MASS DENSITY IN THALASSEMIA SUBJECTS”

Doctoral Student:
MSc. Genti PANO

Scientific Supervisor:
Prof. Dr. Robert ÇINA

Tirana, February 2016

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Abstract

Introduction: Thalassemia is a blood inherited blood disorder that reduces the production of hemoglobin which is one of the most common genetic disorders in the world. Beta thalassemia is a blood disorder that reduces the production of hemoglobin. Patients with thalassemia show a variety of bone disorders that include bone deformities, osteopenia and osteoporosis, growth failure, and spinal deformities (Karimi M et al., 2007). In Albania there are approximately 200 β-thalassemia patients which are being treated with continuous blood transfusions.

Objectives: To assess the level of physical activity in β-thalassemia subjects. Diagnosis, identification and assessment of parameters of bone density in these subjects. Identification of the potential effects that come from a program by exercising intrusive whole body vibrating equipment, combined with some specific exercises, bone density and condition General to subjects β - thalassemia.

Methodology: Literature review was conducted in some of the main online engines such as; PubMed, ResearchGate, Hinari, for studies focusing in the effects of physical activity in β-thalassemia patients, and only 13 studies were selected. A total of 13 subjects (18-32 years old were selected and divided into two groups: 1- Control group (8 subjects, 5 F & 3 M) and 2-intervention group (5 subjects F). A questionnaire with 12 questions was used to evaluate the general activity of daily life and physical activity (Hay JA., 1997). Anthropometric measurements (at baseline and post intervention) were conducted using the "SECA" weight machine that also had a manual stadiometer. Bone density diagnosis was conducted using DEXA-Scan which was focused in the lumbar spine region (L1-L4) and left femur bone.

Results: The survey results showed that the subjects had an inactive lifestyle. Bone mass density (BMD) (L1-L4 & head of the left femur) to the intervention group training after undergoing therapy compared to the control group had no worthwhile statistically improvements (P>.05). The results showed an improvement of bone mineral content BMC (L1-L4) between the 2 groups where both measurements compared with the 46.03 g (cm) to the first measurement of 47.17 in the second measurement (P>.05). Also the BMC results of a comparison between the 2 groups (Measurement 1&2) Reference composition: femoral head of the control group, these values were respectively; the first measurement of 22.81 g and the second measuring 16:25 g. In the intervention group data's show that first measurement results have a value of 23.81 g and second measurements were 23.51g (P>.05).

Discussion: Many studies have dealt with the examination of the relationship between body composition and bone mass density (BMD) and their results are mostly diverse. However, the performance of PA in these patients despite the fact that is one of the best non-invasive methods in the other side it is a big challenge for the carriers, many issues should be considered by all specialists dealing with this social category.

Conclusion: Based on the survey results thalassemia subjects had a low level of physical activity. Examination of bone density parameters in these subjects showed that the values of this parameter were below normal levels compared to healthy population. Exercise on the vibrating platform combined with specific exercises to not only affects the bone density of these subjects but also affects in a number of parameters that determine the overall welfare.

Recommendations: Other studies are necessary to be performed in order to better identify the risk factors, ways of prevention and also to establish specific guidelines as regards the exercise of physical activity well planned and individualized for each subject of this social category. To improve overall health, but also skeletal bone, are recommended physical activities such as; Brisk walking, jogging, aerobics, dancing, different exercise like circuits, weight-lifting exercises with light weights, a healthy way of eating, all depending on the health status of each individual.

Key Words*:* *Thalassemia; Bone Mass Density; Whole body Vibration Therapy; Physical Activity.*

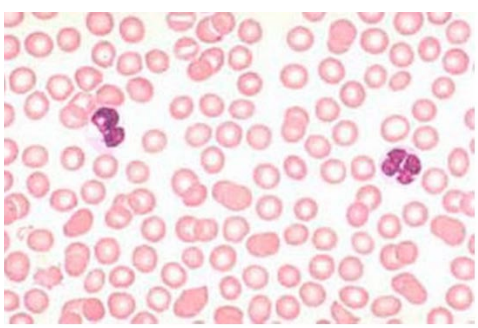
Introduction

General Prescription, Literature Review

What is Beta Thalassemia?

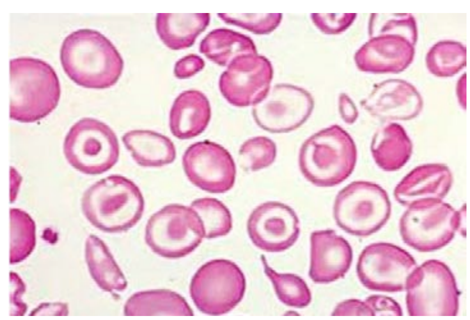
Many diseases in humans are caused by abnormalities in the blood and these are categorized according to the component of the blood which is affected: white cell diseases, platelet diseases and red cell diseases. Haemoglobin disorders or haemoglobinopathies are a group of conditions affecting human blood – more specifically an important substance or protein called haemoglobin contained in the red blood cells, hence the name haemoglobin disorders or haemoglobinopathies. Haemoglobin is a protein that consists of the alpha (α) and beta (β) parts or chains and which are in turn produced by the α-globin genes and β-globin genes respectively. Hence the diseases caused by haemoglobin abnormality either with regards to its production or its structure are divided into α-chain diseases (or α-globin gene) diseases and β-chain (β-globin gene) diseases. These genes are found on chromosomes 16 and 11 respectively. Patients with β-thalassaemia major, the most severe form of thalassaemia, cannot make normal adult haemoglobin, which is made up of equal numbers of α- and β-chains, and as a consequence cannot produce normal red blood cells (RBCs). In these individuals, i.e. those with β-thalassaemia major, each red blood cell contains much less haemoglobin, because the β-globin genes are not working or functioning properly and thus do not or produce very small amounts of β-chains. Consequently, there are far fewer red cells than the normal range. This causes anaemia, which is severe in these patients, as shown in the figure below.

Normal red blood cells (RBCs) under the microscope



**RBCs are round, concave, red cells of equal shapes and sizes*

Red blood cells (RBCs) in β-thalassemia major under the microscope



**RBCs are weak, pale, variety of shapes (poikitocitosis) and sizes (anisocytosis)*

International Thalassemia Day is 8 May.

There are 3 main beta-thalassemia groups:

1. Beta-thalassemia minor
2. Beta-thalassemia intermedia
3. Beta-thalassemia majo (or Morbi Cooley)

Beta-thalassemia (β-thalassemia) is an inhered blood disorder which is very spreaded around the world, and as it is previously mentioned it's the most severe form where the insufficient production of hemoglobin can cause several serious problems in all vital organs. The symptoms of β-thalassemia appear in the first 2 years of life. The high frequency of β-thalassemia is most probably related with malaria disease *(Plasmodium falciparum)* (Flint J et al., 1998). The emigration of the population and the marriages between different ethnic groups had contributed in the spreading of the disease all over the world, including also the North European Part where thalassemia was not even existed. The annual incidence of symptomatic individual is evaluated to be 1 in 100,000 persons in all world and 1 in 10,000 peoples in the European Union. Nevertheless, there is a lack of information regarding the exact number of disease carriers, especially in those places where are living the major part of the infected persons (Vichinsky EP et al., 2005). Thalassemia is a very serious public problem and it is very highly spreaded in the Mediterranean Region, Middle East, South part of India and South-East Asia (Vullo R et al., 1995; Weatherall DJ., 2004). From 300 milion carriers 300 million in all over the world (Angastiniotis M, Modell B., 1998), 55 milion are living in Suoth Asia (Wong HB et al., 1985), where the major part is situated in Maldives. On the other sode in Malyasia, generaly is spreaded in Malaysians and the Chinese Malaysians populations (George E et al., 2001). Malaysian Ministry of Health have concluded that approximately around 150 to 350 new babies are born every year (Tam S., 2005). George et al., 2001 have evaluated that in Malaysia there are around 5,600 blood transfusion dependent patients. In Thailand with a general population of 65 milion inhabitants, around 40% have traits of thalassemia or are carriers, in the mean time 1% of the population is infected from this disease (Diagnosis of Thalassemia Carriers), 7% have a trait of β-thalassemia and 17% with a trait of HbE, and a total of 35,000 patients are living with β-thalassemi syndrome (Thai Thalassemia Foundation). Also the disease is very spreaded in the Mediteranean population; highest frequency is in the Greek islands, in Italy. In Albania according to Ministry of Health, thre are approximately around 300 000 carrriers of thalassemia (8-9% of the population) and around 80 new cases per year. Most part of the subjects are children and youth. Also according National Center of Blood Transfusions, in Tirana are being treated around 200 thalassemia subjects, which are undergoing blood transfusions 2 units per 2 weeks, and around 19 children under 7 years old, which are being treated with 1 blood unit per 2 weeks. In 2013 are reveled, 14 new cases with thalassemia. The diagnostic map of the disease is higher in Fier 9.96%, Saranda 7.92%, Lushnja 7.3%, Berat 7.04% and Shkodër 0.72%. One of the biggests problems of thalassemic patients is that they are very exposed to many risk factors which negatively influence the bone mass density such as; non effective erithropoesis which leads to hyperplasia of the bone and a attenuation of bone cortex (Fung EB et al., 2011), low levels of growth, endocrine and growth hormone lack (Voskaridou E, Terpos E., 2008), diabetes (Bielinski BK et al., 2003; Jensen CE et al., 1998), and a decrease in the vitamin D circulation (Vogiatzi MG 2 et al., 2009). Even thought most of the patients are young, bone mineral deficits are not completely explained from growth and lean mass deficits (Fung EB et al., 2011; Terpos E. Voskaridou E., 2008). Efects of thalassemia on physical health can lead to a deformation in physical growth, growth retardation, and pubertal retardation (De Sanctis V et al., 2006; Telfer P et al., 2005). The disease impact on physical appearance, example., bone deformation and a short stature, are contributors for a low individual image (Mikelli A, Tsiantis J., 2004; Telfer P et al., 2005). Various complications like; heart failure, cardiac arythmia, liver diseases, endocrine complications and also various infections, are very common in thalassemia patients (Caro JJ et al., 2002; Cohen A., 1987). These problems do not influence only the physical appearance but also they are causing also emotional problems, social problems, problems at school and as consequence deterioration in the general patient's lifestyle (Mikelli A, Tsiantis J., 2004; Telfer P et al., 2005; Cao A., 2004; Abetz L et al., 2006). Survival of individual suffering from thalassemia is depended from periodic blood transfusions (every 3 weeks), which leads to iron overload in the body. Patients must undergo another therapy to reduce the concentration of iron in order to prevent serious damage to the vital organs of the body. Thalassemia is also known as a genetic blood disorder that can be fatal if proper treatment is not taken. Over the past decade the development of new treatments and clinical management has significantly improved the prognosis also the survival rate of these patients (Cohen A., 1987; Borgna-Pignatti C et al., 2004; Zurlo MG et al., 1989).

Bone mass density and osteoporosis in thalassemia subjects

Dependent thalassemia patients blood transfusions are more at risk for having problems with osteopeninë and osteoporosis. The pathogenesis of osteoporosis in this group is due to the influence of many factors including; environmental factors, factors that are displayed the way and genetics. The deposition of iron (which comes as a result of blood transfusions) to endocrine glands, can cause an injury or disorder in the secretion of growth hormone (Growth Hormone), deficiency of sexual steroids, diabetes mellitus, hypothyroidism, hypoparathyroidism and vitamin deficiency D but also a loss of bone mass. Erythropoesis uncontrolled but progressive expansion of the bone marrow, are other causes that increase the risk of osteoporosis patient with thalassemia major and intermedia (intermediate). Osteoporosis is a byproduct of iron toxicity on osteoblasts, but also drug deferoxamine, but also affects the treatment of removing excessive amounts of iron that is used in these patients (Voskaridou, E. & E. Terpos., 2004; Wonka, B., 1998). One of the many studies conducted in subjects with thalassemia concluded that there was a reduction in the formation of bone mass in patients with thalassemia major (Mahachoklertwattana P et al., 2003). Patients had committed scanning to measure the density mineral bone (BMD) to the anterio - posterior lumbar spine (L1- L4) and to the head of the femur (neck bone in the femur), using absorpiometri power dual -ray -X (dual energy X - ray absorptiometry).

The World Health Organization (WHO), Osteoporosi Diagnostic Criteria

The World Health Organization (WHO) defines osteopenia as Bone Mineral Density (BMD) T-score of between -1 to-2.5.

The WHO defines osteoporosis as BMD T-Score of lower than -2.5.

Because low bone mass can occur at a much younger age in thalassemia than in the general population, Z-score is used to assess bone mass in patients with thalassemia who are younger than 30 years old. Z score of lower than -2 considered as low BMD.

World Health Organization - Definition of Osteoporosis and Osteopenia for Caucasian Women:

- Normal= T-score at or above -1.0 SD;
- Osteopenia = T-score between -1.0 and -2.5 SD;
- Osteoporosis = T-score at or below -2.5 SD;

The impact of physical activity in improving overall health and bone density in subjects with thalassemia

Physical activity can increase absorption of minerals from the bones (Slemenda CW et al., 1991) however, some cardiovascular exercises should not be performed by thalassemia patients who have cardiac complications. Poor physical fitness is very common in patients with thalassemia. Children with β-thalassemia have a decrease in muscle mass and many of them complain of muscle weakness and myalgia (Tsagris V et al., 2005). The main cause of these symptoms is not yet known. In this process includes various factors such as; soft tissue anoxia, peripheral neuropathies, abnormal calcium metabolism as a result of falling levels of systemic hemoglobin and hemosiderosis (Lindinger A et al., 1998; Sieverding L et al., 1989). Some of the consequences of thalassemia also affect a person's ability to perform some kind of physical training activities. Weak bones, osteoporosis or increased use of desferrioxamine can increase the potential risk of fractures during the performance of certain types of physical activity, such as heavy weight lifting or carrying out exercises to improve resistance. Poor condition of muscle mass is the result of years of psychological de-motivation on whether the exercise of physical activity. Physical activity itself is a very good way to improve blood circulation and oxygenation of soft tissue has hemoglobin in sufficient quantities, and as a result it improves the growth, muscle and bone mass building. Cessation of smoking, the proper way of eating adequate amounts of protein, calories, calcium, vitamin D and exercise regular physical activity are very important factors to having a booth and development overall health. Physical exercises also help in the prevention of fractures and bone deformities possible. Quantities of iron in the blood can be identified by performing Magnetic resonance imaging (MRI), but these techniques are costly and not available in most countries where affected. As a result of the above problems the intolerance to exercise and fatigue are the main factors of which beta thalasssemia patients are complaining. The individual's capacity to practice (Agostoni P et al., 2005; Vasileiadis I et al., 2009) is observed by many studies, has resulted that this is caused by a combination of impact that has anemia and cardiotoxity that comes as a result of the uptake of large amounts of iron (Agostoni P et al., 2005; Cooper DM et al., 1980; Cracowski C et al 1998; Marinov BI et al, 2008). Testing cardiopulmonary functional training are recommended to be usde as tests to identify heart problems (Cracowski C et al., 1998), however the ability to identify cardiac iron burden is still unconsolidated. In 2006, an Indian researcher found that adverse impact of thalassemia mostly perceived in education (70%) and sports (72%).

The group of people who participated in this study had shown that they had physical weakness which prevented the took part in different physical activities, but also they had clearly admitted that they were disappointed by their physical appearance which impact on self -concepting negative about themselves (Khurana A et al., 2006). Many studies conducted in patients with thalassemia major have brought different results that usually are not compatible with each other but on the other hand most of them have highlighted the fact that abnormalities in the functioning pulmonary appear as disease restrictive lung which deteriorate with age, while the degree and duration of loads of iron explained as the main factor in the pathogenesis (Factor JM et al., 1994). Another group of researchers had studied cardiorespiratory functions before and 24 hours after blood transfusions and as a result have concluded that there was an improvement in the groups of patients with thalassemia who previously didn't had a problem with an obstructive pulmonary disease (Santamaria F et al., 1994). These patients are advised to increase their consumption of foods high in calories, protein, and fruits before performing the exercises in order to combat the reduce of organs oxygenation.

Therapy equipment / vibrating platforms (vibration), the effects of whole body vibrations

One of the therapies which are thought to improve lifestyle and general physical fitness, is whole bode vibrating therapy. This therapy has been proved to be effective in keeping the bones strong and stimulating the formation of new bone mass. This way is more profitable for adults and women who suffer from osteoporosis, also for sedentary people who do not practice any other way of exercising as exercises to improve strength or weight-lifting exercises. However, a study published in the American Journal of Hematology (Fung EB et al., 2012) has shown that there is also a group of other people who can benefit from the effect of the strengthening of the bone mass that it comes to the use of exercises with equipment which are based on vibration.

According to the researches of Children's Hospital & Research Center, Oakland, California, vibration / vibrations throughout the body can be one way or a safe non-pharmacological way for patients with thalassemia. Besides abnormal blood composition, people suffering from thalassemia also suffer from, an increase of risk to suffer fractures which prevents them to engage in normal physical activities. However, researchers in Canada have shown that exercises that are performed using vibration throughout the body, carried out for 20 minutes a day, with a frequency of 30Hz and a G force of 0.3g, can bring improvements to serum markers of bone formation. Up to now there is no therapy non-invasive anabolic to improve the density of bone in people who suffer from this disorder, ie the fact that the vibrations throughout the body can improve the density and volume of mineral bone after 6 months is a very good news. However, it is necessary to conduct further studies to confirm the findings of this study but also the benefits of this therapy in people with thalassemia.

- Taken into consideration the conclusions of the last part but also from all the problems discussed above, we thought pertinent to perform a study, the main focus of which would be the β-thalassemia patients living in Albania, trying to throw any light but also helping them as much as we could, including and interventional exercise program, focusing on improving bone mass density.
- Given that physical activity is estimated to be one of the main physiological stimulus for mantaining a normal bone volume and density, the assessment of the impact of vibration therapy combined with different exercises thought constitute an interesting and important subject to be studied taking into account the specificities of this popolation category.

Hypothesis

Various studies have concluded that regular physical activity more precisely therapy whole body vibration therapy, when performed on a regular basis for a period and at a certain frequency, is one of the best non-invasive therapyes and with positive effects in terms of improvement of bone density in beta-thalassemia subjects.

In light of this fact, the hypothesis that we assume to solve in this paper is:

- If the whole bode vibration, combined with various exercises that are performed while subjects were on the device (also during periods of recovery), is more effective in improving overall physical fitness and but also more efficient in terms of improving bone mass density in β-thalassemia subjects.

Objectives

Objective 1: To assess the level of physical activity to β - thalassemia subjects.

Objective 2: Diagnosis, identification and evaluation of bone density parameters in these subjects.

Objective 3: Identification of the possible effects of an intrusive program of practice by whole body vibration therapay, combined with some specific exercises on bone density of these entities as well as their general condition.

Material and Methods

General perscription

This study is focused on a very fragile population category as that of subjects suffering from hemoglobinopathies more specifically β- thalassemia patients (social group with special needs). Subjects were selected from different Albanian cities; 1- Lushnjë - Fier (and their suburbs), known as endemic areas. These subjects were treated in the Regional Hospital Lushnjës " Ihsan Çabej", "Regional Center of Hemoglobinopathies" and 2-from Tirana city where there is a large concentration of population. These subjects were treated in the "National Center of Hemoglobinopathies" located near " Mother Teresa University Hospital Center".
The literature search was conducted mainly in a few major search engines such as PubMed, ResearchGate, HINARI, where the main focus of the studies was focused on the effects of physical activity to β-thalassemia subjects. Key words that we have used were; Thalassemia, bone mass density, physical activity, non- invasive therapy. Comparisons between groups (control group and intervention group) were made using SPSS 20. To view the possible differences variables bony after the phase intervention (10 weeks' therapy with vibrating equipment/vibration combined with different exercises). Pearson correlation coefficient (Pearson 's Correlation coefficient) was used to assist the relationship between changes in bone mass density.
All study research procedures have been prepared in full compliance with the guidelines established by the "Declaration of Helsinki "Related to studies conducted in humans, in cooperation with "Department of Sports Medicine" part of "Faculty of Movement Sciences" part of "Sports University of Tirana". Also all study research procedures have been presented to NCB (National Council of Bioethics) (Appendix 2). In regard to the processing of personal data for scientific purposes and statistical, the methodology of this study it is in accordance with the laws and legal provisions which are administered by the Office of the Commissioner for Freedom of Information and Protection of Personal Data, the office to which our institution has received the confirmation to conduct studies accoriding to the laws.

Criteria for the selection of subjects

- β-thalassemia patients aged 18-32 years old, who have no problems with heart and lungs (functional echography and functional data's)
- They had not received any other treatment except for dismissal therapy quantities of iron overload;
- No previous occurrences of a stroke, lack of hydroxyurea or transfusion therapy for a long time.
- No hospitalization or any other health problem for at least 2 weeks before the main experiment.

Exclusion criteria in the selection of subjects

Subjects were excluded if they had previously had previous health problems, problems known to their impact on bone health but also the subjects that were with hemodynamic instability or neurological or orthopedic diseases that limited the performance of movement.

After completing the selection of participating subjects, they were divided into 2 groups:

1. The control group (N=8, 5 females & 3 males 18-32 years old)

2. The intervention group training (N=5, female 18-32 years old)

Evaluation of physical activity

The "Habitua1 Activity Estimation Scale (HAES)). FAQ "Rating Scale Ordinary Activities" is an instrument of self-reporting which is designed to assess the habits or attitudes concerning the activities of daily life related to lifestyle, including the time spent to feed and also the physical activity engagment level. Completion of this questionnaire includes assessment ratios or divisions of time spent in four different categories during a typical day describing inactive weekly hours (JA Hay., 1997). The questionnaire consisted of 12 questions. The questionnaire was completed individually and independently from all entities participating but combined with an individual interview the leaders of the study in order to obtain more realistic results from each subject.

Profiles and anthropometric measurements, diagnostics/measurement of bone mass density and body composition of subjects

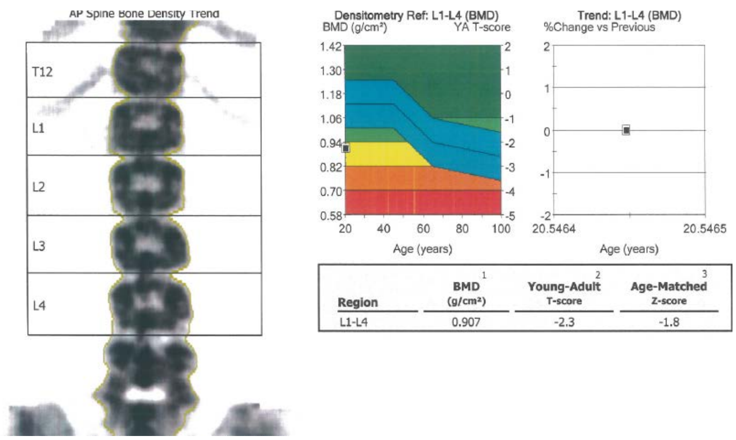
Before beginning any DEXA scanning anthropometric measurements were conducted; weight and

height, the results of which are provided below. Scan results except variables that assess bone density and BMI (body mass index) together with the percentage of tissue of body fat% and lean body mass%. Measurements and diagnostics prior assessment carried out; for the control group, the first measurement was conducted on 05/30/2015 from 10:00 am onwards and the second measurement was conducted on 27/12/2015 from 10:00 am onwards. As for the control group and diagnostics prior measurements were carried out on 05.06.2015 from 10.30 am onwards in the morning, but others were completed throughout the next week, while the second measurement (in 3 subjects) were performs on 12/24/2015 from 15:30 pm onwards and 2 subjects during the week before the festive season (New-Year celebrations). Anthropometric measurements such as weight and height of the subjects were carried out on the scale electronics "SECA" an integral part of which was a stadiometer manual, prior to intervention training and after 11 weeks at the end of the intervention training (see in the results session). This equipment was located in the premises where the subjects underwend anthropometric measurements before performing DEXA-Scan diagnosis.

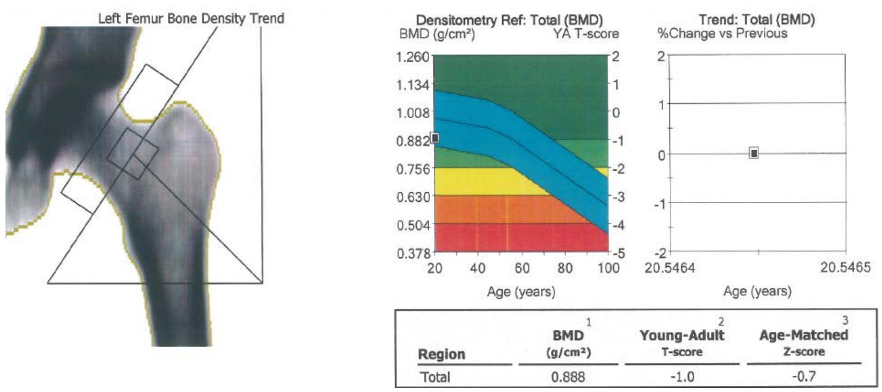
All scans were performed by the same staff and with the same diagnostic equipment in one of the main hospitals of Tirana (Hygeia Hospital Tirana). Diagnostic device used for this study was DEXA-Scan (GE Healthcare Lunar DPX NT + 151 392; Scan Mode: Standard 20.0 µGy); which had a program software specific and tailored for this age group and no adverse affections (collateral effects). The examination room had optimal conditions with an air temperature and humidity suitable but also optimal hygiene levels.

The main parts measured by DEXA-Scan were bone mass density and mineral bone composition (BMC) of:

• The lumbar spine vertebrae from L1 up to L4 and



- Left femur bone mass density (BMD) and bone mineral composition (BMC)



Bone mass density evaluation is a results form the division of the surface area on which it is done the scanning which yields a value in grams per square centimeter (gcm^2), but the most important outcome is the T-score. T-score is the result which the radiologist uses to determine whether or not the individual has osteoporosis.

• A T-score from +1 to -1 means that bone density is normal,

• A T-score from -1 to -2.5 means that the individual has osteopenia and

• A T-score below -2.5 is defined as osteoporosis.

Osteopenia is a term used to define bone density which is not normal but not to low and is the level were bone mass density is classified as osteoporosis. As defined by the World Health Organization, osteopenia is defined by performing bone densidometrisë which T-score is between -1 to -2.5. The fact that the decrease bone density in thalassemia can occur in an earlier age compared with the population of generic, the Z -score which is used to assist the bone mass in normal patients younger than 30 years olds it is thought that in thalassemia subjects the Z-score of less than -2 will be considered as a low bone density level.

Composition or bone mineral content (BMC)

Measuring bone mineral content in a certain volume of bone, used as a yardstick to measure the health of the bone mass but also in the diagnosis of osteoporosis. (The American Heritage® Stedman's Medical Dictionary). BMC can be measured with most of the equipment or diagnostic techniques densidometrike. PMK (BMC) can be defined either as a measure of bone mineral content of a complete bone (g) or as a measure of minerals for bone length units (g / cm). However, bone mineral mass is expected to be given the best in terms of stability of the bone, and significantly BMP (BMC) is a parameter that depends on the measures. (Genant HK et al., 1996; Riggs BL et al., 1999). Subjects participating in the study underwent the scanning procedure at the beginning of the study but also after the intervention in order to see and avaluate any potential differences in the above parameters. All scanning procedures including both parts but also the time of anthropometric measurements (weight and height) go approximately 15 minutes for each subject.

The following variables were taken from each bone DEXA scan:

• Bone mass density (BMD)

• Bone mineral content (BMC), and

• Body composition was identified by examination DEXA Scan for the whole body fat mass (g) Lean body mass (g), and total body fat %,

All these data were to be processed. During examinations there was no problem and the subjects were happy to perform it for the first time that they were conducting an examination of this kind

Diagnosis and transfusions

All subject were under regular transfusions in order to maintain adequate levels of hemoglobin concentration (10 g/dL).

Patients were constantly getting transfusions as treatments for reducing the levels of concentration of iron (Fe) in the blood:

• Deferiprone (pills) (deferiprone; 1 grain 500mg (9 pills = 45000mg every day).

• Desferal (sub-cutaneous) (desferal; 2 times/week 4 ampoules 2.5 mg = 10 mg) .

• The amount of blood 600ml 2 times/week.

Exercise Intervention Training. The use of vibrating platforms

Vibrating devices are some of the best equipment for the treatment of bone problems such as; osteoporosis, arthritis, etc. These devices use a low amplitude and speed which are benefitial for patients who suffer from these problems. These devices in the recent years have begun to have a wide use because they do not cause damages to the soft tissues and ligaments.

The use of these devices has the following effects:

• Influence for a better stretching

• Improve blood circulation and thus the supply and feeding of bones with the necessary elements

• Improve muscular strengthening

• Helps in lymphatic drainage

• Help in reducing of swellings/inflammations

One of equipment used was branded Turner (TP-5) which had different levels of vibration that ranged from 15-40 Mhz. Also two other devices were used s backup. These devices were mobile and when the subjects were standing up the device a little flutter was performed to the whole skeletal body axis. They also show the time of performing the exercises as well as the intensity of vibrations. Subjects were asked to stay on the platform without shoes (barefoot

or with sports shoes with orthopedic rubber) for 20 min every day for 3-5 days a week for 10 weeks. The platform was placed on a hard surface and not slipery. The platform was scheduled to turn off after 10 minutes' work with a frequency up to 30 MHz. The group of researchers periodically communicate with entities for any possible problems. Every patient of the intervention group subject had a total of approximately 600 min time spent on vibrating platforms combined with different exercises. Below is explained all of exercise protocol used in this study.

Training program

The whole exercise intervention program was performed at the fitness gym facilities located within the premises of the Sports University of Tirana. Common training schedule was from 16:30 to 18:00 pm during the period 5 October 2015 to 22 December 2015. The program structure consisted as follows:

Warm-up: 5-10 min

- Walking, running light, streçingu exercises, free exercises, exercises with gymnastic balls, using gymnastic mattresses, therabands (rubber band) exercises etc.

Main part: 20 min (2 times x 10 min = 20 min) on the vibrating platform with 25-30 Mhz.

Exercise 1: Side leg lift

• The frequency of the vibrating platform 20 Mhz
• Repetitions and series: 10-15 reps, 2-3 series.

Involved muscles:

• aductor muscle group (collector) leading,
• M. gluteal muscles
• M. tensor fasciolatic croser (m. passing by the head of the femur to the knee).

Exercise 2: Bent over row

• **The frequency of the vibrating platform:** 20 Mhz
• **Repetition and series:** 10-15 reps, 2-3 series.

Muscles involved:

• M. deltoid,
• M. rhomboid (the back of the shoulders and mid-back) and
• abdominal muscles.

Exercise 3: Knee Raises

- **The frequency of the vibrating platform:** 15-20 Mhz
- **Repetition and series:** 10-15 reps, 2-3 series

Involved muscles:

- buttock muscles, m. hamstring
- M. Quadriceps
- Core muscles

Exercise 4: Modified Push-ups

- **The frequency of the vibrating platform:** (20 Mhz)
- **Repetitions and series:** 10-15 reps, 2-3 series.

Involved muscles:

- M. pectoralis,
- M. triceps,
- M. deltoid

Exercise 5: Squat

- **The frequency of the vibrating platform:** (15-30 Mhz)
- **Repetitions and series:** 8-12 reps, 2-3 series.

Involved muscles:

- M. gluteus;
- M. kuadriceps;
- M. hamstring dhe
- Femur rector muscles.

The final part: 5-10 min

Subjects after coming down from the vibrating device took an active break of 10-15 min during this time they could do exercises with rubber bands gymnastic exercises with light weight 1-2 kg, with gymnastic exercises, etc. Then they perform the second part of the program of practice similar to the first. Relaxing in the end carried the 10-15 min, which included various activities such as:

• Stretching of the major muscle groups

• Relaxation music on gymnastic mattresses

• Combination of relaxation therapy through music and speech, etc.

In total a training session went about 50-60 min. Each subject has performed approximately 600 minutes on the vibrating platform, with different frequencies depending on the exercise combined with various exercises which are allocated explained above.

Results

Results of both groups compared

Control group

Table 67. BMD results of control group (N=8). Reference: Spine (L1-L4) and Left Femur.

Reference	*Pre-intervention*	*Post-intervention*	*P-value**
Spine (L1-L4), BMD (g/cm²)	0.861	0.886	.366 (NS)
Left femur BMD (g/cm²)	0.824	0.811	.138 (NS)

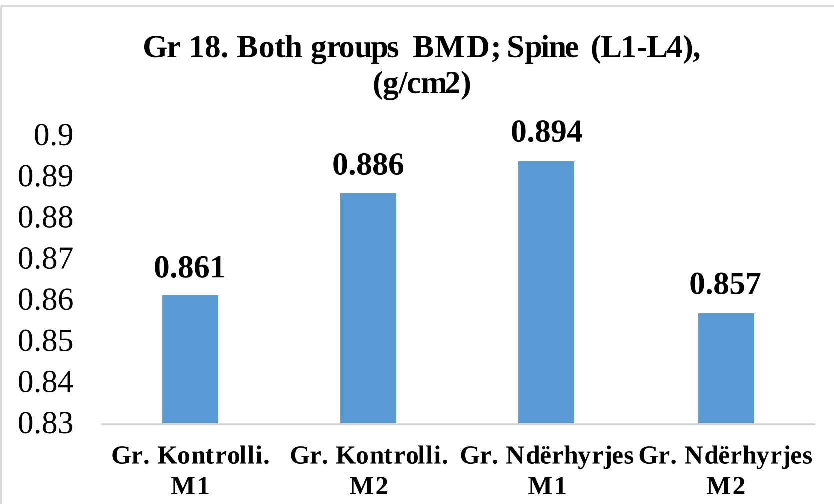
Intervention group

Table 68. BMD results of control group (N=5). Reference: Spine (L1-L4) and Left Femur.

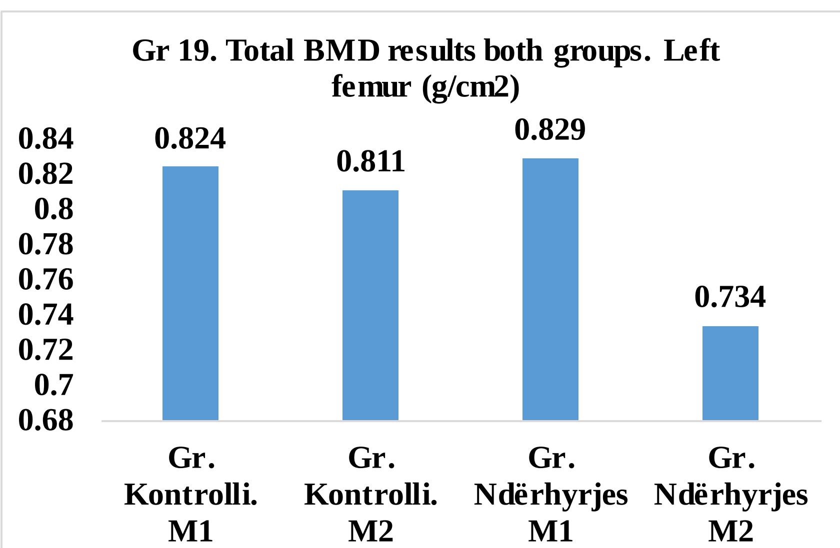
Reference	*Pre-intervention*	*Post-intervention*	*P-value**
Spine (L1-L4), BMD (g/cm²)	0.894	0.857	.269 (NS)
Left femur BMD (g/cm²)	0.829	0.734	.138 (NS)

Table 69. BMD results, both groups compared (N=13). Reference: Spine (L1-L4) and Left Femur.

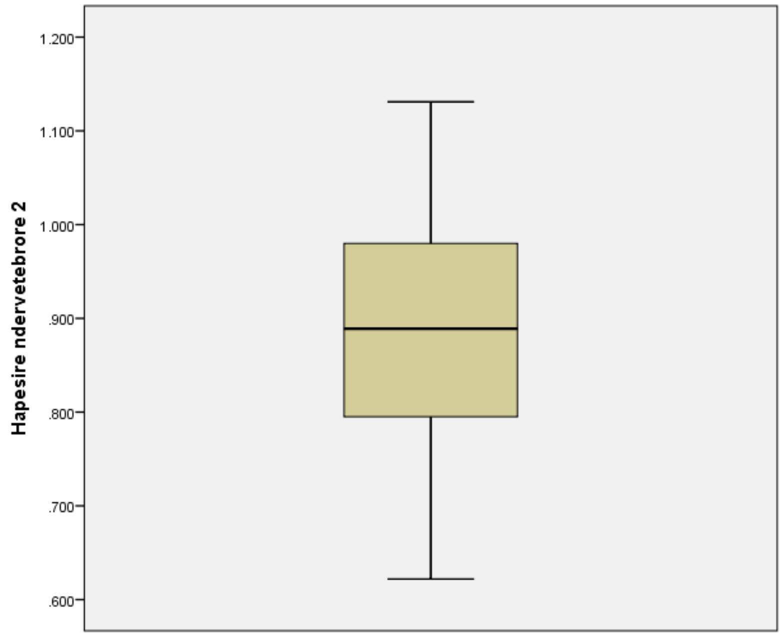
Reference	Control Group M1	Control Group M2	P-value*	Intervention group M1	Intervention group M2	P-value*
Spine (L1-L4), BMD (g/cm²)	0.861	0.886	.366	0.894	0.857	.269
Left femur BMD (g/cm²)	0.824	0.811	.138	0.829	0.734	.138



Graph 18. Total *BMD results, both groups compared (N=13). Reference: Spine (L1-L4).*



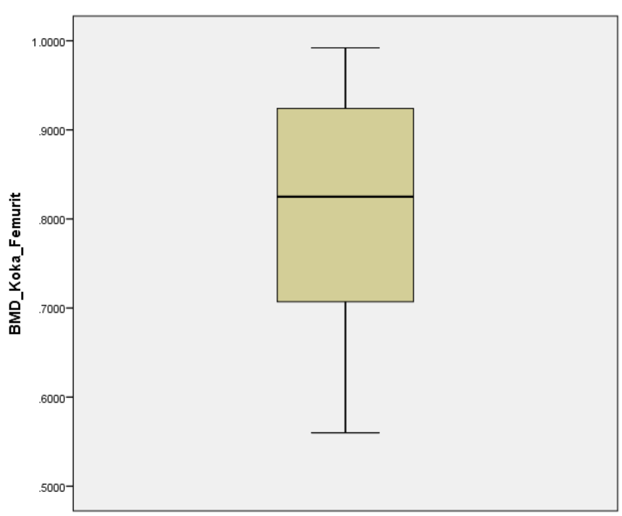
Graph 19. *Total BMD results, both groups compared (N=13). Reference: Left femur.*



Graph 20. *Boxplot, Analysis of both measurements of BMD: Reference: Spine (L1-L4) Total both groups (N=13).*

**. Correlation is significant at the 0.01 level (2-tailed).

Pearson Correlation was used to assess differences between first and second measurement results of control group (N=8) also differences between first and second measurement results of intervention group (N=5): Reference: Spine (L1-L4) and comparison in total for both groups (N=13). Results show that for control group for both measurements the Std. Deviation =.044133 and for intervention group for both measurements Std. Deviation= .0606647. For the control groups Pearson 's correlation =.969, p=.162 (p>.05) and for the intervention group Pearson 's correlation= .804, p=.269 (p>.05), revealed that there is no significat correlation between the 2 measurements (p>.05).

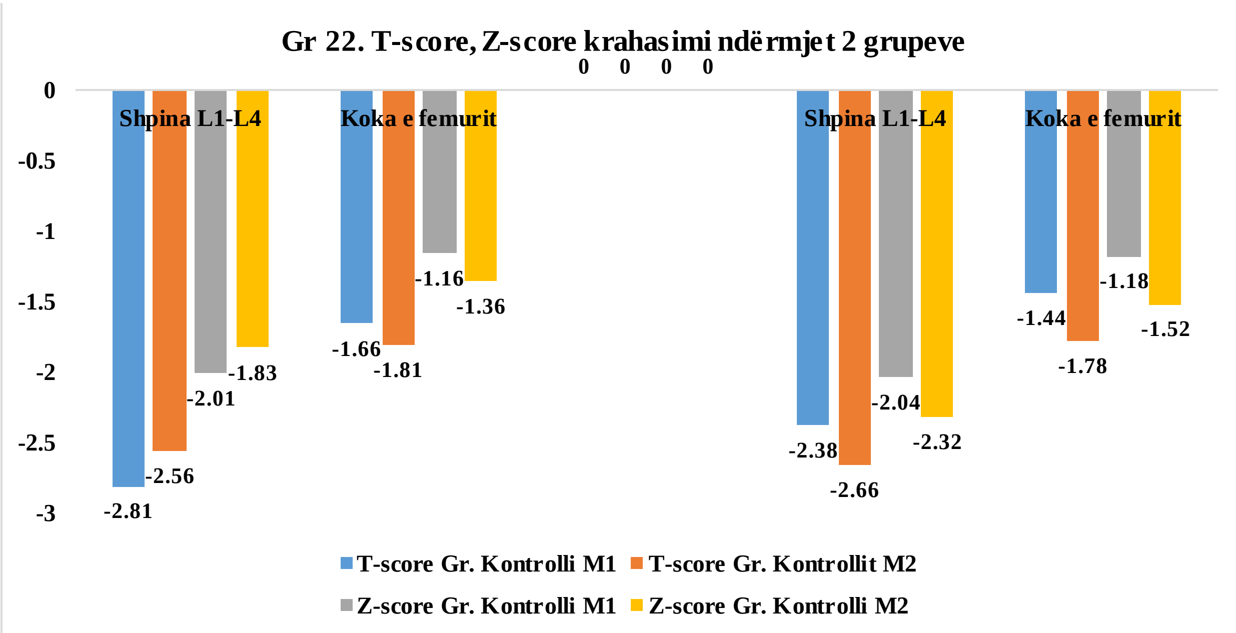


Graph 21. *Boxplot, Analysis of both measurements of BMD: Reference: Lef femur. Total both groups (N=13).*

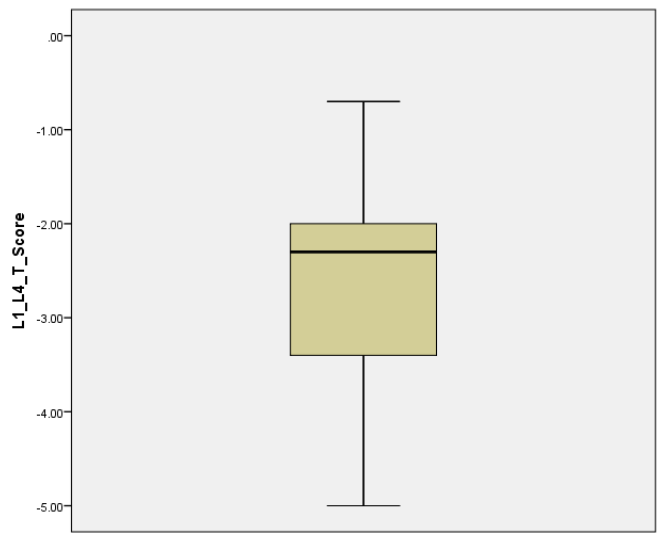
Pearson Correlation was used to assess differences between first and second measurement results of control group (N=8) also differences between first and second measurement results of intervention group (N=5): Reference: Left femur and comparison in total for both groups (N=13). Results show that for control group for both measurements the Std. Deviation =.0456532 and for intervention group for both measurements Std. Deviation=.0234585. For the control groups Pearson 's correlation ==.941, p=.585 (p>.05) and for the intervention group Pearson 's correlation= .994, p=.138 (p>.05), revealed that there is no significat correlation between the 2 measurements (p>.05).

Table 70. T-score and Z-score of total BMD, both groups compared (N=13). Reference: Spine (L1-L4) and Left Femur.

Control group	**T-score M1**	**T-score M2**	**Z-score M1**	**Z-score M2**
Spine (L1-L4)	-2.81	-2.56	-2.01	-1.83
Left femurit	-1.66	-1.81	-1.16	-1.36
Control group	**T-score M1**	**T-score M2**	**Z-score M1**	**Z-score M2**
Spine (L1-L4)	-2.38	-2.66	-2.04	-2.32
Left femurit	-1.44	-1.78	-1.18	-1.52

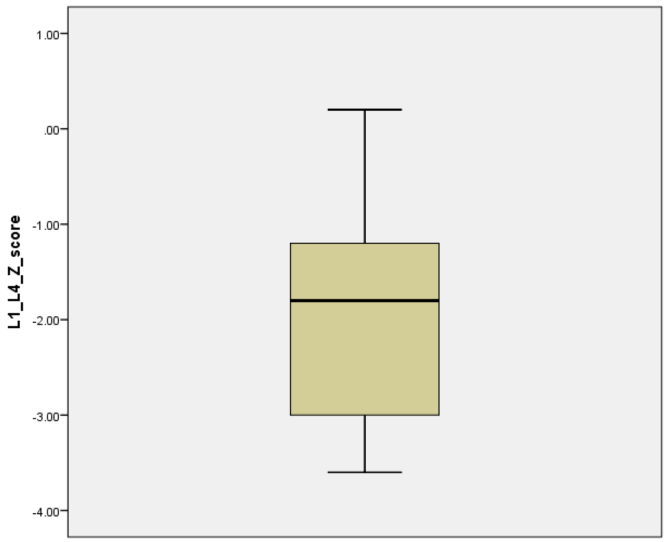


Grafiku 22. *T-score and Z-score of total BMD, both groups compared (N=13). Reference: Spine (L1-L4) Left Femur.*



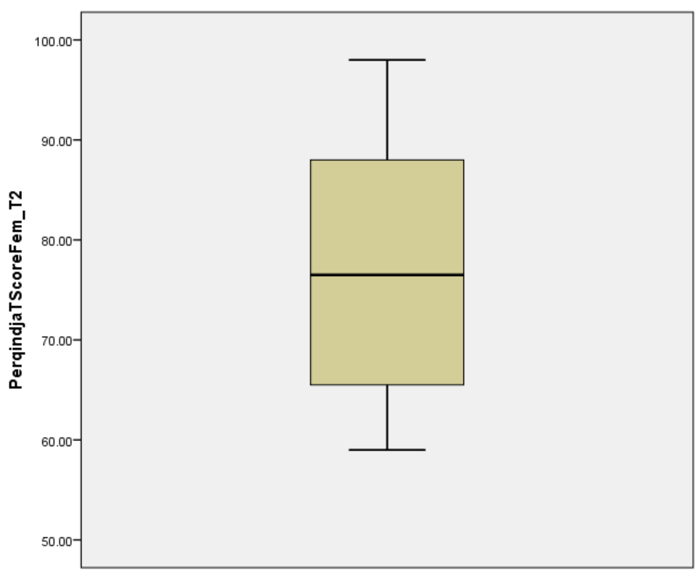
Graph23. *Boxplot, Analysis of both measurements of BMD: Reference: Spine (L1-L4). Total both groups (N=13).*

Pearson Correlation was used to assess differences between first and second measurement results of control group (N=8) also differences between first and second measurement results of intervention group (N=5): Reference: Left femur and comparison in total for both groups (N=13). Results show that for control group for both measurements the Std. Deviation =.0456532 and for intervention group for both measurements Std. Deviation=.58907. For the control groups Pearson 's correlation ==.941, p=.585 (p>.05) and for the intervention group Pearson 's correlation= .730, p=.348 (p>.05), revealed that there is no significat correlation between the 2 measurements (p>.05).



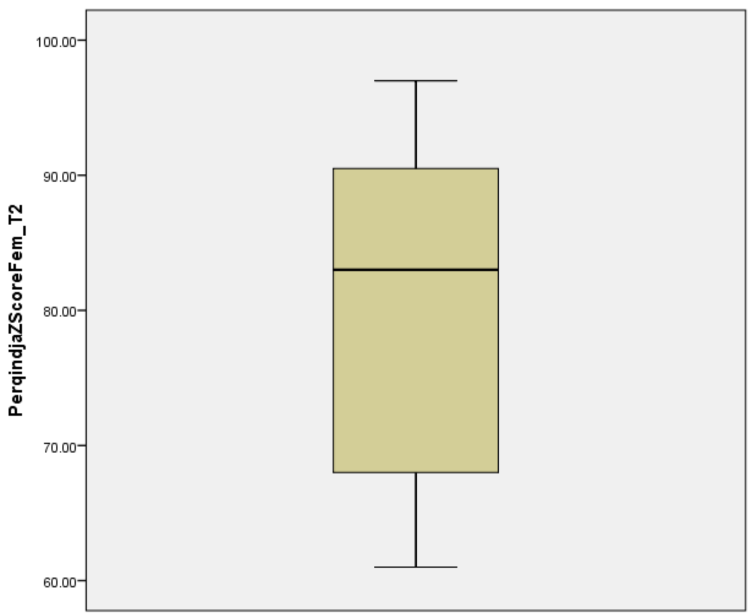
Graph 24. *Boxplot, Analysis of both measurements of BMD: Reference: Spine (L1-L4). Z-score Total both groups (N=13).*

Pearson Correlation was used to assess differences between first and second measurement results of control group (N=8) also differences between first and second measurement results of intervention group (N=5): Reference: L1-L4 and comparison in total for both groups (N=13). Results show that for control group for both measurements the Std. Deviation =.45591 and for intervention group for both measurements Std. Deviation=.61400. For the control groups Pearson 's correlation .958, p=.314 (p>.05) and for the intervention group Pearson 's correlation= .590, p=.366 (p>.05), revealed that there is no significat correlation between the 2 measurements (p>.05), revealed that there is no significat correlation between the 2 measurements (p>.05).



Graph 25. *Boxplot, Analysis of both measurements of BMD: Reference: Left femur. T-score Total both groups (N=13).*

Pearson Correlation was used to assess differences between first and second measurement results of control group (N=8) also differences between first and second measurement results of intervention group (N=5): Reference: Left femur (T-score), and comparison in total for both groups (N=13). Results show that for control group for both measurements the Std. Deviation =.35632, and for intervention group for both measurements Std. Deviation=.21909. For the control groups Pearson 's correlation .947, p=.402 (p>.05) and for the intervention group Pearson 's correlation= .991, p=.226 (p>.05), revealed that there is no significat correlation between the 2 measurements (p>.05).



Graph 26. *Boxplot, Analysis of both measurements of BMD (Z-score: Reference: Left femur. Total both groups (N=13).*

Pearson Correlation was used to assess differences between first and second measurement results of control group (N=8) also differences between first and second measurement results of intervention group (N=5): Reference: Left femur (Z-score), and comparison in total for both groups (N=13). Results show that for control group for both measurements the Std. Deviation =.42908, and for intervention group for both measurements Std. Deviation=.19235. For the control groups Pearson 's correlation .923, p=.256 (p>.05) and for the intervention group Pearson 's correlation= 994, p=.235 (p>.05), revealed that there is no significat correlation between the 2 measurements (p>.05).

Results comparison for both groups subjects of the same age group

Control group

Table 71. BMD results of control group (N=5 females mean age group 21.6 years old). Reference: Spine (L1-L4) and Left Femur.

Reference	Pre-intervention	Post-intervention	P-value*
Spine (L1-L4), BMD (g/cm^2)	0.820	0.856	.366 (NS)
Left femur BMD (g/cm^2)	0.840	0.829	.138 (NS)

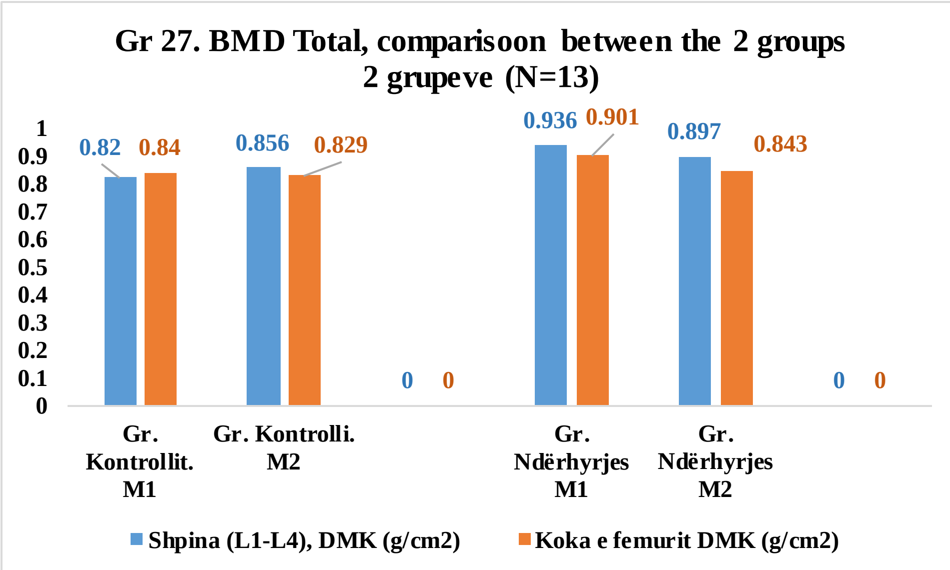
Intervention group

Table 72. BMD results of control group (N=3 females mean age group 21 years old). Reference: Spine (L1-L4) and Left Femur.

Reference	Pre-intervention	Post-intervention	P-value*
Spine (L1-L4), BMD (g/cm^2)	0.936	0.897	(P>.05)
Left femur BMD (g/cm^2)	0.901	0.843	(P>.05)

Table 73. Total BMD results, comparison between the 2 groups (N=13). Reference: Spine (L1-L4) and Left Femur.

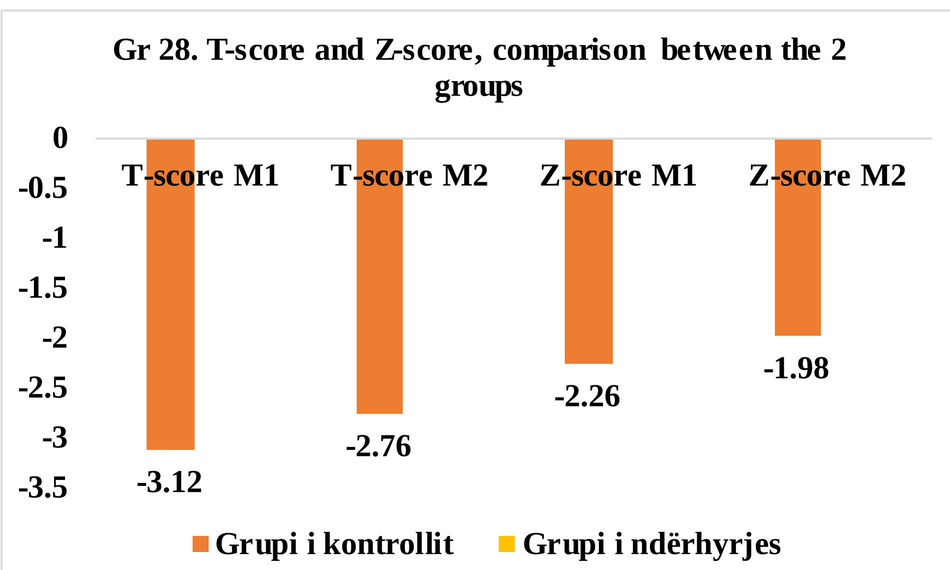
Reference	*Control gr. M1*	*Control gr. M2*	*P-value**	*Intervention gr M1*	*Intervention gr M2*	*P-value**
Spine (L1-L4), BMD (g/cm^2)	0.820	0.856	(P>.05)	0.936	0.897	(P>.05)
Left femur BMD (g/cm^2)	0.840	0.829	(P>.05)	0.901	0.843	(P>.05)



Graph 27. *Total BMD results, comparison between the 2 groups (N=13). Reference: Spine (L1-L4) and Left Femur.*

Table 74. T-score and Z-score, comparison between the 2 groups (N=13). Reference: Spine (L1-L4).

	T-score M1	T-score M2	Z-score M1	Z-score M2
Control group	-3.12	-2.76	-2.26	-1.98
Intervention group	-2.03	-1.73	-2.3	-2



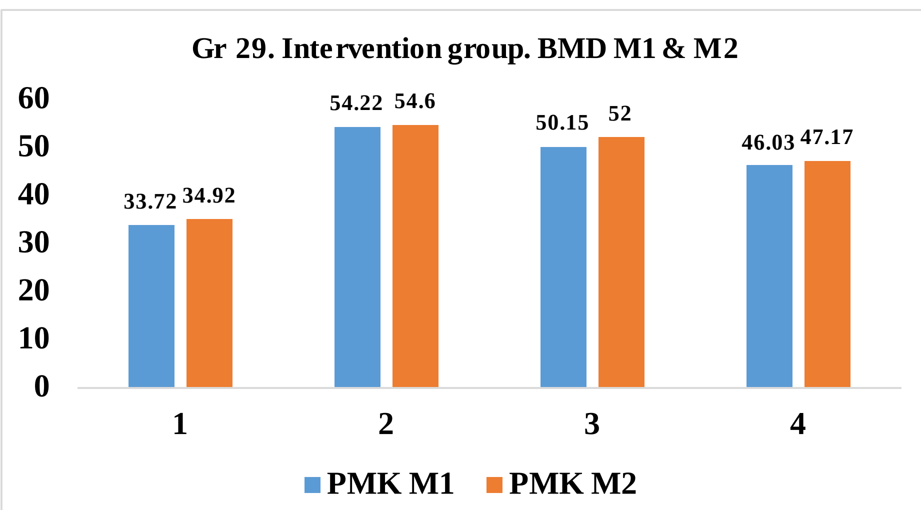
Graph 28. *T-score and Z-score, comparison between the 2 groups (N=13). Reference: Spine (L1-L4).*

Table 75. Bone mineral density of control group subjects (N=5 females age group 21.6 years old). (Measurement 1 & 2) Reference: Spine (L1-L4).

Reference	BMD M1	BMD M2
L1-L4	22.59	23.8
L1-L4	35.19	32.25
L1-L4	36.65	35.84
L1-L4	30.17	36.26
L1-L4	47.84	45.26
Mean	33.08	34.68

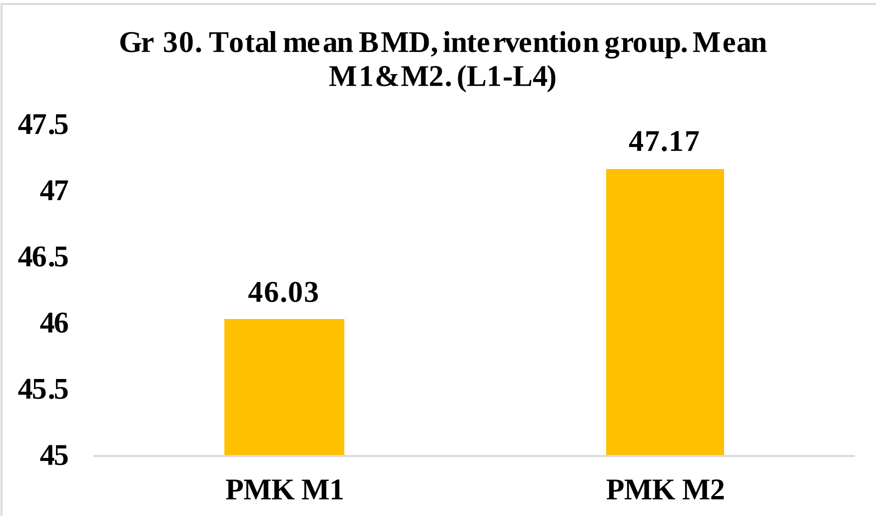
Table 76. Bone mineral density of control group subjects (N=3 females age group 21 years old). (Measurement 1 & 2) Reference: Spine (L1-L4).

Reference	BMD M1	BMD M2
L1-L4	33.72	34.92
L1-L4	54.22	54.6
L1-L4	50.15	52
Mean	**46.03**	**47.17**



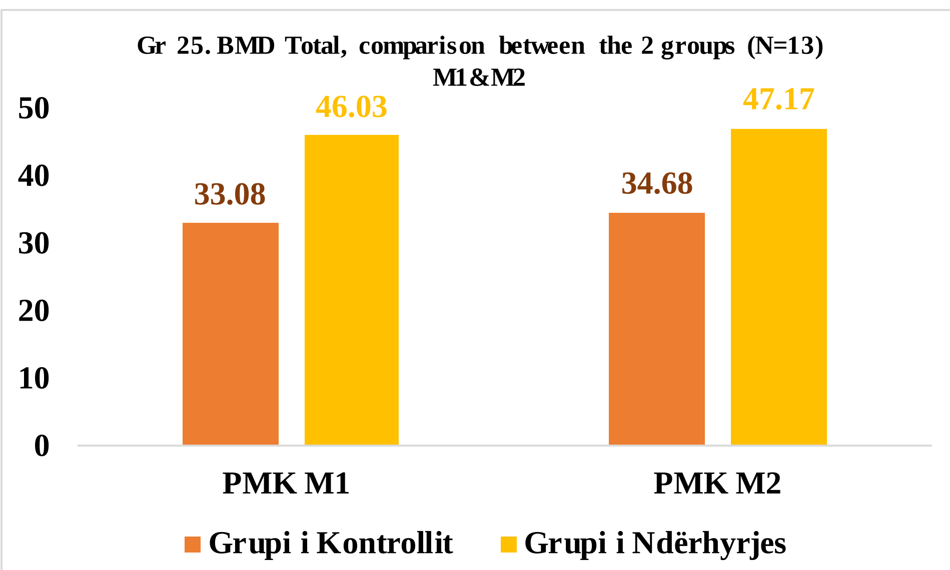
Graph 29. *Bone mineral density of both groups (Measurement 1 & 2) Reference: Spine (L1-L4).*

In Graph 29, are showed the resuls of bone mineral composition of both groups for the first and second measurement, Reference: Spine (L1-L4). The results of intervention group show that there is an improvement of these parameter, respectively the first subject (ID Nr 1) result from 33.72 g in the first measurement in 34.92 g in the second measurement; subject ID Nr 2 from 54.22 in 54.6 and the third subject ID Nr from 50.15 to 52 g.



Grapf 30. *Total mean BMD, intervention group. Mean M1&M2. (L1-L4) (N=3 femra). (M 1&2) Reference: Spine (L1-L4)*

In Graph 30, are showed the resuls Total mean BMD, intervention group. Mean M1&M2. (L1-L4) (N=3 femra). (M 1&2) Reference: Spine (L1-L4). Data show an improvement of these parameter between first and second measurement, respectively from 46.03 g in 47.17 g.



Grapf 31. *BMD Total, comparison between the 2 groups (N=13) M1&M2. Reference: Spine (L1-L4).*

Table 76. Bone mineral composition in the control group (N=5 females age group 21.6 years old). (Measurement 1 & 2) Reference: Left femur.

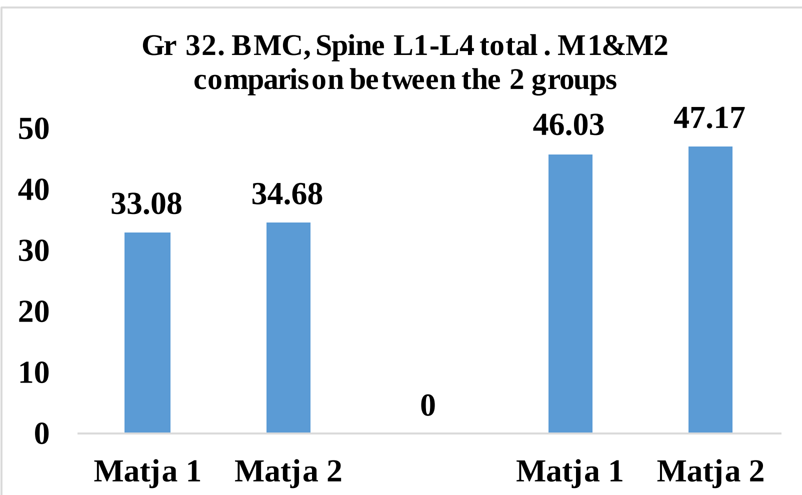
Reference	BMC M1	BMC M2
Left femur	20.47	21.24
Left femur	29.5	13.19
Left femur	22.88	3.24
Left femur	13.3	14.73
Left femur	27.92	28.85
Mean	**22.81**	**16.25**

Table 77. Bone mineral composition in the control group (N=3 females age group 21 years old). (Measurement 1 & 2) Reference: Left femur.

Reference	BMC M1	BMC M2
Left femur	33.72	34.92
Left femur	54.22	54.61
Left femur	50.15	52
Mean	**46.03**	**47.17**

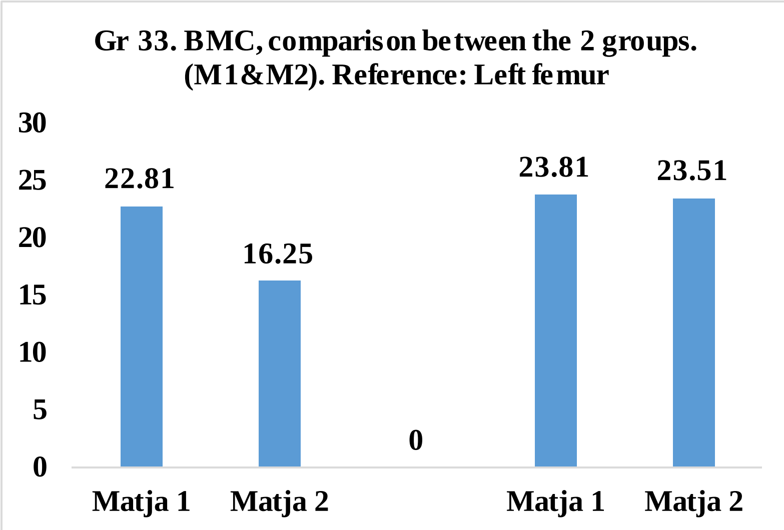
Table 78. Results of the first 5 control group subjects (mean age 21.6 years old) and result oaf the 3 intervention group subjects (N=3 mean age 21 years old). Reference: Spine L1-L4 and Left femur, total

Control group	**BMC M1**	**BMC M2**
Spine L1-L4	33.08	34.68
Left Femur	22.81	16.25
Intervention group	**BMC M1**	**BMC M2**
Spine L1-L4	46.03	47.17
Left Femur	23.81	23.51



Graph 32. *Total bone mineral conten, comparison between the 2 groups (Measurement 1&2) Reference: Spine (L1-L4)*

In Graph 32, are showed the resuls of total bone mineral composition of both groups for the first and second measurement, Reference: Spine (L1-L4). The results of control group data's respectively show that in the first measurement the value is 33.08 and in the second measurement is 34.68 g. In the other side regarding intervention group, results show that in the first measurement the valur from 46.03 g is increased to 47.17 g.



Graph 33. *Total bone mineral composition, comparison between the 2 groups (Measurement 1&2). Reference: Left femur.*

In Graph 33, are showed the resuls of total bone mineral composition of both groups for the first and second measurement and comparison between the 2 groups, Reference: Left femur. The results of control group data's respectively show that in the first measurement the value is 22.81 and in the second measurement is 16.25 g. In the other side regarding intervention group, results show that in the first measurement the valur from 23.81 g to 23.51 g, wich reveals a small decrease.

Discusssion

This study was initiated into consideration the enormous problems but also sensitivity that exists against this very specific category of society. It is worth to mention that at the beginning of the study were selected 28 subjects of which 15 would fall in the control group and 13 in the intervention group. 28 subjects after they had agreed to participate in the study underwent anthropometric measurements as well as with DEXA Scaner examination to assess bone mass density. A part of the control group subjects the day designated for the performance of the second diagnosis by DEXA Scan, for various reasons could not be present. The same situation was with regard to the control group, where in the beginning stage of the training, intervention group for various reasons; commitments to school, work schedule or even deficiency health problems, they could not participate and finally only 5 of them managed to finish the exercising program.

This is also the reason why the intervention group made up only 5 subjects still referring to the fact that Albania is thought to be about 200 β- thalassemia subject's dependent on transfusions think that this number represents this category. Regarding the first objective of this study which was; Assess the level of physical activity to β-thalassemia subjects, based on the survey results thalassemic subjects had a low level of physical activity and noted that in general all entities of both groups had an inactive lifestyle. This result may come as a result of all the problems that accompany an individual who suffers from thalassemia. Another reason of this result may be the fact that most of the subjects are from rural areas to major cities endemic are Lushnja and Fieri where most do not have the opportunity or the infrastructure necessary to exercise but lack affordability since the bulk coming from the lower or medium social level. However, on the results of this survey to the control group in question 6 (For a weekday common, how would you rate your activity overall) to option 4 (active) (run, jump, ski, bike, skates, swimming, games that require a lot of buzz and make you breathe and sweat), have a margin result with the control group respectively 20 % and 43 % of the intervention. However in terms of the questionnaire results for "The extent of evaluation activities ordinary activities " (Habitua1 Activity Estimation Scale (HAES)), must specify that its records were taken and used only to create a general idea as concerns the activities of daily life of the individual participants, without processed the data statistically in terms of validity and reliability since the primary focus was the potential effects of physical activity on the density of bone mass and not the relationship between the status of previous or current physical individuals. Perhaps in another study, these data can be processed and used to find a relationship between these two variables. Regarding DEXA-Scan, based on studies carried out in this field, we can say that is one of the best methods with respect to the density of bone mass. Megjitëse there are also many other ways of diagnosis, DEXA remains one of the best techniques for determining low bone mass in children and adults (Hamidi Z et al., 2008). Moving to the second objective of the study which was; Diagnosis, identification and evaluation of parameters of bone density in these subjects, we can say that from the data obtained by DEXA - Scanning were numerous but while many variables within the groups in the study but rather between individuals when compare with each other but also among the same age group. While seeing the results of the density of bone mass (BMD) in the lumbar spine (L1-L4) shown in Table 69 but also in graphs 18 and 19 which also presented the results of BMD Total comparison between the 2 groups (N = 13). Reference composition: Spine (L1-L4) and femoral head and see the results vary and are different when comparing with the period before the intervention. Also in terms of T

–score Z -score, respectively, there was a small deterioration of average bone density, compared with the average of the control group.

Small deterioration of bone density of perhaps the result of several different reasons or factors. One of the reasons could be the fact that two of the few subjects of practice before the end of the program underwent therapy for discharging excessive amounts of iron in the blood, therapy which lasted several days it just before the end of therapy ended. Also subjects who underwent this therapy were age over 25 years, which is believed to be the age at which completed the period of skeletal bone formation. Many studies have dealt with the examination of the relationship between body composition and bone mass density. Forces that interact to bone skeleton through continuous muscle contraction as; exercise, etc, have a positive impact on the independent to the bone mass density and this was one of the reasons it was thought that the introduction of a program of practice intruders. Also measures fat has a huge impact because it is connected and serves as a deposit which keeps in itself many hormones and cytokines that affect the health of bone mass and to the subjects involved in this study based on the level of BMI and their classification showed that most were normal weight and some were underweight.

Fat body mass is also related to the secretion of the hormone active formation of bone coming from the pancreas as insulin (Thomas T et al., 2001) amylina (Cornish J et al., 1995), the production of leptine (Thomas T, Burguer B., 2002), and the return of testosterone to estrogen (Thomas T et al., 2001). These hormones increase bone mass through streets which increases the amount of osteoblasts and reduce osteoclasts activity. Environment or other factors and hormonal mechanics by which muscle and fat mass to exert their influence bone mass are; gender, age and gonadal specifications. A strong correlation between muscle mass on bone mass density can affect contributing to the growth of the relationship between bone weight compared to fat mass in males and adult females. Women who are affected by thalassemia may be less active than men and this fact can reduce the strengthening of the relationship between Lean muscle mass and bone mass density. Reid et al., 1995, has not described the relationship between fat mass and bone mass density in favor of a better ratio between muscle and bone in women after menopause which were subjected to a regular program of practice. Factors predisposing to the emergence of osteoporosis in patients who perform transfusions as a result of thalassemia are: heart failure endocrine (due to loads of iron, delay of sexual maturation, hypoparatiroidism, hypotyroidism, diabetes melitus, insufficiency of growth hormone, iron toxicity directly to osteoblasts, the progressive expansion of the marrow due to accelerating hematopoesis and adverse effects of deferoxamine (which is used as a discharge of excessive amounts of iron) (Voskaridou, E. & E. Terpos., 2004; F Garofalo et al. 1998; Voskaridou, E. & E. Terpos., 2008; Terpos E, Voskaridou., 2010; Olivieri, NF, 1999). Hatice-Hamarat and others, studied the frequency of osteoporosis in patients with thalassemia major in Turkey, the survey results showed that in a group of 25 patients with thalassemia major (14 males, 11 females) 16 patients had osteoporosis, while 9 patient's others had osteopenia (HaticeHamarat et al., 2013). Salim M AL Jadir and others, have conducted a study in patients with thalassemia in Iraq and have concluded that the prevalence of osteoporosis in these patients was 67.5%, while osteopenia 9.4% and density of bone normal 22.9% (Salim M AL Jadir et al., 2012). Karimi M and others, also have contributed to the study of bone density in patients with β-thalassemia major and intermedia and have drawn the conclusion that patients younger than 20 years, had a density bone density mineral lower in the lumbar backpack (Karimi M et al., 2007). Random studies have reported a high prevalence of neuromuscular diseases in patients with thalassemia (Logothetis et al., 1972; Mollica et al., 1980; Zafeiriou et al., 1998; Stamboulis et al., 2004).

Regarding the third objective of the study which was; Identification of the possible effects of an intrusive program of practice by whole body vibration therapay, combined with some specific exercises on bone density of these entities as well as their general condition, we can say that indicators of bone density but also bone mineral density indicators had much to variable data. Coming back to the study of Fung EB et al. 2012, from which it got the image this study (where the emphasis of the study was put on the fact that there is also a group of other people who can benefit from the effect of the strengthening of the bone mass that comes as a result of the use of exercises with equipment which are based on vibration), based on our study results we can say that our session comparing the data of both groups in general, to the results of bone mass density (BMD) but especially the results bone mineral composition (BMC), noted that in 3 first subjects of the intervention group, when compared with the subjects of the control group of the same age group, we have noticed an improvement of this parameter. However based on the Canadian researchers who have confirmed that the exercises that are performed using vibration throughout the body carried out for 20 minutes a day, with a frequency of 30Hz and a G force of 0.3g, could bring improvements on indicators of the formation of bone (serum markers of bone formation) can say that the program of equipment vibration to the whole body combined with different exercises for a period of 10 weeks was probably insufficient to achieve more results of good in terms of these parameters improved bone density. However, a phenomenon of concentration of blood (hemo-concencatrion) associated with physical activity has been shown recently to occur in patients with thalassemia intermedia (Agostoni et al., 2005), but the contractions of the spleen is to the same patients not affected significantly performing physical activity.

Conclusions and Recomandations

Objectives conclusions

Objective 1: To assess the level of physical activity to β-thalassemia subjects. Based on the survey results thalassemic subjects had a low level of physical activity.

Objective 2: Diagnosis and identification and evaluation of bone density parameters in these subjects. Examination of bone density parameters in these subjects showed that the values of this parameter were below normal levels compared to healthy population.

Objective 3: Identification of the possible effects of an intrusive program of practice by vibrating equipment / vibrant combined with some exercises specific to bone density of these entities as well as their general condition. Exercise on the vibrating platform combined with specific exercises to not only affects the bone density of these subjects but also in a number of parameters that determine the overall welfare.

Physical activity also in the intervention group subjects had a positive effect, bringing an improvement in:

- their overall fitness physical
- Improving but articular pain reduction (art. Femoral coke processing, knees, ankles, art. scapulo-humeral etc.)
- muscular mass strengthening, especially the lower limbs and part of the back-end.
- Improving overall flexibility and range of motions (ROM)
- Improve the sense of physical well-being, social etc.

Based on all the references to studies mentioned above but also to the results of this work can draw some conclusions but also recommendations for this category of subjects.

- Improvement of density, hardness and mineral composition in subjects with thalassemia is in itself a huge challenge for these individuals as well as for members of the medical staff specialized in this direction. It also requires the commitment of many different actors and factors.

• There is a lack of studies that focus on the impact of physical activity in improving bone density in this category of patients.

• This in itself we think that somehow managed to speech to improve their state of physical and psycho - physical, a very important aspect of a part of their lives .

Recommendations

• Other studies are necessary to be performed in order to better identify the risk factors, ways of prevention and also to establish specific guidelines as regards the exercise of physical activity well planned and individualized for each subject of this social category.

• All patients should be checked periodically to measure bone density, so they have comparative data to prevent further problems.

• Early diagnosis, and treatment of endocrine insuficiency, regular blood transfusions, can help achieve an optimal bone density in this category of patients.

• Conduct regular physical activity as one of the best ways and most efficient but does not use medication recommended by a doctor that the experts can bring a significant improvement in these subjects in terms of bone density.

• To improve overall health, but also skeletal bone recommended physical activities such as; Brisk walking, jogging, aerobics, dance, exercise with different circuit forms, weight-lifting exercises with light weights, a healthy way of eating, all depending on the health status of each individual. These activities are carried out before the individual would be good to consult first with a doctor specialist but also with a specialist health and physical activity knowledge in this field.

• Due to the fact that reducing the density and hardness of bone is highly correlated with increased risk for an individual to suffer fractures, it is recommended to carry out other studies that have in their focus therapy or other activities that I have focus them to this problem.

• Also frequent consultations with the physician rheumatologist and / or endocrinologist should be performed in these patients. Also these patients should be; consuming foods with abundant amounts of calcium, should avoid heavy physical activities, they should not smoke.

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