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| **Supplementary Table 1. Differences in Volumetric Percent Density by Tertiles of Circulating RANK and sRANKL** |
| **Biomarkers** | **Tertile 1** | **Tertile 2** | **Tertile 3** | **P-trend** |
| **Among All Study Participants** |  |  |  |  |
| **RANK, range (pg/mL)** | 0.2-8.3 | 8.3-47.6 | ≥47.6 |   |
| Adjusted for age and BMI1  | Ref. |  0.5 (-0.8, 1.8) |  1.3 (0.0, 2.6) | 0.02 |
| Multivariable adjusted2 | Ref. |  0.4 (-0.9, 1.7) |  1.1 (-0.2, 2.4) | 0.02 |
| **sRANKL, range (pmol/L)** | 2.1-142.2  | 142.3-255.7  | ≥255.7 |  |
| Adjusted for age and BMI1 | Ref. |  1.2 (-0.1, 2.5) |  0.5 (-0.8, 1.8) | 0.21 |
| Multivariable adjusted2 | Ref. |  1.2 (-0.1, 2.5) |  0.7 (-0.6, 2.0) | 0.23 |
| **Among Women with Lower Progesterone** |
| **RANK, range (pg/mL)** | 0.2-8.3  | 8.3-42.9  | ≥42.9 |   |
| Adjusted for age and BMI1  | Ref. |  0.4 (-1.4, 2.3) |  0.8 (-1.0, 2.3) | 0.42 |
| Multivariable adjusted2 | Ref. |  0.4 (-1.5, 2.3) |  0.8 (-1.1, 2.7) | 0.62 |
| **sRANKL, range (pmol/L)** | 2.1-142.2 | 142.3-255.7 | ≥259.1 |  |
| Adjusted for age and BMI1 | Ref. |  1.7 (-0.1, 3.6) |  0.1 (-1.8, 1.9) | 0.86 |
| Multivariable adjusted2 | Ref. |  1.6 (-0.2, 3.5) |  0.1 (-1.7, 2.0) | 0.72 |
| **Among Women with Higher Progesterone**  |
| **RANK, range (pg/mL)** | 0.2-7.9 | 8.5-47.6 | ≥47.6 |   |
| Adjusted for age and BMI1  | Ref. |  0.6 (-1.2, 2.5) |  1.8 (-0.1, 3.7) | 0.02 |
| Multivariable adjusted2 | Ref. |  0.6 (-1.3, 2.5) |  1.6 (-0.3, 3.5) | 0.01 |
| **sRANKL, range (pmol/L)** | 18.3-141.5 | 144.4-249.5 | ≥256.2 |  |
| Adjusted for age and BMI1 | Ref. |  0.6 (-1.3, 2.5) |  0.9 (-0.9, 2.8) | 0.02 |
| Multivariable adjusted2 | Ref. |  0.7 (-1.2, 2.7) |  1.3 (-0.6, 3.2) | 0.01 |

1Adjusted for age and body mass index (BMI).
 2Adjusted for age (continuous), age at menarche (continuous), body mass index (continuous), family history of breast cancer (Yes/No/Unknown), parity (0, 1, 2, ≥3), race (White/African American/Other) and current alcohol intake (Yes/No).

**Supplementary Table 2. Least Square Means of Non-Dense Volume by Tertiles of Circulating RANK and sRANKL**

|  |  |  |
| --- | --- | --- |
|   | Non-Dense Volume (cm3) | P-trend |
| **Biomarkers** | Tertile 1 | Tertile 2 | Tertile 3 |  |
| **RANK, range (pg/mL)** |  0.2-8.3 |  8.3-47.6 |  ≥47.6 |  |
| Age and BMI adjusted1 | 974.6 | 963.2 | 942.1 | 0.37 |
| Multivariable adjusted2 | 956.1 | 941.9 | 932.3 | 0.40 |
| **sRANKL (pmol/L)** |  2.1-142.2  |  142.3-255.7  |  ≥255.7 |  |
| Age and BMI adjusted1 | 1006.8 | 852.0 | 1025.9 | 0.95 |
| Multivariable adjusted2 | 988.9 | 837.2 | 1010.9 | 0.76 |

1Adjusted for age and body mass index (BMI).
 2Adjusted for age (continuous), age at menarche (continuous), body mass index (continuous), family history of breast cancer (Yes/No/Unknown), parity (0, 1, 2, ≥3), race (White/African American/Other) and current alcohol intake (Yes/No).

**Supplementary Table 3. Least Square Means of Volumetric Percent Density, Dense Volume, and Non Dense Volume by Tertiles of Circulating RANK, Excluding Women whose Circulating RANK Values were reported as**

**<2 pg/mL.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | Tertile 1 | Tertile 2 | Tertile 3 | P-trend |
|  | Volumetric Percentage Density (%) |  |
| Age and BMI adjusted1 | 7.7 | 8.5 | 9.2 | 0.01 |
| Multivariable adjusted2 | 8 | 8.8 | 9.3 | 0.04 |
|  | Dense Volume (cm3) |  |
| Age and BMI adjusted1 | 69.4 | 75.8 | 82.2 | 0.01 |
| Multivariable adjusted2 | 71.7 | 77.4 | 83.1 | 0.02 |
|  | Non-Dense Volume (cm3) |  |
| Age and BMI adjusted1 | 979.6 | 956.6 | 952.3 | 0.67 |
| Multivariable adjusted2 | 975.5 | 952.8 | 958.2 | 0.81 |

1Adjusted for age and body mass index (BMI).
 2Adjusted for age (continuous), age at menarche (continuous), body mass index (continuous), family history of breast cancer (Yes/No/Unknown), parity (0, 1, 2, ≥3), race (White/African American/Other) and current alcohol intake (Yes/No).