Chapter Five

SUMMARY, CONCLUSIONS & RECOMMENDATIONS
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SUMMARY

Chronic diseases are the most serious public health burden that the world faces in twenty first century. Among these chronic diseases, cardiovascular diseases, cancer and musculoskeletal disorders are the most important; and are related to physical inactivity. Osteoporosis was known as a clinical condition. It was only in 1992 that osteoporosis was upgraded to a progressive systemic disease characterized by low bone mass and deterioration of bone tissue leading to bone fragility and fracture.

Physical activities and sport provide several beneficial effects on human body and mind. Various systems in the human body respond differently to varying degrees of physical activities. Intensity, volume and frequency are essential parameters to assess the benefits physical activities on human biological systems. It is widely accepted that physical activity benefits the musculoskeletal system but the mechanisms affecting bone mass and density that are set off by physical activity in general and mechanical loading in particular are still poorly understood. Adolescent’s indulgence in physical activities have cumulative effects which are obvious during old age. The use of exercise to maintain bone health throughout life and ultimately prevent osteoporosis related fractures has received substantial research attention in recent years because it is a low cost intervention that is available to most of the general public. However, training studies examining the effects of exercise on BMD have led to conflicting results. The purpose of study was to examine the differential BMD among athletes with impact and active loading and non athletes. The
study also aimed at comparison of BMD among athletes indulged in various sports disciplines and control group. Furthermore, the study intended to assess the causal relationship between muscle performance in terms of high, average and low ability on BMD of athletes.

The study included 30 boys and 40 girls within the age of 15 to 19 years. All of them belonged to Thiruvananthapuram district of Kerala state. Purposive random sampling technique was observed to select subjects for impact loading, active loading and non athletic control groups. Impact loading group in girls section included five sportspersons each from kabaddi, taekwondo, middle & long distance running, volleyball and boxing. Impact loading group in boys section included sportspersons from gymnastics, taekwondo and middle & long distance running. Active loading group in girls and boys section included five sportspersons each from cycling and swimming. The variables selected for the study were BMD at legs, femoral neck, pelvis, spine, arms, dominant hand forearm and total body measured with dual energy x-ray absorptiometry (DXA). Muscle performance variables included static strength in terms of dominant hand grip strength, explosive strength in terms of vertical jump, muscular endurance in terms of flexed arm hang (for girls) and pull ups (for boys) and dynamic strength in terms of sit ups in one minute.

The study comprised a quasi experimental design having a static group comparison with the treatment not under the control of the researcher. Athletes were actively indulged in serious training in their predominant sport for 3.33±.53 and 2.44±.54 years for girls and boys respectively. All the subjects included in the study were administered a self structured questionnaire enquiring age, education, sports participation, diet practices, medication
details, fracture incidents (if any), smoking, alcohol consumption, weight reduction strategies (if any), menarche & menstrual cycle (for girls only).

All the subjects including control group were tested for BMD and Muscle performance once. BMD was assessed in a laboratory, in the presence of investigator, by an expert lab technician mostly handling the equipment for clinical purpose since past 15 years. Results were electronically provided for each subject. Muscle performance was assessed by the investigator with the assistance of a helper in an indoor sports complex.

The data collected through questionnaire, DXA and field tests were treated with appropriate statistical techniques. Apart from descriptive statistics, one way analysis of variance was employed for comparison between different loading patterns and sports disciplines. For assessing the influence of muscle performance, the athletes were categorized into high, average and low performance groups for each aspect. LSD post hoc test was applied wherever the F-ratio was found to be significant. The level of significance was chosen as .05. Multiple regression analysis was carried out to assess the of prediction total body BMD though muscle performance.

CONCLUSIONS

On the basis of the results and within the limitations of the study, following conclusions were drawn:

1. There existed significant difference in BMD of female athletes with different loading patterns and non athletic control at legs, pelvis, spinal column, femoral neck and total body BMD.
2. There existed significant difference in BMD of male athletes with different loading patterns and non athletic control at pelvis, spinal column and femoral neck.

3. There existed significant difference in BMD of female athletes engaged in different sports disciplines and non athletic control at all the given BMD sites and total body BMD.

4. There did not exist any significant difference in BMD of male athletes engaged in different sports disciplines and non athletic control at any of the given BMD sites and total body BMD.

5. There did not exist any significant difference in BMD of dominant hand forearm in female and male athletes possessing high, average and low dominant hand grip strength and control group.

6. There did not exist any significant difference in BMD of legs in female athletes possessing high, average and low ability to perform vertical jump and control group.

7. There existed significant difference in BMD of legs in male athletes possessing high, average and low ability to perform vertical jump and control group.

8. There did not exist any significant difference in BMD of arms in female and male athletes possessing high, average and low ability to perform flexed arm hang (females) & pull ups (males) and control group.

9. There existed significant difference in BMD of femoral neck in female athletes possessing high, average and low ability to perform sit ups and control group.
10. There did not exist any significant difference in BMD of femoral neck in male athletes possessing high, average and low ability to perform sit ups and control group.

11. There did not exist any significant difference in total body BMD of female and male athletes possessing high, average and low muscle performance and control group.

12. Muscle performance capacity in terms of grip strength, vertical jump, flexed arm hang (for girls), pull ups (for boys) and sit ups were not significant predictors of total body BMD in trained female and male athletes.

**RECOMMENDATIONS**

On the basis of observations and conclusions drawn from the study, the following recommendations are made.

1. It is recommended for young girls and boys to participate in weight bearing activities which include multifarious bodily movements in order to enhance BMD.

2. It is recommended for young girls and boys to include site specific loading to acquire high BMD at certain fracture prone sites.

3. It is recommended for young girls to increase abdominal strength through dynamic exercises in order to accrue high BMD at femoral neck.

4. It is recommended for young boys to increase lower extremity strength through explosive exercises in order to accrue high BMD at legs.

5. It is recommended for young girls and boys to involve in indigenous games which are advantageous in order to acquire high BMD.
6. It is recommended for young girls and boys to prefer games like water polo to swimming or even cycling.

7. A longitudinal study to examine the long-term durability of loading and muscle performance effects is felt essential.

8. Similar studies may be conducted for assessing socio-economic and socio-ethnic factors associated with BMD.

9. Specific dose-response associations need to be determined with similar study or even an experimental design.

10. Similar studies including several other BMD sites, sport disciplines and performance abilities are essential.

11. Interactions between pubertal development and different forms of physical activity on bone mass outcomes need to be extensively studied.

12. Interactions between different loading patterns and nutritional aspects need to be intensively studied.

13. It is also recommended to study the hypothetical bone mineral alteration possibly caused by the hormonal imbalance.

14. A quantitative approach in which individual study findings addressing a common problem are statistically integrated and analysed is essential.