



ROLE OF FOLIC ACID AND POTASSIUM SUPPLEMENTATION AGAINST LOSS OF BONE MINERAL DENSITY (BMD) IN POSTMENOPAUSAL OSTEOPOROTIC WOMEN: A RANDOMIZED CONTROL TRIAL

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Abstract:

Osteoporosis is a disorder in which bones become brittle and risk of fractures increases and is also becoming common day by day. In US, almost 10 million women and men are affected by this disease. Previously, among all nutrients most of the attention was given to calcium and vitamin D for treating bone disorders but now latest studies suggest that other nutrients such as Folic acid, vitamin B12 and Potassium are also beneficial for bones in addition to vitamin D and calcium. The objective of this study was to evaluate the collective role of Folic acid and Potassium supplementation against loss of Bone Mineral Density in Postmenopausal Osteoporotic women. This study was conducted on postmenopausal osteoporotic women of age 35 to 55 years at Jinnah Hospital, Lahore. The duration of this study was 3 months and study design was Randomized Control trial. The sample size 60 was divided in to two groups. Pre and post testing was done. Group A was control group which did not receive any supplementation while group B was intervention group and received folic acid and potassium supplementation. Results showed positive outcomes and concluded that both folic acid and potassium supplementation have significant effect ($p < 0.05$) as they both increase bone anabolism, lower bone resorption, decrease bone stress and fatigue, while value for BMD remained same.

Keywords: Bone resorption, Bone Mineral Density, Folic acid, Potassium, Postmenopausal Osteoporosis

1: INTRODUCTION

Osteoporosis is a disease that is identified by decreased bone mass, degeneration of tissues of bones thus damaging the structure and functions of bone, weakening the ability of bones to provide strength and increasing the risk of fractures. There are multiple factors that contribute to osteoporosis but the most common of them are; Aging and menopause (Sözen et al., 2017). Osteoporosis is also becoming a cause of increased mortality. In US, almost 10 million women and men are affected by this disease (Tu et al., 2018). Future estimations conclude that almost 40% of

women of age greater than 50 years will suffer from fractures caused by osteoporosis and could increase to 50% in near future while in case of men increase in bone fractures will be almost 13% as fractures due to osteoporosis are becoming common day by day (Akkawi & Zmerly, 2018). Osteoporosis is divided into 2 types. One is Primary Osteoporosis that is subdivided into 2 more types as Postmenopausal osteoporosis (Type 1) and the Senile osteoporosis (Type 2). The second type is called secondary osteoporosis and is caused by taking medications such as glucocorticoids and can be due to other disorders like hyperparathyroidism (Drake et al., 2015). The most common type of osteoporosis is Postmenopausal osteoporosis and is caused by deficiency of estrogen in the body (Eastell et al., 2016). Main biomarker used to identify bone disorders by WHO is BMD (Bone Mineral Density) (The National Osteoporosis Guideline Group (NOGG) et al., 2017). Following are different ranges defined by WHO to differentiate between bone disorders. Normal value of T-score is greater or equal to -1SD. For osteoporosis value of T-score is less than or equal to -2.5SD. For osteopenia (Due to low mass of bone) the value of T-score is less than -1SD and greater than 2.5SD. For severe osteoporosis value of T-score is less than or equal to -2.5SD with fragility Fractures (Ratajczak et al., 2020).

According to latest research not only macronutrient but micronutrient deficiency can also be associated with different diseases (Hussain et al., 2019) therefore, more focus is required to the use of micronutrients along with therapeutic diets to prevent prognosis of a particular illness (Hussain et al., 2019). Most of the attention is given to vitamin D and Calcium when we talk about bone disorders but research suggests that micronutrients such as Folate, Potassium, Manganese, vitamin K, Copper, boron, vit B12 and vit B6 present in whole food items are also beneficial in treating osteoporosis (Rondanelli et al., 2022). Folic acid and vitamin B12 show positive effects on bones by lowering homocysteine levels. Increased homocysteine levels lower BMD thus indicating an increased risk of fractures (Sahni et al., 2015). Latest studies show 4% decrease in fracture rate for 50 pmol/L increase in vitamin B12 amount. Folic and vitamin B12 acid have active participation in conversion of homocysteine to methionine hence lack of these vitamins causes hyper-homocysteinemia (Rondanelli et al., 2022). Potassium is another important mineral that helps in preventing calcium losses from bone and reducing acid burden. It maintains alkaline state of the body and increased intake of potassium is linked with great BMD in hip, lumbar and femur neck in men and postmenopausal women. Thus, low rate of bone resorption has significant benefits on bone health (Ratajczak et al., 2020). As mentioned above, it is clearly seen that Folate and Potassium have influence on bones as they help in improving BMD and lowering bone resorption process. So, the current study aims at evaluating the role of Folic acid and Potassium supplementation together against loss of bone mineral density in postmenopausal osteoporotic women.

2: MATERIALS AND METHODS

Study area

This study was performed in Jinnah Hospital Lahore, from November 2023 to January 2024.

Preparations of capsules

Folic acid, Potassium and placebo capsules were prepared from a local pharmacy in Lahore.

Sample size

The sample size was calculated from the online calculator Raosoft. (Raosoft 2020). The study sample size was 60 participants (n=30).

Study groups

Group A (Control group): This group received placebo capsules.

Group B (Treatment group): This group received Folic acid 5mg as well as potassium 3g.

Inclusion criteria

- Age group of 35 -55 years
- All osteoporotic women
- Post-menopausal women
- Who were willing to cooperate

Exclusion criteria

- Pregnant, lactating, disabled, teen agers and young girls
- Who had history of any physiological and psychological disorder.
- Who had addiction of alcohol consumption.
- Males
- Who had any medical issue such as Diabetes, HTN etc

Data collection tool

Anthropometrics

Anthropometrics including height and weight were taken. A standard weighing scale was used for determination of weight while height was measured by height measuring scale.

BMD test

Osteosys SONOST BMD machine was used to measure Bone density using the heel area as heel bone is a wide calcaneus bone. The ultrasound pulse that passes through the bone is significantly attenuated with the signals diffusing and is absorbed by spongy tissues as they store Minerals.

Levels of serum Folic acid

For Folic acid test, it is important to fast up to 8 hours before test. Blood samples were taken from the participants to evaluate the results.

Levels of serum Potassium

Blood samples were collected from the participants to evaluate the results.

Ethical approval

The study was approved by Research and Ethics committee of Riphah International University, Lahore. (No. REC/RCR & AHS/22/0807)

3: RESULTS

The study was designed to access the role of Folic acid and Potassium supplementation against loss of Bone Mineral Density (BMD) in Postmenopausal Osteoporotic Women.

Baseline characteristics of participants

All the participants selected for the study were females excluding males. The age distribution of the participants in the control and treatment groups showed that the control group which was given placebo capsules consisted of 2 females of age 35-39years, 7 females of age 40-44years, 9 females of age 45-49 years and 12 females of age 50-55years while the treatment group which was given Folic acid and Potassium supplementation consisted of 2 females of age 35-39years, 7 females of age 40-44years, 8 females of age 45-49years and 13 females of age 50-55years.

Table: 1 Characteristics of participants (n= 60) before treatment

Parameter	Control group	F-K ⁺ group
	Mean ± SD	Mean ± SD
BMD	-2.82 ± 0.18	-2.86 ± 0.24

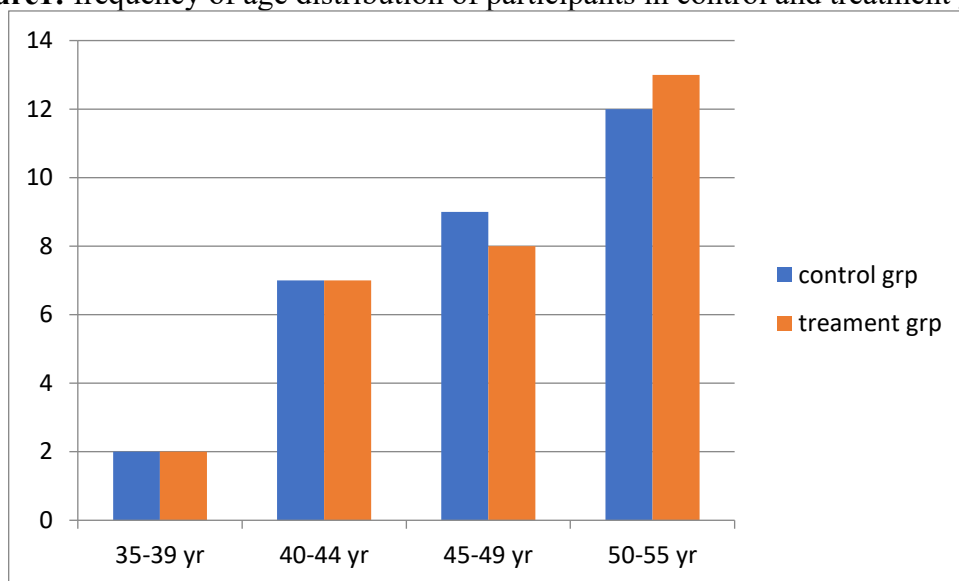
Serum folate	6.00 ± 2.09	6.94 ± 2.70
Serum K ⁺	4.32 ± 0.59	3.93 ± 0.62

BMD: Bone Mineral Density, K⁺ Potassium and F -K⁺: Folic acid and Potassium

Table: 2 After effects Folic acid and Potassium Supplementation on BMD

Parameter	Groups	Before treatment	After treatment
		Mean ± SD	Mean ± SD
BMD	Control	-2.82 ± 0.18	-2.84 ± 0.18
	F-K ⁺	-2.86 ± 0.24	-2.86 ± 0.24
Serum folate	Control	6.00 ± 2.09	5.91 ± 2.07
	F-K ⁺	6.94 ± 2.70	7.26 ± 2.66
Serum K ⁺	Control	4.32 ± 0.59	4.32 ± 0.59
	F-K ⁺	3.93 ± 0.62	4.29 ± 0.58

Figure1: frequency of age distribution of participants in control and treatment group



Effect of Folic acid and Potassium supplementation on Bone Mineral Density (BMD)

Folic acid and Potassium supplementation given to the treatment group showed significant results (p<0.05) as bone pain and lethargy were significantly reduced in the participants while Bone Mineral Density (BMD) value remained same. In the control group where participants were given placebo capsules serum folate values were decreased. Potassium and Bone Mineral Density (BMD) remained insignificant (p>0.05).

4: DISCUSSION

The current study demonstrated that Folic acid and Potassium supplementation have positive effects on Bone mineral density as they significantly lowered bone distress and overall fatigue in patients without any harmful effects. For this propose, they were given 5mg of Folic acid and 3g of Potassium for 3 months. Previous study conducted in 2014 have shown that 1mg of folic acid given to females of age (50-87) years for 6months in a randomized double-blind study also improved bone metabolism by increasing bone biomarkers like osteocalcin and vitamin B12 (Salari et al., 2014). Another study was done in 2017 to access the role of Potassium on Bone Mineral Density in post-menopausal women. Upon nutrition examination and BMD testing of femur, neck, lumber spine and hip bone, the results showed that post-menopausal women having Potassium rich diet had improved BMD with positive impact on bones (Kong et al., 2017) while the current study also resulted in decreased physical symptoms like fatigue, generalized weakness, bone pain and inactivity thus having optimistic outcome.

In a study conducted in 2017, folic acid was randomly given in a dosage of 800 mcg along with vitamin B12 in a dosage of 1000mcg for about 4 months. The study concluded that both folic acid and vitamin B12 significantly improved bone biomarker homocysteine thus improving bone health (Vijayakumar et al., 2017). The present study also improved bone anabolism due to its bone pain easing properties in post-menopausal Osteoporotic women.

The current study showed that supplementation of Folic acid and Potassium improved bone mineral density; reduce bone resorption thus making bone health better without changing values of Bone Mineral Density (BMD). The results of the current study are in line with a previous study that concluded that potassium citrate lowers bone resorption in post-menopausal women, potassium citrate decreased bone turnover rate and has potential foe being used as a bone loss treatment but Bone Mineral Density (BMD) remained same (Gregory et al., 2015)

5: CONCLUSION

Osteoporosis is identified by degeneration of bone tissues, increased bone resorption and disturbance of bone microarchitecture resulting in decreasing the ability of bones to provide strength and diseased person is at more risk of bone fractures. Aging and menopause in females are most common factors leading to this disease. More attention is required to address this disease. Based on literature and current study results, Folic acid and Potassium supplementation have significant effects on Bone Mineral Density as they ease bone pain/ bone distress and lethargy in patients due to their properties in reducing bone resorption and enhancing bone anabolism however we know BMD value cannot be changed. Both Folic acid and Potassium only delayed osteoporosis from becoming worse.

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