The determination of the effects of addition of calcium and vitamin d on the bone mineral density and on some blood parameters of the sportsmen

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Abstract

This study was carried out to determine the effects of calcium and calcium +D vitamin on the bone mineral density (BMD) and some blood parameters of 60 elite sportsmen who study in different branches of Physical Education Colleges. In the study, lumbar and pelvis (neck, troch, inter, wart triangle) area measurements were used to determine BMD. Procalcitonin, parathyroid, sodium, potassium, chlorine, calcium, phosphorus, magnesium, phosphate, and vitamin D3 in the blood, and level of pridinolin in the urine were examined as biochemical values. The subjects were divided into tree as calcium (Ca), calcium vitamin +D(Ca D), and control groups. The subjects in the calcium group were given 1000 mg extra calcium tablets and the ones in the vitamin D group were given 600 mg calcium +400 IU vitamin D. No extra tablets were given to the control group. Two measurements were taken for the study: one in the beginning and the other at the end. "One Way ANNOVA", "Duncan" tests were applied in and inter groups. As a result of the study, it was found that there was no significant statistical difference in the values of procalcitonin, parathyroid, potassium, calcium, phosphorus, magnesium, alkaline phosphates in the blood, pridinoline in in the urine, and BMD of the subjects ($p>0.05$); whereas, the value of vitamin D3 in CaD groups increased more than other groups ($p<0.05$). The value of sodium decreased in all groups ($p<0.001$), but the value of chlorine increased ($p<0.05$). These statistical findings prove that the extra calcium and calcium vitamin +D given to the elite sportsmen has no effect on them.

Keywords: Sportsmen, calcium and vitamin D, bone mineral density, blood parameters.

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Introduction

Calcium is a major nourishment element playing an important role in terms of protecting bone mineral density (Mehlenbeck, 1998). Bone takes a role as a mineral reservoir so that calcium balance in the body can be regulated. Cumming (1998) has suggested that, with increasing the calcium receiving beyond this point, bone mineral density (BMD) will not be affected; thus, when the calcium reaches a balance with the needs of the body, more calcium will be required.

In the long term, it has been considered that physical activity performed in reasonable intensity is the most important and the only determining thing, which identifies the bone mass (Anderson and Metz, 1993). On the contrary of this, it has appeared that athletic activities in higher and extremely higher intensity can have dangerous effects on BMD. Intensively weight lifting and endurance activities can reduce the BMD (Rockwell *et al.*, 1990). In a study carried out on the amateur male bicyclist (Ricardo *et al.*, 1993), in their age 15 to 19, the total bone mineral content (BMC) and bone mineral density (BMD) were found extremely lower for the bicyclists exercising more than 10 hours a week, when compared to control group. According to this, reasonable intensity exercises result in the increase in BMD, while higher-level exercises can form dangerous effects on bone density. There are both cortical and trabecular (or spongy) tissues in the frame structure of an adult person. Cortical bone or compact bone presents more dense structure and equals 80 – 85 % of total bone mass in the body. Only a part for 15 -20 % consist of trabecular bone i.e. spongy bone. The accumulated evidences indicate that trabecular bone is not a bone showing a development depending on the age; and additionally, the rate of the trabecular bones in the different individuals have also become different in this direction (Einborn, 1992). Renewing values of the cortical and trabecular bones have become different as well; the renewing rate of the trabecular bone in an adult person is probably 5 or 10 times more than that of the cortical bone (Parfitt, 1988). All renewing process lasts 3 to 4 months. In structuring of the bone, parathyroid hormones (PTH) are major developer of osteoclasts and have accelerating effects the remodeling of the bone (Lin, 2000). PTH makes an effect in changing of osteoclast pioneers into multi–celled osteoclasts. Additionally, the performance of osteoclastic absorption depends on the existence of PTH there (Lin, 2000). However, calcitonine (CT) is a peptide hormone with 32- amino acid, which is secreted by thyroide. It is secreted against hypercalcemia primarily and helps to reduce the calcium level in plasma; therefore, is inhibitor of potential bone destruction (Lin, 2000). As a result of CT addition into the culture medium of the organ, it has appeared that osteoclasts and amount of seed per cell has decreased (Freton *et al.* 1993). And, in case of their exposing to CT, the osteoclasts shrink in seconds and become motionless (Chambers and Magnus, 1982; Pandali and Gay, 1980). However, exposing to an extended CT has decreased the sensitivity of the reactions of osteoclasts

to hormones and this is called as “escape” (Obie and Cooper, 1979). This “escape” event has brought CT into less ideal therapeutic instrument.

In this study, giving calcium and extra “calcium + vitamin D” to male and female sportsmen studying in Physical Education and Sport College of Seljuk University and performing sport actively in elite level, the effects of this process have been investigated on bone mineral density (BMD) and some blood parameters.

Material and Methods

60 sportsmen of different branches, who study in Physical Education and Sport College of Seljuk University, perform sport actively in elite level, and are in 18 to 23 years old have participated in this study voluntarily. Investigation is a controlled study examining the effect of tablet addition with the composition “calcium, calcium + D vitamin” on bone mineral density (BMD) and some blood parameters. Independent variable in this study was the addition of calcium and calcium + vitamin D. And recurrence and dependable variable were BMD, and blood parameters measured by DEXA. The subjects tested were divided into 3 groups according to the BMD and blood calcium levels obtained as a result of initial measurements as Calcium Group (Ca), Ca + Vitamin D Group (CaD), and Control Group (C).

The subjects participated in the study, including 15 athletes, 13 sportsmen involved in tae kwon do, 9 judoists, 13 soccer players, and 10 wrestlers; consisted of 60 sportsmen totally, most of whom are in national team. During study, totally 7 sportsmen (3 from Calcium, 2 from Calcium + Vitamin D Group, 2 from Control Group) were excluded from the study, because they didn’t use the tablets given during the study regularly and had disorders. Thus, final sample group consisted of 53 sportsmen totally (13 female, 40 male).

In a health organization, 5 cc of blood sample were taken from the sportsmen received to the study by the nurses, while the sportsmen were hungry. In the serums obtained from the blood sample taken, the values of procalcitonin, parat hormone, sodium, potassium, chlorine, calcium, phosphor, magnesium phosphate, and vitamin D_3 were determined. In addition, having the sportsmen discard the first urines in the morning, pridinolin values were determined in the second urine samples (5 cc) taken. For PTH and calcitonin hormones, it was worked on immulite 1000 by chemiluminessan method. Pridinolin and Vitamin D_3 were determined by HPLC method; whereas the other biochemical measurements, by standard measurement methods used in medical science.

After these determinations, sportsmen were evaluated by DEXA. DEXA equipment used in the study was a hologic QDR – 4500 C. Lumbar L1, L2, L3, L4, total L1 –L4 BMD of the

sportsmen, and their leg, neck, troch, inter, wards triangle areas were measured; statistical assessments obtained from these measurements were used.

1000 milligrams of extra tablet a day was given to Calcium Group; 600 mg tablets with the composition "calcium + 400 IU vitamin D" a day was given to "Calcium + Vitamin D Group". However, no extra tablet was given to the Control Group.

In statistical analysis, SPSS 12 packet program was used. Comparing to ONE WAY ANOVA "DUNCAN" test the data of the sportsmen received to the study in-group and inter-groups, their significance levels were determined.

Results

60 sportsmen, performing sport in the top level actively, in their ages 18 to 23, participated in this study voluntarily and 53 of sportsmen have completed the study. The study was carried out in order to determine the effect of tablet addition with the composition "calcium, calcium + vitamin D", which was given to the sportsmen at the beginning of the study on the BMD and some blood parameters of the sportsmen at the end of the study.

Table 1: Total bone density of test groups in lumbar area, which is between LI and L4 areas.

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2)		St.	P
L1-L4 BMD	Group added Calcium: Ca	Beginning of test	17	1,078	±	0,032	0,999
		End of test	17	1,092	±	0,029	
	Group added calcium + vitamin D: CaD	Beginning of test	18	1,087	±	0,032	
		End of test	18	1,091	±	0,030	
	Control Group:C	Beginning of test	18	1,094	±	0,036	
		End of test	18	1,099	±	0,037	
	Total		106	1,090	±	0,013	

(P > 0,05)

Table 2: Bone mineral density of test groups in hipbone/neck area

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2		St.	P
NECK BMD	Group added Calcium: Ca	Beginning of test	17	1,034	±	0,040	0,907
		End of test	17	1,046	±	0,046	
	Group added calcium + vitamin D: CaD	Beginning of test	18	1,084	±	0,039	
		End of test	18	1,092	±	0,040	
	Control Group:C	Beginning of test	18	1,074	±	0,039	
		End of test	18	1,075	±	0,039	
	Total			1,068	±	0,016	

(P > 0,05)

Table 3: Bone mineral density of test groups in hipbone troch area

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2		St.	P
TROCH BMD	Group added Calcium: Ca	Beginning of test	17	0,867	±	0,033	0,935
		End of test	17	0,926	±	0,067	
	Group added calcium + vitamin D: CaD	Beginning of test	18	0,904	±	0,029	
		End of test	18	0,919	±	0,036	
	Control Group: C	Beginning of test	18	0,895	±	0,036	
		End of test	18	0,908	±	0,035	
	Total		106	0,903	±	0,016	

(P > 0,05)

Table 4: Bone mineral density of test groups in hipbone inter area

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2	St.	P
INTER BMD	Group added Calcium: Ca	Beginning of test	17	1,203 ±	0,039	0,528
		End of test	17	1,211 ±	0,037	
	Group added calcium + vitamin D: CaD	Beginning of test	18	1,273 ±	0,042	
		End of test	18	1,280 ±	0,041	
	Control Group: C	Beginning of test	18	1,267 ±	0,043	
		End of test	18	1,291 ±	0,042	
	Total			1,255 ±	0,017	

(P > 0,05)

Table 5: Bone mineral density of test groups in hipbone warrds area

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2	St.	P
WARDS BMD	Group added Calcium: Ca	Beginning of test	17	0,960 ±	0,043	0,426
		End of test	17	0,992 ±	0,052	
	Group added calcium + vitamin D: CaD	Beginning of test	18	1,097 ±	0,066	
		End of test	18	1,084 ±	0,053	
	Control Group: C	Beginning of test	18	1,063 ±	0,071	
		End of test	18	1,000 ±	0,044	
	Total			1,034 ±	0,023	

(P > 0,05)

Table 6: Total Bone mineral density of test groups in neck, troch, inter areas of hipbone

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2	St.	P
TOTAL BMD	Group added Calcium: Ca	Beginning of test	17	1,089	± 0,037	0,669
		End of test	17	1,094	± 0,036	
	Group added calcium + vitamin D: CaD	Beginning of test	18	1,149	± 0,039	
		End of test	18	1,154	± 0,038	
	Control Group: C	Beginning of test	18	1,140	± 0,040	
		End of test	18	1,157	± 0,038	
	Total			1,131	± 0,015	

(P > 0,05)

Table 7. Vitamin D_3 Values in the blood of the test groups

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2	St.	P
VIT D3	Group added Calcium: Ca	Beginning of test	17	24,088	± 1,531 c	0,005
		End of test	17	30,300	± 2,009 abc	
	Group added calcium + vitamin D: CaD	Beginning of test	18	26,556	± 1,902 bc	
		End of test	18	35,422	± 2,107 a	
	Control Group: C	Beginning of test	18	27,817	± 2,037 bc	
		End of test	18	31,628	± 2,855 ab	
	Total			29,342	± 0,919	

(P > 0,05)

Table 8: Sodium Values in the blood of the test groups

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2		St.	P
Na	Group added Calcium: Ca	Beginning of test	17	142,235	±	0,458 ab	0,000
		End of test	17	140,118	±	0,477 c	
	Group added calcium + vitamin D: CaD	Beginning of test	18	142,722	±	0,341 a	
		End of test	18	141,278	±	0,449 bc	
	Control Group: C	Beginning of test	18	142,556	±	0,398 a	
		End of test	18	140,278	±	0,378 c	
	Total			141,538	±	0,195	

(P > 0,05)

Table 9: Chlorine Values in the blood of the test groups

	Test Groups	Test Time	N Number of individual	Mean (gr/cm^2		St	P
Cl	Group added Calcium: Ca	Beginning of test	17	105,471	±	0,478 a	0,015
		End of test	17	106,941	±	0,503 a	
	Group added calcium + vitamin D: CaD	Beginning of test	18	105,167	±	0,355 b	
		End of test	18	106,833	±	0,506 b	
	Control Group: C	Beginning of test	18	105,222	±	0,417 a	
		End of test	18	105,778	±	0,482 b	
	Total			105,896	±	0,196	

(P > 0,05)

Discussion and Conclusion

For L1 to L4 lumbar area total BMD measurement of the subjects received to the study, in Ca Group, group mean of measurement value at the beginning of the test is 1,078 ± 0,032 g/cm^3, while group mean of measurement values at the end of the test is 1,092 ± 0,029 g/cm^2. In CaD Group, for measurement value at the beginning of the test, group mean of total BMD measurement in L1 to

L4 lumbar backbone area was 1.087 ± 0,032, while total BMD group mean of measurement value at the end of test was 1,091 ± 0,030 g/cm^2. For control group, at the beginning of the test, total BMD group mean of L1 to L4 lumbar area was found as 1,094 ± 0,036 and BMD group average of measurement value at the end of the test was 1,099 ± 0,037 g/cm^2. Total BMD mean of all groups was 1,090 ± 0,013 In terms of comparisons in group and inter – groups, the significant difference was not met in BMD of total L1 to L4 area. (P > 0,05) (Table 1)

When BMD measurement values are compared to each other for each area (neck, troch, inter, and wards triangle) in the hipbone of the subjects received to study, any statistically significant difference has not been seen among the Ca, CaD and Control Groups. (P > 0,05) (Table 2 to 6)

Rourke *et al.* (198), in the study they carried out on the young male athletes about whether Ca addition increases the BMD of the sportsmen or not, could not find any significant difference concerning the differences in BMD in "inter-groups measurements" for the measurements in 6th and 12th months (P > 0,05). Lloyd *et al*. (2004), for the young female sportsmen in 12 to 22 ages, didn't met any significant relationship between receiving 500 mg/ per day of calcium and total bone gain of the body (P > 0,05). Mc Clanahan *et al.* (2002) found that, in the study they carried out on BMD's and BMC's of triathlon athletes, no change occurred in the measurements performed in the first six months of the season in BMD and active mass index for active triathlon athletes (P > 0,05). The obtained findings from these studies carried out are in parallel with the findings we obtained from our study.

When $VitD_3$ level of the test groups, whose measurements were made at the beginning and end of the test, were examined, $VitD_3$ levels in the blood of the group, which $VitD_3$ was given, and the other groups has been higher than the values measured at the beginning of the test. But, when the values of test results are compared, the values of the group, to which ViD_3, was given, which was higher than the other group mathematically, has been different statistically (P < 0,05). According to these results, it can be said that ViD_3 addition has improved the blood values. However, for the other groups, being higher of the values measured at the end of the test more than the ones at the beginning of the test can be explained with the fact that the season was the summer, in which these measurements were made, and increasing of $VitD_3$ synthesis in the skin by the influence of sunrays (Table 7).

When Na and Cl levels in the blood of the subjects received to the study were examined, in general, it has been observed that, even though Na levels decrease, Cl levels increase (P < 0,05). It has been reached a result that this change is not in any relation to the applications carried out. It has been supposed that this difference can be related to sweating and loosing liquid resulted from the fact that the summer season was warmer (Table 8 - 9).

As a result, according to the data obtained from the study period for 3 months, it has been found that tablet addition with the composition of 1000 mgs of Calcium and "600 mgs of Calcium + 400 IU vitamin D " a day had no effect on BMD and some blood parameters of the sportsmen. It has been made a decision that more comprehensive and long termed studies should be carried out, in order to clarify better the existing study topic and light the way for the other studies.

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