Calcium

in plant-based diets

Jane Philpott MA (Oxon) MSc PhD
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Calcium……..mg

Vegetables

Spring greens, 1 cup, steamed.....160
Butternut squash, 1 cup, baked.....85
Broccoli, 1 cup, boiled.....80
Watercress, 1 cup.....58
Brussels sprouts, 1 cup.....56
Kale, 1 cup.....52
Carrots, 2 medium.....50

Legumes

Tofu, raw, firm, ½ cup.....253
White beans, 1 cup, cooked.....160
Navy beans, 1 cup, boiled.....126
Tempeh, cooked, ½ cup.....92
Baked beans, 1 cup.....86
Chickpeas, 1 cup, boiled.....80
Pinto beans, 1 cup, boiled.....79
Lentils, 1 cup, boiled.....38

Grains

Wheat flour (fortified), 1 cup.....420
Soy flour, 1 cup.....288
Quinoa, 1 cup.....138
Barley grain, 1 cup.....88
Bulgur wheat, 1 cup.....77
Oats, 1 cup.....55
Millet flour, 1 cup.....48
Rye flour, 1 cup.....38
Couscous, 1 cup.....33
Buckwheat, 1 cup.....21
Cornflour, 1 cup.....18

Nuts and seeds

Poppy seeds, 1 tbsp.....158
Tahini, 1 tbsp.....102
Sesame seeds, 1 tbsp.....54
Chia seeds, 1 tbsp.....51
Flax seeds, 1 tbsp.....26
Almonds, 10g.....24
Brazil nuts, 10g.....17
Hazelnuts, 10g.....14
Sunflower seeds, 10g.....11

Herbs and spices

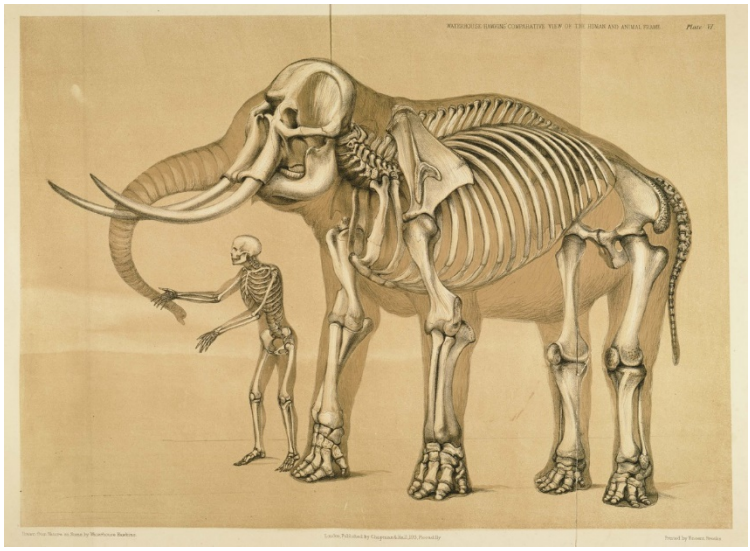
Basil, dried, 1 tsp.....63
Marjoram, dried, 1 tsp.....60
Thyme, dried, 1 tsp.....57

What is calcium?

Calcium is a mineral necessary for life. Like all minerals, it's found in soil and taken up by plants through their roots and incorporated into root tissue, stems, leaves, flowers and fruits.

Animals then eat plants to obtain calcium and other important minerals.

The skeletons of the largest animals on earth, like the elephant, hippopotamus, giraffe, horse, and cow, are formed solely by consumption of plants. So, there's more than enough calcium in plants to form the relatively smaller skeleton of a human.



Why do we need calcium?

Calcium plays a key role in building strong bones and teeth; regulating nervous tissue and muscle contractions, including heartbeat; and ensuring blood clots normally. It's thought that calcium may help lower high blood pressure and protect against colon and breast cancer, although more evidence is needed to confirm this.

The average adult body contains approximately 1 kg (2.2 pounds) of calcium. This represents the most abundant mineral

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Herbs and spices cont…

Dill, dried, 1 tsp.....53
Sage, dried, 1 tsp.....50
Cinnamon, ground, 1 tsp.....37
Parsley, fresh chopped, 1 tbsp.....20
Nutmeg, ground, 1 tsp.....6
Paprika, ground, 1 tsp.....6
Turmeric, ground, 1 tsp.....5

Sea vegetables

Arame, dried, small handful (7g).....82
Kombu, dried, 1 strip.....63
Wakame, dried, 1 strip.....46
Agar agar, 1 tbsp.....15
Nori, dried, 1 sheet.....12

Fruit

Rhubarb, 1 stick.....121
Figs, 1 serving 30g/1oz.....75
Orange, fresh, 1.....62
Pineapple, dried, 30g/1oz.....36
Currants, 30g/1oz.....28
Dried apricots, 30g/1oz.....28
Olives, 30g/1oz.....18
Blackcurrants, raw, 30g/1oz.....18
Dates, dried, 30g/1oz.....14
Blackberries, 30g/1oz.....12
Lemon zest, 1 tbsp.....8

Comparison – dairy products

Sheeps milk, raw, 1 cup.....340
Cheese, Emmental, 30g/1oz.....291
Cow's milk, semi-skimmed, 1 cup.....240
Cheddar cheese, 30g/1oz.....222
Goat's milk, 1 cup.....200
Low fat yoghurt, plain, 100g/4oz.....190
Parmesan cheese, grated, 1 tbsp.....120

Comparison - fish, egg, meat

Sardines, 1 can, 100g/4oz.....550
Pilchards, 1 can, 100g/4oz.....250
Sea bass, raw, 100g/4oz.....120
Chicken egg, 1.....28
Salmon, steamed, 100g/4oz.....23
Tuna, canned in brine, 100g/oz.....8
Minced beef, 100g/4oz.....9
Chicken, 100g/4oz.....4

in the human body and bones serve as an important storage depot for this calcium - 99% of it is found in the skeleton in the form of calcium phosphate salts.

We regularly lose calcium from our bloodstream through urine, sweat and faeces. It's renewed with calcium from bone or from the diet. Bones are constantly broken down and built up again. After the age of 30, bones tend to break down more quickly than they're renewed. The loss of too much bone calcium can lead to fragile bones or osteoporosis.

How much calcium do we need?

Calcium consumption varies greatly worldwide, ranging from 800 mg per day or more in industrialized countries to 200 to 300 mg in some developing countries[1].

Region	Calcium intake (mg per day)		
	Animal	Vegetable	Total
USA/Canada	717	314	1031
Europe	684	212	896
Oceania	603	233	836
Other developed	314	251	565
USSR	567	184	751
All developed	617	233	850
Africa	108	260	368
Latin America	305	171	476
Near East	223	261	484
Far East	109	196	305
Other developing	140	292	432
All developing	138	206	344

The differences are mainly due to variation in the intake of dairy products, which are the richest sources of calcium. In countries where milk is scarce or culturally avoided, calcium is obtained from consumption of vegetables and grains.

Official dietary guidelines for calcium vary from 500 to 1000mg per day; upper values are probably way more than necessary.

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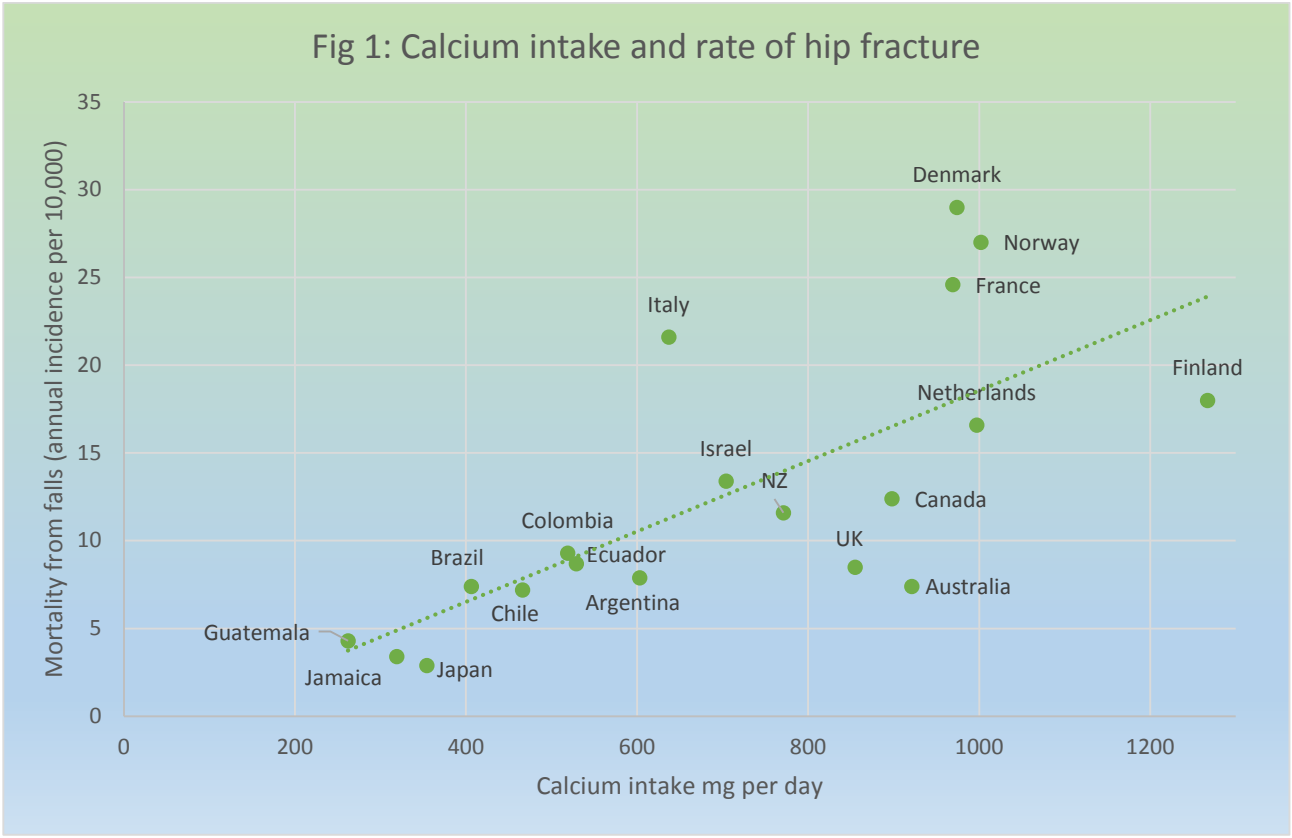
Despite this large variation in calcium intake, there's no evidence that osteoporosis is more common in developing than in industrialized countries. Indeed, the reverse is true – countries with the highest average intake of calcium per day have the highest rate of mortality from hip fracture in the elderly (Fig 1)[2,3].



Calcium regulation

Calcium balance is maintained by the actions of three organ systems - gastrointestinal tract, bone, and kidney.

Under healthy conditions, the body uses an activated form of vitamin D, calcitriol, to adjust how much calcium it absorbs from food and how much it excretes and distributes in bone.

Calcitriol is a hormone. When more calcium is needed, it enhances calcium absorption in the intestinal tract and restricts calcium excretion by the kidneys.

If we consume high amounts of calcium by drinking pints of cow's milk or taking supplements, the intestinal cells block absorption of calcium and the kidneys eliminate the excess.

If too much calcium is consumed over a long period of time, the body may lose its ability to regulate calcitriol, temporarily or permanently disrupting the regulation of calcium absorption and excretion.

Disturbing the mechanism of balancing calcium in this way, increases the risk of osteoporosis in menopausal and post-menopausal women.

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Calcium loss

Osteoporosis is a disease typically caused by excess loss rather than inadequate intake of calcium.

A number of factors affect calcium loss from the body:

- Diets high in protein increase calcium loss in urine. Protein from animal products causes more calcium loss than protein from plant foods[4]. This may be one reason why vegetarians tend to have stronger bones than meat-eaters.
- Diets high in sodium increase calcium loss in urine[5].
- Caffeine consumption increases calcium loss in urine[6].
- Smoking increases the loss of calcium from the body[7]
- Reduction in oestrogen levels post menopause increases loss of calcium[8]

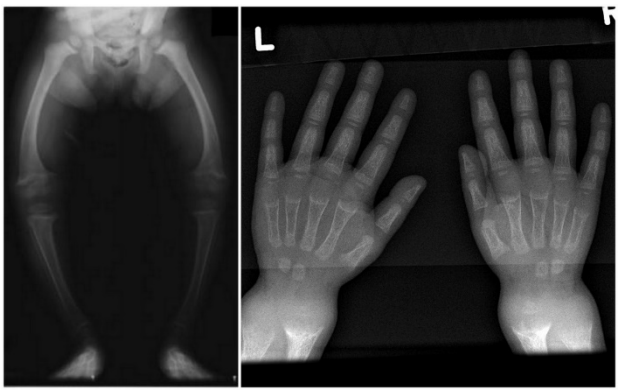
A number of factors increase bone building in the body:

- Exercise is one of the most important factors in maintaining bone health[9].
- Exposure to sunlight allows the body to make the bone-building hormone vitamin D
- Consuming calcium from plant-based sources, especially green vegetables and beans, is excellent for building and maintaining strong and healthy bones

Calcium deficiency

Disease caused by deficiency of calcium is very rare.

Nutritional rickets - a condition of weakening of the bones, leading to fractures and deformity - causes considerable disability among children.



It's usually associated with a deficiency of vitamin D, but studies in Africa and the USA have suggested that calcium deficiency may also play a part, though the data are equivocal[10,11].

Short duration of breast feeding, reduced calcium content of breast milk, high dietary intake of phytates, which inhibit absorption of calcium, impaired physiologic adaptation or extreme diets are thought to be contributory factors.

A small number of cases of rickets caused by calcium deficiency have been reported in the USA. In one report, three children received commercial soy milk as their main source of nutrition for 6 months[12]. In another case, a child was fed apple sauce and oatmeal with no milk until after 1 year[13].

Children and adults on normal, natural diets are highly unlikely to be deficient in calcium and there is scant scientific justification for encouraging high levels of dairy consumption for promoting bone health[14].

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Should you take calcium supplements?

The success of the dairy industry's marketing campaigns has made everyone believe that if you don't consume enough calcium from milk, you'll suffer from osteoporosis. As we've seen from Fig 1 above, the opposite is true.

The nutraceuticals industry also plays on this fear and markets calcium supplements as a means to prevent osteoporosis. But is there any scientific evidence to support their claims?

Calcium supplements, given alone, improve bone mineral density, but have little benefit in reducing the risk of fractures and might even increase the risk of fractures[15,16]. Any benefit of supplements is likely due to neutralisation of the acid-forming Western diet[17].

Systematic reviews published in the *British Medical Journal* indicate that calcium supplements, with and without vitamin D, increase the risk of myocardial infarction (heart attack) by 24 to 30 per cent, and are associated with small increases in the risk of stroke and overall mortality[18,19].

To be on the safe side, it's best to consume calcium only from its most natural sources: plants.

Sample plant-based menus

Breakfast
Whole oat porridge with seeds and raisins

Lunch
Butternut squash and ginger soup with sprouted bread

Dinner
Chickpea (garbanzo) and cashew nut korma, with turmeric rice and steamed broccoli
Grilled pineapple with strawberry and mint

Snacks
Lemon and thyme hummus on rye bread
Blueberry and banana smoothie

Total calcium: 507mg

Breakfast
Apple and almond puree with blueberries
Mashed banana and cinnamon on sprouted bread

Lunch
Quinoa, chickpea (garbanzo), avocado, bell pepper and olive salad

Dinner
Spiced stuffed butternut squash with hazelnut, orange and avocado salad
Banana and caramel ice cream

Snacks
Guacamole and tortilla chips
Cranberry and cashew nut bars

Total calcium: 585mg

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Recipes

Whole oat porridge with seeds and raisins

Makes 2-3 servings

Ingredients

Porridge

- 1 cup oat groats
- 4-5 cups water if using slow cooker or 6 cups water if using regular cooking pot
- ½ cup (100ml/3½ fl oz) nut milk, e.g., hazelnut milk (optional)

Topping

- 1 tbsp ground seeds, made from:
  - 2 tbsp pumpkin seeds
  - 2 tbsp sunflower seeds
  - 2 tbsp sesame seeds
- 1 tsp (7g/¼oz) raisins

Method

- Put oat groats and water in a slow cooker and cook on medium heat for 2-3 hours or until the oats are soft, white and creamy.
- If you don't have a slow cooker, you can use a regular cooking pot with a lid. You'll probably find you need to add 6 cups water for every 1 cup of oat groats because you lose more water by evaporation with this method. Just bring the water to a boil and turn down the heat low and allow the oat groats to simmer with the lid on for 2-3 hours until soft, white and creamy.
- Add seeds to a coffee grinder or kitchen blender and grind to a powder. Sprinkle on porridge with raisins.

Lemon and thyme hummus

Makes 16 servings

Ingredients

- 2 tsp olive oil or 1-2 tbsp water
- 1 small pinch of sea salt
- 1 small (110g/4oz) onion (diced)
- 1 clove garlic (peeled and crushed)
- 1 can (400g - 240g/8oz drained weight) chickpeas (garbanzo beans)
- 1 lemon - zest of whole lemon and 2 tbsp lemon juice
- 2-3 sprigs (3g/0.1oz) fresh thyme or 1 tsp dried thyme
- 2-3 teaspoons spoon light tahini (paste made from ground sesame seeds)
- 1-2 teaspoons spoon sweet white (shiro) miso or salt and pepper to taste if you don't have miso.

Method

- In a pan, sweat onion and garlic in a small amount of olive oil or plain water with a pinch of sea salt over a low heat until soft and translucent.
- Add all the other ingredients and blend until smooth. If the mixture is too dry, add some more lemon juice or water to achieve the desired consistency.
- Add tahini and white (shiro) miso to taste.
- Garnish with a sprig of fresh thyme and serve on rye bread

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Butternut squash and ginger soup

Makes 4-5 servings

Ingredients

- 2 tsp olive oil or 1-2 tbsp water
- 1 pinch sea salt
- 2 medium (260g/9oz) white onions (peeled and chopped)
- 1 large (800g/28oz) butternut squash (peeled and chopped into 2cm chunks)
- 2cm piece of fresh ginger root (approximately 30g/1oz), peeled and finely chopped
- 1 strip (3g/0.1oz) kombu sea vegetable
- 1 pint/500ml water
- 2-3 tsp sweet white (shiro) miso paste diluted in a little water
- Sprig fresh herbs
- 2-3 pieces of sprouted bread

Method

- Put the oil or water in a thick pan with a pinch of sea salt, add the chopped onion and sweat gently for 5 to 10 minutes until the onions are soft and translucent. Add butternut squash and ginger to the pan and pour in enough water to just cover the vegetables; I needed approximately 1 pint water.
- Add a strip of kombu sea vegetable for extra minerals and bring to a boil, reduce heat and simmer for about 20 minutes or until the butternut squash is soft.
- Remove the strip of kombu and blend remaining ingredients until smooth with a simple hand blender.
- Right at the end, add miso paste to season the soup. It's best to add a little at a time and keep tasting. Some brands of miso paste are much saltier than others, so go carefully.
- Garnish with fresh herbs and serve with sprouted spread.

Chickpea (garbanzo) and cashew nut korma with turmeric rice

Makes 4-5 servings

Ingredients

Rice

- 1 cup brown basmati rice, washed
- 2 cups water
- 1 tsp ground turmeric

Main dish

- 2 tsp olive oil or 1-2 tbsp water
- 1 pinch sea salt
- 2 large white onions (peeled and chopped)
- 1 clove garlic (peeled and crushed)
- 1 tsp garam masala
- 1 tsp ground cumin
- 1 tsp ground coriander
- ½ tsp ground cardamom
- 1 tsp fennel seeds
- 1 tsp turmeric
- 1 piece of fresh root ginger (c. 2cm thick or 30g/1oz), peeled and finely grated
- 2-3 tbsp coconut powder or 60g/2oz creamed coconut dissolved in 500ml/1 pint boiling water or 1 can coconut milk
- 1 cup/125g/4oz whole cashew nuts
- 1 can (400g - 240g/8½oz drained weight) cooked chickpeas (garbanzo beans)

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- 2 medium carrots (peeled and cut into small pieces)
- ½ large sweet red bell pepper (washed, seeds removed and diced)
- 2-3 tsp white (shiro) miso, diluted in a little water
- 1 tbsp fresh coriander (cilantro), washed and finely chopped

Vegetable side dish

- 1 head broccoli, washed and cut into florets

Method

- Add rice to a thick-based pan, together with water and turmeric. Cover and bring to a boil, turn heat down and simmer for 40-45 minutes until rice is soft and the water has all evaporated.
- Whilst rice is cooking, place chopped onions and crushed garlic in a pan with a pinch of sea salt and gently sweat in oil or water over a low heat until the onions become soft and translucent.
- Add the spices and ginger and continue to sweat the ingredients over a low heat for a few more minutes.
- Dissolve the coconut powder or creamed coconut in the boiling water and add half of this to the onions and spices in the pan, or add ½ can coconut milk.
- Place half the onion mixture in a food processor along with half of the cashew nuts and half the chickpeas (garbanzo beans). Process until smooth. If you don't have a food processor you can use a simple hand blender, or mash chickpeas (garbanzo beans) with a fork and use ground almonds instead of cashews.
- Add the remaining coconut milk, cashew nuts and chickpeas (garbanzo beans) to the onions left in the pan.
- Add the carrots and red pepper to the pan; bring to a boil and simmer until the carrots and sweet pepper are tender.
- Add the processed cashews, chickpeas (garbanzo beans) and onions to the pan and continue to simmer. Take care as this mixture burns easily.
- Add the diluted miso paste little by little, tasting as you go, until you've achieved the desired level of seasoning.
- Mix in the chopped coriander (cilantro) and garnish with some fresh coriander (cilantro).
- To steam broccoli, place florets in a steamer for 4-5 minutes; it should be tender without being too soft. You can boil it instead but you'll lose nutrients this way.
- Serve chickpea (garbanzo bean) and cashew nut korma with the turmeric rice and lightly steamed broccoli.

Grilled pineapple with strawberry and mint

Makes 4 servings

Ingredients

- 1 fresh ripe pineapple, peeled, cored and chopped into chunks
- 180g/6oz fresh sweet ripe strawberries, washed and sliced
- 1 sprig fresh mint, washed and finely chopped

Method

- Thread pineapple chunks onto wooden skewers and grill for 5-10 minutes, turning regularly.
- If you soak the wooden skewers in water first, they'll burn less easily.
- Keep a few strawberries aside to garnish. Blend the rest with the chopped mint.
- Arrange pineapple skewers on a plate and spoon strawberry and mint sauce over the top.
- Serve garnished with fresh strawberries and a mint leaf.

Nutrient analysis of menu

Total nutrients in menu and % of guideline daily amount

calories kcal	carbs g	Sugars g	Fibre g	Protein g	Fat g	Sat Fat g	Sodium mg
1648	264	91	33	51.5	51	11	1103
79%	85%	-	185%	114%	63%	45%	69%

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About Jane

As a young child I was distressed by pictures of famine in Ethiopia and vowed to solve the world food problem when I grew up.

My first degree was in Biological Sciences, specialising in agriculture, at Oxford University in the UK, followed by an MSc in Crop Protection, with Distinction, at Imperial College, London.

After completing a PhD in plant physiology at Bristol University, I spent 14 years in senior leadership roles in research and development in multinational agribusiness, focused on increasing global production of food.

A health issue drew me to the scientific literature on nutrition and I was hooked.

I left my career in industry, undertook further academic qualifications in nutrition and training in whole food cookery, and started my own business – www.cookingforhealth.biz – whilst also working part-time as a Non-Executive Director in the health and social care industries.

Now I'm leading a gentle revolution, inspiring transformation of health and well-being by making simple changes to what you eat, drink and think.

Eat plants not pills.

Website:
www.cookingforhealth.biz

Interesting articles about nutrition and health
https://drjanephilpott.wordpress.com/

Recipes
http://vegetabledoctor.blogspot.co.uk/

You can also find me
on Facebook, Twitter, Pinterest and LinkedIn.

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