

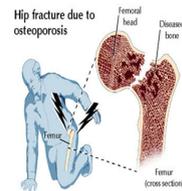
PURPOSE

To examine impact of usual daily physical activity on bone structure at the hip (Hip Structural Analysis [HSA]) in 430 Midwestern post-menopausal women.

Magnitude of Osteoporosis Problems:

- 10 million have disease (80% females-20% males)
- Cause in women - decreased bone strength due to menopause and aging
- One in every two women will fracture
- Annual health care costs in U.S.: \$19 billion

After hip fracture: 50% lose independence and 12-24% die within a year of the fracture.



RATIONALE

- Best predictor of fractures is bone strength - determined by both bone structure and BMD.
- Structure -size, shape, and distribution of bone mass. Past studies on impact of activity on BMD - not on structure. Thus impact of activity on bone may be underestimated.

Hip Structural Analysis (HSA):

- Structure at hip measured using Dual Energy Absorptiometry (DXA) and Hip Structural Analysis (HSA) software. HSA measures: cross sectional area (CSA) and section modulus (SM) at narrow neck (NN), intertrochanter (IT), and femoral shaft (FS) sites of proximal femur

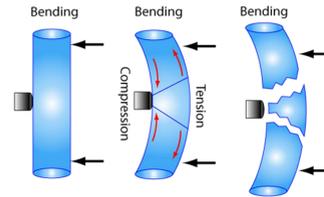
CSA (cm²): total surface area of bone in a cross-sectional slice, excluding marrow and soft tissue:

- Greater CSA = greater cortical thickness. Cortex is solid outer layer of bone. Cortical thickness in post-menopausal women reduced. Studies report increase of in cortical thickening with exercise.



Section Modulus (cm³ (SM): indicator of bending strength of bone-ability to withstand bending stress:

- Improved SM = better resistance to bending stress
- Improved CSA = better resistance to compression stress
- Result is reduced fracture risk.



METHODS

Sample:

Mean Age	54.5 years
Mean Weight and Height	163 lbs. / 64 inches
Mean % Lean Mass	58.1%
White / Not Hispanic	n=368 89.8%
BMD Categories	
•Normal	n=259 61%
•Osteopenia	n=138 32%
•Osteoporosis	n=29 7%
Activity Level	
•Minimal	n=11 3%
•Moderate	n=180 42%
•Active	n=234 55%

DESIGN

Descriptive correlational study - secondary analysis of baseline data from women volunteering for a federally funded study: "Prevention of Osteoporosis in Post-menopausal women"

HSA & BMD measures obtained using Dual Energy X-ray Absorptiometry (DXA)



Physical Activity Profile (HAP):

- Self-reported questionnaire
- Scores correlate with physiologic assessments of activity
- Ranks 94 activities in order of energy to perform
- HAP / Adjusted Activity Score (AAS) - usual physical activity
- 3 categories of AAS
 - Healthy active engage in strenuous leisure activity
 - Moderately active have no limitations at home or work
 - Minimally active only perform grooming and basic household demand.

RESULTS

Usual daily activity (AAS) had a significant indirect effect on Section Modulus (SM) and CSA at all three sites - the narrow neck (NN), intertrochanter (IT), and femoral shaft (FS) sites of the proximal femur (p<.001). Figures 1 and 2 depict path analysis for outcomes of CSA and SM at the neck of the femur – a common site of hip fracture.

Figure 1. Proposed path analysis depicting the association between activity, weight, lean mass percentage, and CSA at femoral neck.

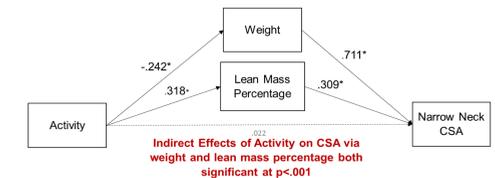
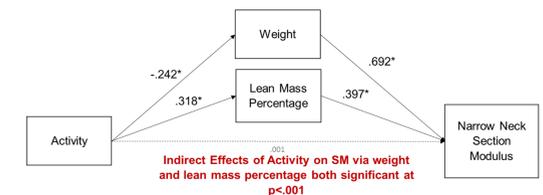


Figure 2. Proposed path analysis depicting the association between activity, weight, lean mass percentage, and Section Modulus at femoral neck



CONCLUSIONS and IMPLICATIONS

- In this study of 430 postmenopausal women, usual daily activity (AAS) had a significant indirect effect on Section Modulus and CSA via activity's effect on weight and % lean mass.
- Only 55% of women healthy active and engaging in strenuous leisure activities.
- Average body mass index (BMI) was 27.7. BMI >25 categorized as overweight.
- This sample had a % lean body mass (LBM) of 58.1%. Ideal % LBM ≥ 68%
- > BMI, < % LBM, and < % healthy active in this sample of women a concern for their long-term health. Implication is need to promote increases in activity and a healthier diet.
- For maximum bone health, women should participate in both resistance training and weight bearing activities with high bone-loading forces 3-5 times per week.
- Women who participate in these aggressive bone-loading exercises will require additional demonstrations, training, monitoring, and support.