Increased fractures in Asian populations have been reported in various studies, with patients with diabetes being at a significantly higher risk compared to individuals without diabetes [2]. Studies have found that diabetes is a risk factor for fracture in Asian populations, and that this association is independent of BMD or diabetic complications [3]. There was limited evidence indicating lipid metabolism or hyperglycemia and risk of fracture or bone loss. One study found that women with high triglycerides had a significantly lower risk of fracture [3].

**LIMITATIONS**

- **Electrocardiogram (ECG):**

  **Objective:**
  - The International Osteoporosis Foundation projects that by 2050 more than 50% of all osteoporotic fractures will occur in East and South-East Asia [1]. In addition, the prevalence of lifestyle-related metabolic disorders is rapidly increasing in Asia [2,3].
  - Glucose intolerance and diabetes are common in people with lifestyle-related metabolic disorders.
  - The majority of studies included in the review were cross-sectional studies.
  - Findings from this review suggest that diabetes is a risk factor for fracture in Asian populations.
  - Atherosclerosis may also be associated with increased fractures in Asian populations, and specific risk factors include metabolic disorders, osteoporosis, and fracture risk in Asia.

**METHODS**

- The databases searched were EMBASE.com (includes Medline and EMBASE) and The Cochrane Library. The overall search strategy included terms for osteoporosis, BMD, fracture, and the following risk factors:
  - Type 2 Diabetes
  - Hyperglycemia
  - Hypercholesterolemia, hyperlipidemia, and dyslipidemia
  - Metabolic syndrome (MetS)
  - Atherosclerosis

- Only observational studies (cohort, case-control, or cross-sectional reporting) were included. Studies with only risk factors were included, but not studies with only cross-sectional reporting.
- Fractures, studies reported risk estimates (odds ratio, hazard ratio or relative risk) and corresponding confidence intervals. For BMD, studies reported risk estimates for osteoporosis (i.e., BMD T-score < -2.5) or osteopenia (i.e., BMD T-score < -1.0 and > -2.5). In addition, studies reporting mean values of BMD and measures of variance (SE, SD or 95% CI) in patients with and without metabolic disorders were included.
- Studies were assessed as **(high quality)**, **(acceptable)** or **(low quality)** using checklists for cohort and case-control studies developed by the Scottish Intercollegiate Guidelines Network (SIGN).

**RESULTS**

- The literature search identified 32 observational studies for inclusion, including 28 studies conducted in East and South-East Asia and four in the Middle-East.
- The majority of studies were cross-sectional study (24 studies).
- One study [2] was assessed as high quality (+ + +) and 31 as adequate (+ +).
- There were 15 studies that included both men and women, two studies in men only and 17 studies in women only.
- The most commonly controlled variables were age (29 studies), BMI or weight (22 studies) and smoking (18 studies).
- Studies reporting risk of fracture are shown in Table 1. Studies reporting risk of osteoporosis are shown in Figure 2 and studies examining mean BMD in subjects with and without the disorder are summarized in Table 1. In addition, there were three studies reporting mean difference in BMD [30-32].

**CONCLUSIONS**

- Findings from this review suggest that diabetes is a risk factor for fracture in Asian populations. Atherosclerosis may also be associated with increased fractures in Asian populations, and MetS associated with bone loss in Asian men, however the extent of causality in these observations is yet to be determined.
- These findings highlight the importance of properly managing patients with these risk factors to minimise the risk of fractures. Further appropriately adjusted prospective cohort studies are needed to investigate the extent and mechanisms of these associations in Asian populations.