THE EFFECTS OF 24-WEEKS DEEP WATER TRAINING ON BONE DENSITY

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The Purpose of this study was to determine the influence of prolonged deep water training on bone mineral density (BMD).

The following questions were formulated:

1. To what extent will deep water aerobics have influence on bone mineral density?
2. Do any changes occur at the women exercising aqua aerobic in comparison to the women not involved in any physical exercises?

Participants

Two groups of women, between the ages of 30-62 participated in this research.

Additionally the groups were divided for:

- Before menopause and postmenopausal:
- They do not suffer from medical problems which may affect their bone density.
- They do not take any medications
- They do not smoke.

Tab.1 Comparison of data for the experimental and control groups

	A 2 (n= 6) Before meno	B2 (n = 10) Before meno	A 1 (n=10) Postmeno	B1 (n = 9) Postmeno
Age [years**]**	41,3 ± 6,1	42,2 ± 4,5	**54,6** ±4,5	**55,1** ± 4,9
BMI [kg/m2**]**	25,6 ±3,6	25,7 ±3,8	26,2 ±3,4	26,1 ±3,5

- A1, A2 exercised: 2 x 45 min per week, with the same instructor throughout the period from October to March for a 24 wks.

- B1,B2 provided normal daily activity and not engaged in any physical exercises.

METHODS

The forearm bone mineral density in the non-dominating arm has been examined using p-DXA method by OSTEOPLAN+ :

- in the mid distal,
- ultra distal section.

The results were expressed in:

- Bone mineral density BMD (mg/cm2)
- T-score (the number of standard deviations (SD) above or below the mean BMD values for a young healthy adult)
- Z-score (the number deviations above or below the mean BMD values for a population of the same age and gender)

Information on dietary intake was obtained by three-day food records:

- two workdays,
- one weekend day.

DEEP WATER TRAINING

- The water temperature 27-28 degrees C;
- The swimming pool depth 140 - 360 cm;
- All activity was conducted at deep water with using flotation belts;

- The sessions were conducted accordingly with safety principles and standards of AEA and American College of Sports Medicine guidelines (ACSM, 2000).

DEEP WATER TRAINING

Minutes

45	**COOL DOWN (stretching)**						
40	Toning 20-25 reps without equipment only water resistance	Toning 15-20 reps light resist. lever lenght, surface, movemt. speed	Toning 10/14 reps x 2sets moderate resist. gloves, noodle, latex band	Toning 10/12 reps x 2/3sets 6-8 exercises gloves, noodles, paddles, kickboards, ankle and wrist weights,	Strength 12 reps x 2 sets or all aerobic portion with equipment	Strength 8 reps x 3sets	Strength 8reps x 2 sets
30							
	Water walking,jogging	**Water aerobics**	**Interval**	**Circuit tr. with stations/interval**	**Water aerobics**	**Water aerobics/ running**	**Water aerobics/ interval**
20	**20 min**	**20 min**	**25 min**	**25- 30 min**	**30 min**	**30 min**	**30 min**
8							
0	**WARM UP**						
	WEEKS	**1-4**	**5- 10**	**11- 13**	**14-16**	**17-20**	**21-24**

RESULTS

Table 2. BMD values pre and post intervention program in the experimental A1 and control groups B1 – (postmenopausal)

Parametr			A1 (n = 10)		B1 (n = 9)	
			before	post	before	post
ULTRA DISTAL MID DISTAL	BMD [mg/cm^2]	V-score	397,6 ± 48,6	390,6 ± 49,0	384,9 ± 31,7	381,3 ± 36,8
		Z-score	0,892 ± 1,088	0,852 ± 1,082	0,649 ± 0,578	0,674 ± 0,649
		T-score	0,238 ± 0,964	0,100 ± 0,965	-0,011 ± 0,622	-0,079 ± 0,728
	BMD [mg/cm^2]	V-score	646,6 ± 34,5	**633,3** ** ± 33,5	631,0 ± 59,5	**612,4** ** ± 57,9
		Z-score	-0,199 ± 0,635	-0,384 ± 0,748	-0,452 ± 0,731	**-0,639** * ± 0,681
		T-score	-0,767 ± 0,548	**-1,061** ** ± 0,547	-1,016 ± 0,944	**-1,309** ** ± 0,918

*** p<0.05; **p<0,01**

RESULTS

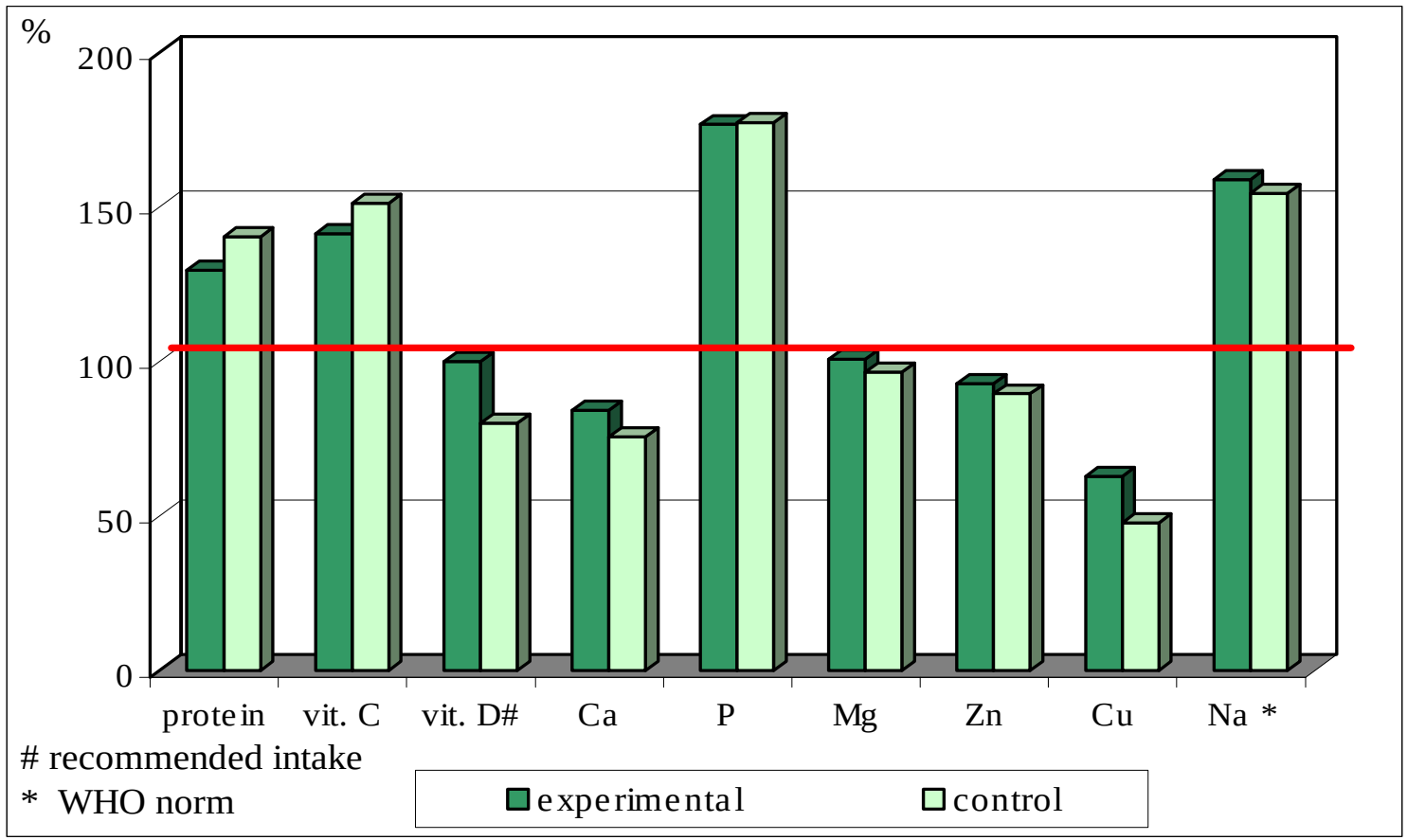
Table 3. BMD values pre and post intervention program in the experimental A2 and control groups B2 – (before menopausal)

			A2 (n = 6)		B2 (n = 10)	
			before	post	before	post
ULTRA DiSTAL MID DISTAL	BMD [mg/cm^2]	V-score	400,8 ± 55,0	395,5 ± 65,1	414,9 ± 57,7	414,7 ± 58,1
		Z-score	0,355 ± 1,065	0,275 ± 1,268	0,618 ± 1,144	0,644 ± 1,143
		T-score	0,303 ± 1,087	0,200 ± 1,291	0,580 ± 1,144	0,577 ± 1,152
	BMD [mg/cm^2]	V-score	660,5 ± 52,4	653,0 ± 46,5	667,1 ± 45,9	658,8 ± 53,9
		Z-score	-0,495 ± 0,799	-0,600 ± 0,700	-0,386 ± 0,720	-0,503 ± 0,847
		T-score	-0,548 ± 0,830	-0,667 ± 0,740	-0,445 ± 0,726	-0,575 ± 0,854

*** p<0.05; **p<0,01**

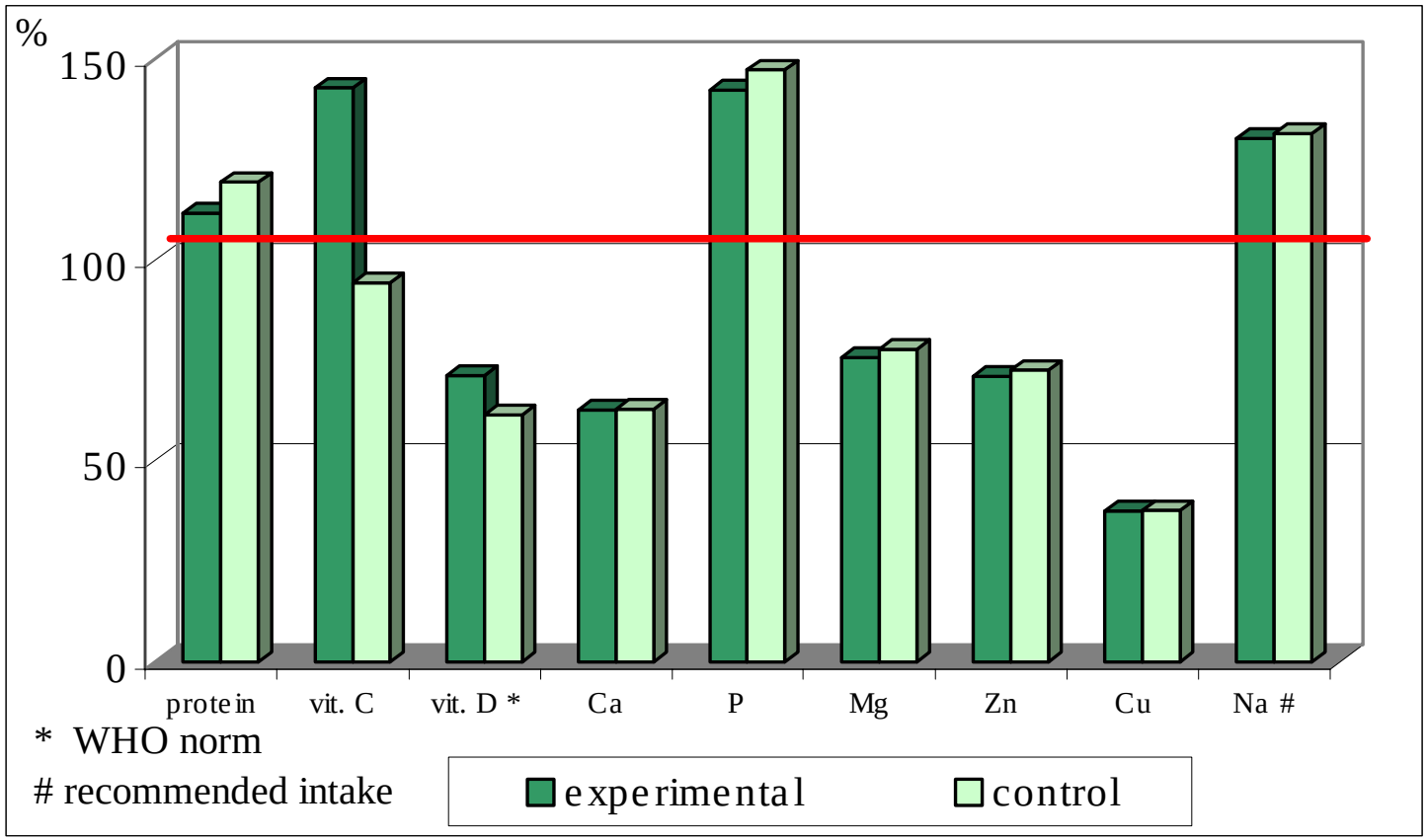
RESULTS

FIG. 1. PERCENTAGE OF SAFE LEVEL OF NORM IN POSTMENOPAUSAL WOMEN



RESULTS

FIG.2. PERCENTAGE OF SAFE LEVEL OF NORMS IN BEFORE MENOPAUSAL WOMEN



RESULTS

- In all groups the average value of total protein intake was above the safe level of Polish RDA.
- Total protein intake was higher in postmenopausal women (A1, B1). Animal protein intake (from 70,0% to 74,7% of total protein) significantly exceeded prescribed level.
- Minerals intake was lower than the safe level of Polish RDA, except phosphorus and sodium.
- The average phosphorus intake was very high and covered from 154% to 173% safe level of Polish RDA.
- In comparison to the acceptable level of sodium intake according to the WHO we observed a high exceeding of this level form 30% to 60%.
- In connection with high intake of phosphorus and low intake of calcium a ratio of Ca to P was very low.
- The sufficient intake of vitamin D has been observed only in postmenopausal experimental group but vitamin C in all group.

CONCLUSIONS

- 1. The mean values of BMD in both groups of postmenopausal women (exercisers and control group) contained in the range of changes recognized as the progressive physiological process.

- 2. The study showed in both groups many risk factors for osteoporosis.

  The most important of them was small in the relation to norms consumption of the calcium, magnesium, zinc, copper and vitamin D (except exercising postmenopausal women - A1 group) and excessive intake of the protein, phosphorus and sodium.