

# Forecasting the Risk of X-Ray Radiation Exposure to Radiation Workers in the Radiology Department RSUP X. Jakarta

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**ABSTRACT** - Radiographer in general have a duty and responsibility to audit includes examining patients for radiodiagnostic including nuclear medicine and ultrasonography (USG), radiation exposure techniques in radiotherapy and perform accuracy and security measures radiation protection in radiology and operating equipment or radiation sources. This study aims to estimate the risk of X-ray radiation exposure to radiographer in the Department of Radiology RSUP X using Environmental Health Risk Analysis (ARKL). In calculating the estimated risk forecasts ARKL, risk of X-ray radiation exposure dose radiographer obtained from measurements of the film badge. Data patterns of activity (duration of work, frequency of exposure and years of work) obtained based on the results of a survey of 35 radiographers in the Department of Radiology RSUP "X" Based on the calculations performed, the average value of Excess Cancer lifetime Risk (ELCR) is 0.005 and the value of Excess Real-time Cancer Risk (ERRC) the average is 0,001. Because theoretically carcinogenicity has non-threshold value, then the forecast is declared unacceptable risk (unacceptable) when  $ECR \leq E-3$ . Range of numbers obtained from the E-3, carcinogenicity default values used by the ICRP (1990). Based on the calculation of the ELCR and ERRC forecasts illustrate the risk of carcinogenic effects that occur in the radiographers in the Department of Radiology RSUP "X", unacceptable on cancer risk both in the ELCR and ERRC

**Keyword:** *risk analysis, Excess cancer Risk, radiation, X-rays, radiographer,*

## 1. INTRODUCTION

One of the stages of health based on the life cycle that is important to be considered is the health of elderly women, which refers to women above 49 years old. A *parubaya* woman will experience physiological changes and eating patterns that can affect her health condition.

Changes in hormones, especially estrogen, are one of the physiological changes associated with the health conditions of *parubaya* woman. The decline in estrogen is often associated with the menopause phenomenon, namely the cessation of the menstrual cycle in a woman. The main marker of menopause is the Final Menstrual Period (FMP) or the last menstrual period followed by 12 months of amenorrhea. Meanwhile, post menopause is the period after menopause or FMP <sup>1</sup>.

Estrogen's changes in the postmenopausal women's group have been associated with the occurrence of diseases such as diabetes, obesity and osteoporosis<sup>2</sup>. The changes in estrogen that occur from three years before menopause and continue into the fourth year after menopause cause a decrease in bone mass of one to three percent. This decrease in bone mass will continue and finally a postmenopausal woman can lose 35-50% of her bones<sup>3</sup>.

Hormonal Replacement Therapy (HRT) is one of the clinical treatments for postmenopausal women because this therapy can be used to restore the balance of estrogen. However, the practice of using HRT is still debated because the side effects of increasing other diseases such as cancer and stroke as well as the use of HRT do not completely eliminate the health risks in menopausal women. <sup>4567</sup>

Several studies have developed the concept of functional food as an alternative solution to address the problem of hormonal imbalance in postmenopausal women. Research on fermented black soy pulp (phytoestrogen content) by Go-Eun Hong, *et al* (2012). revealed that the effect of functional foods helps fat and bone metabolism in postmenopausal women to avoid various health risks including osteoporosis.

Phytoestrogen compounds are compounds with structures and functions such as estrogen. One of the phytoestrogen compounds is isoflavones which have been known to exist in soybeans<sup>5</sup>. A high-isoflavone diet is an alternative solution to health problems in postmenopausal women. However, a high diet of isoflavones so far is still dependent on soybeans as the main food ingredient. Alternative solutions such as this high isoflavone diet, it is not easy to directly apply to postmenopausal women. In addition to the limitations of foodstuffs that stick to soybeans, there is a population of postmenopausal women who cannot independently manage their own nutrition. This population of postmenopausal women requires companion in their nutritional management. One of the parties who can carry out the task of assisting nutrition management regularly is an *panti werdha* (elderly nursing home). *Panti werdha* are institutions that are in accordance with the direction of the Indonesian government's policy in realizing the elderly who have a better living standard. Law number 13 of 1998 concerning elderly welfare and social ministerial regulation number 106 / HUK / 2009 clearly shows that elderly nursing homes have a duty to help the elderly to live a reasonable life in the lives of themselves, their families and communities. Elderly nursing homes may initiate to develop age-friendly environment. As the beginning, elderly nursing homes might to set out equity indicators as one of WHO core indicators of age-friendly environment. The presence of elderly nursing homes should ensure that there is no more systematic disparities in elderly's health. However, until now the existence of elderly nursing homes in the midst of Indonesian society also still has a negative stigma. Thus, elderly nursing homes have not been able to optimally carry out their duties in the direction of the Indonesian government policy.

The dependence on soybeans as the main ingredient of a high isoflavone diet and the possibility to maximize the potential of elderly nursing homes, opens the opportunity to conduct research on other isoflavone sources that can be utilized specifically by elderly nursing homes. Searching for various other sources of isoflavones is necessary to answer the need for sources of isoflavones other than soybeans that are easy to use. Therefore, this study aims to find local foods that can be used as a source of isoflavone diets, especially by elderly

## **2. MATERIALS AND METHOD**

This research is a qualitative research conducted at the *Panti Werdha Mandiri Salib Putih (PWMSP) Salatiga*. The inclusion criteria for this study were postmenopausal women aged 55 to 85 years with comorbid osteoporosis and still able to communicate and cooperate. The exclusion criteria for this study were women with menopausal disorders and other sexual aspects of postmenopausal women.

The research began with a food consumption assessment regarding the level of food intake and consumption using a 24-hour recall method. Furthermore, in-depth interviews were conducted regarding the incidence of osteoporosis comorbidities in the study target and local food ingredients believed to be useful as a cure for the disease in the postmenopausal woman group. The interview was conducted using a recorder. In addition to interviews, observations of local foods that can be used as food for postmenopausal women with osteoporotic comorbidities related to availability and possible use in the study area were conducted. Literature review were conducted to find supporting data on the content of isoflavones in various local food ingredients that are considered beneficial for postmenopausal women.

## **3. RESULTS AND DISCUSSION**

### **Characteristic of Postmenopausal Women Respondents**

The first respondent was 75 years old with knee height 28 cm with estimated height based on knee height was 119.77 cm and upper arm circumference was 23 cm. Respondents had experienced falls several times during their activities while staying in PWMSP since 2012. As a result of the fall, respondents had experienced a broken bone in the right shoulder.

"...bagian mana, sini, tulang (pegang daerah pundak). ...lama...ya kalau apa itu, sekali sakit nanti, berapa hari sakit lagi." (First respondent, personal communication, 2018)

Respondents experienced a change in the shape of the spine (hunchback) and reduced of the size of the left legs. The respondent could no longer stand and walk but could still sit and eat independently. The

respondent's appetite is still good because the respondent can still receive all the food provided at PWMSP. In addition, respondents also like to eat snacks such as chips and biscuits aside from toothless she had. The second respondent was 55 years old with a body weight of 55 kg and a height of 140.5 cm. Respondents said that they had never heard much about osteoporosis.

“belum...sakit tulang iya he eh...*boyoan*, kasih obat udah gitu aja.” (Second respondent, personal communication, 2018)

Respondents knows that osteoporosis is just a bone pain. Respondents have never experienced severe injuries to the bone but often feel pain in the spine especially at night.

“...obat tulang *kalo* malem, mau tidur *ga betah* kalo *ga* minum obat... itu yang *NEO rheumacyl*, itu kan yang dianjurkan dari tv kan ada minum *NEO rheumacyl* itu toh, he eh, tiap mau tidur minum itu... : he eh, itu kan ada yang dari tv itu, saya berani kalo yang lain-lainnya *ga* berani mas.” (Second respondent, personal communication, 2018)

However, respondent was still able to do daily activities well including being able to lift weights properly without feeling unbearable pain. Respondent often drinks boiled water of *kijang menjangan* leaves (cakar ayam leaves) and consume moringa leaves because she believe that those two leaves can help overcome bone pain. During this time, respondents had never had a spinal pain checked by a doctor or other health professional and only took over-the-counter drugs, NEO Rheumacyl.

### Food Intake of Postmenopausal Women at PWMSP

Table 1. Macro Nutrient Intake of Postmenopausal Women at PWMSP

Respondent	Rata-rata Asupan Nutrisi			
	Energy (kkal)	Carbohydrate (gr)	Protein (gr)	Fat (gr)
Respondent 1	958,75	165,15	33,95	43,5
Respondent 2	1057,45	135,2	36,2	43,05

The macro nutrient intake of the first respondents was 958.75 kcal of energy, 165.15 grams of carbohydrates, 33.95 grams of protein and 43.5 grams of fat. While the macro nutrient intake of respondents was 1057.45 kcal of energy, 135.2 grams of carbohydrates, 36.2 grams of protein and 43.05 grams of fat. The first respondent had a lower energy and protein intake but had a higher carbohydrate and fat intake.

### Food Service Management and The Potential Local Food at PWMSP

PWMSP allocate daily meal budget as Rp5,000 for all three meals in one day. Funding limitations are dealt with by choosing affordable food items, limit menu variations by using only two menus of vegetables and side dishes for three meals and utilizing several plants in the PWMSP yard as food ingredients.

One of the plants planted in the PWMSP yard is moringa tree (*Moringa oleifera*). Based on the results of interviews with respondents, the community around PWMSP Salatiga believes that Moringa leaves have the effect of helping to overcome various diseases including diseases in the elderly. Moringa leaves are used by PWMSP as a medicinal plant and as an alternative food source that can be used most of the time. Limited funds and labor have caused food service management in PWMSP to not be able to prepare food in detail for those who need specific diet plan. However, PWMSP has limited the use of salt and sugar. Thus, the health condition of elderly is expected to remain good.

The menu provided is quite varied even though the fried menu's frequency looks more often than other cook methods. While in terms of food ingredients it is also quite varied for vegetable food groups. Whereas, for side dishes are limited to using type of vegetable protein like tofu and tempeh. Egg is the only animal-

based protein which often to be used. The animal-based protein group derived from animal meat is rarely used because of budget constraints. In addition, on weekends or certain days PWMSP can still provide snacks for the elderly in the form of green bean porridge.

## **Discussion**

Menopause is one of the important periods in a woman's life related to endocrine changes in her body which is one of the causes of osteoporosis and obesity in women with an average age above 50 years. After experiencing menopause and entering the postmenopausal period, changes in endocrine coupled with poor eating habits can affect the nutritional status of postmenopausal women as a result of interpretation of changes in anthropometric values<sup>8</sup>

Deal with osteoporosis needs special attention because osteoporosis is a chronic disease that is commonly found in women, especially in postmenopausal women due to the low estrogen hormone. Osteoporosis is a major cause of disability including postmenopausal women. Every year, one in three people aged 65 years and over experiences a fall that causes severe injuries with 50% of them being fractures. This fact also illustrates conditions such as those experienced by the first respondent, namely falling several times which causes fractures and disability. The possibility of osteoporosis in postmenopausal women is greater because of factors in weight loss and low body weight in postmenopausal women<sup>9,10</sup>.

Macro nutrient needs per day for women aged 65-80 years based on Indonesia's nutritional adequacy standard are 1550 kcal, 252 grams of carbohydrates, 56 grams of protein and 43 grams of fat. Meanwhile, the number of respondents based on the results of 24-hour recall is 958.75 kcal of energy, 165.15 grams of carbohydrates, 33.95 grams of protein and 43.5 grams of fat. Based on the value of the nutritional adequacy standard and the 24-hour recall result, the first respondent macro nutrient intake for energy, carbohydrate, protein and fat were 61.9%, 65.5%, 61% and 101.2% respectively to the standard.

Macro nutrient needs for women aged 50-64 years are 1900 kcal energy, 285 grams carbohydrates, 57 grams protein and 53 grams of fat. Meanwhile, the amount of respondent's intake based on the 24-hour recall results is 1057.45 kcal energy, 135.2 grams carbohydrates, 36.2 grams of protein and 43.05 grams of fat. The level of adequacy of the second respondent for energy, carbohydrate, protein and fat was 55.6%, 46.4%, 63.5% and 81.2% respectively to the nutrient needs.

The results of the calculation about the level of adequacy of energy, carbohydrate, protein and fat of the two respondents indicated an imbalance in the nutritional intake of postmenopausal women. Nutritional imbalance in respondents can affect weight management which further affects the incidence of osteoporosis in respondents.

The incidence of osteoporosis and nutritional imbalance is a real thing in postmenopausal women. Dietary improvements that can be given to both respondents is to provide a diet high in phytoestrogens and increase energy, carbohydrate and protein intake along with restrictions on fat intake. Phytoestrogen compounds in some food ingredients are expected to replace the presence of estrogen which begins to decline in the postmenopausal female body<sup>89</sup>.

Moringa leaf (*Moringa oleifera* L.) is a plant that is already familiar to people in various places. This plant is widely known as a plant that has so many benefits including in the health sector. Even moringa plants are also called miracle trees because of the many benefits this plant offers. Meanwhile, *Moringa oleifera* is a part of *Moringa oleifera* which has been studied and proven to be rich in nutrients.

The phytochemical test using 10% NAOH reagent, Wilsaster reagent and Smith-Metacalve reagent on Moringa leaf extract showed positive results for flavonoid content according to positive colour changes<sup>10</sup>. Flavonoids as phytochemical compounds that can protect the body from toxic substances have several subclasses including isoflavones. Moringa leaves containing potential flavonoid content are expected to also be used as an alternative source of isoflavones<sup>11</sup>. Flavonoid compounds in Moringa leaves have the highest number compared to other compounds which are also contained in Moringa leaves. The increasing number of flavonoid compounds in Moringa leaves is also expected to increase the potential of Moringa leaves as a source of isoflavones<sup>12</sup>. Thus, Moringa leaves become an ingredient that can increase the variety of isoflavone sources on the diet of postmenopausal women.

Isoflavone-containing foods are important for postmenopausal women related to the risk of osteoporosis in postmenopausal women. Estrogen deficiency in postmenopausal women causes an increase in bone

resorption and inhibition of calcium absorption in the colon which will worsen the incidence of osteoporosis. Moringa leaves that can be used as a source of isoflavones will function as phytoestrogens. Isoflavones will intervene in the endocrine system and produce estrogen-like properties that have the potential to inhibit the progression of osteoporosis due to estrogen deficiency in postmenopausal women<sup>413</sup>.

Besides containing isoflavones that can function as phytoestrogens, Moringa leaves also have other nutrients such as iron, protein, vitamin A, vitamin B and calcium. Calcium which is known to be good in preventing or reducing the severity of osteoporosis in postmenopausal women is also found in fresh Moringa leaves as much as 350-550 mg which equivalent to four glasses of milk<sup>14</sup>.

Moringa potential can be utilized more optimally if there are parties who can introduce Moringa leaves as part of the daily nutrition management of postmenopausal women. The elderly nursing home can be present as one of the parties because the operational of the elderly nursing home is directly related to the nutrition management of postmenopausal women. Elderly homes can make Moringa leaves as a basic ingredient in the daily menu plan.

Moringa leaves as a food source possibly to be done considering the ease of multiplying Moringa plants. The percentage of moringa seed germination is high because the cuttings and roots are easy to grow<sup>1215</sup>. Thus the elderly nursing home is easy to do the multiplication of Moringa plants to supply food ingredients as what have done by PWMSP. Good nutrition management services by elderly nursing homes, including by utilizing nutritious local food ingredients such as Moringa leaves is expected to provide a positive value for the existence of a elderly nursing home.

Most of Indonesians still live with the stigma that taking care of the elderly is a family obligation so the decision to hand over the care of parents to the elderly nursing home is considered a bad thing<sup>16</sup>. Elderly nursing homes in fact have the opportunity to be one example of the age-friendly environment. Opportunities to be an age-friendly environment can be carried out by elderly nursing home by providing maximum service including good nutrition management. Maximum service by the nursing home will provide space to reduce the stigma of the community and show that the nursing home can provide a good life for the elderly.

#### 4. CONCLUSION

High isoflavone diet can be an alternative solution in overcoming osteoporosis in postmenopausal women. Moringa leaves (*Moringa oleifera* L.) can be an alternative isoflavone source for postmenopausal women. The flavonoid content in *Moringa oleifera* L. opens the possibility of isoflavone content as a subclass of these flavonoids. The elderly nursing home can be a party that helps the nutrition management of postmenopausal women by making Moringa leaves as part of the daily menu plan. Good service from the nursing home is expected to be a means to change the negative stigma in the community that the obligation to take care of the elderly is not only on the family side. Thus, it is expected to form a more age-friendly environment. Further research should be done, in order to quantify the isoflavone content in moringa leave.

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#### REFERENCE

1. Karvonen-Gutierrez C, Kim C. Association of Mid-Life Changes in Body Size, Body Composition and Obesity Status with the Menopausal Transition. *Healthcare*. 2016;4(3):42. doi:10.3390/healthcare4030042.
2. Yasui T, Matsui S, Tani A, Kunimi K, Yamamoto S, Irahara M. Androgen in postmenopausal women. *J Med Invest*. 2012;59(1-2):12-27. doi:10.2152/jmi.59.12.
3. Deotale M, Ranganathan U, Mankeshwar R, Akarte S. Study of epidemiological features of health problems in perimenopausal and postmenopausal women in an urban community. *Int J Med Public Heal*. 2015;5(2):147. doi:10.4103/2230-8598.153823.
4. Van Dijk GM, Kavousi M, Troup J, Franco OH. Health issues for menopausal women: The top conditions have common solutions. *Maturitas*. 2015;80(1):24-30. doi:10.1016/j.maturitas.2014.09.013.
5. Hong G, Pyun C, Kim S, Han K, Yang C LC. Effects of Fermented Black Soybean Pulp on Lipid and Bone Metabolism in Ovariectomized Rats. *Food Sci Biotechnol*. 2012;21(5):1397-1403.
6. Qamariah S, Kandou PRD, Wagey FW, Loho MF. Kualitas Hidup Wanita Menopause yang

- Menggunakan Terai Sulih Hormon dinilai dengan MENQOL di RSUD Dr. R. D Kandou Manado. *e-CliniC*. 2013;Vol 1(November 2012).
7. Kotecha N, Lockwood B. Soy - relieving the symptoms of menopause and fighting osteoporosis. *Pharm J*. 2005;275(7371):483-487.
  8. Tursunovic S, Jasic M, Beganlic A HN. Nutritional Status and Dietary Habits of Menopausal Women. *Sci Prof J Nutr Diet*. 2012;3(20):116-125.
  9. Hana B, Abdulaziz F. Nutrition for Menopause and Beyond. 2010:1-19.
  10. Ali Hirani AA, Fehmi A, Momin M, et al. Osteoporosis in Post-Menopausal Women. *i-manager's J Nurs*. 2014;4(2):7-10. doi:10.26634/jnur.4.2.2770.
  11. Aminah S, Ramdhan T, Yanis M. Syarifah Am inah et. al.: Kandungan Nutrisi dan Sifat Fungsional Tanaman Kelor ( *Moringa oleifera* ). *Bul Pertan Perkota*. 2015;5(30):35-44.
  12. Möller FJ, Diel P, Zierau O, Hertrampf T, Maaß J, Vollmer G. Long-term dietary isoflavone exposure enhances estrogen sensitivity of rat uterine responsiveness mediated through estrogen receptor  $\alpha$ . *Toxicol Lett*. 2010;196(3):142-153. doi:10.1016/j.toxlet.2010.03.1117.
  13. Beecher GR. Third international scientific symposium on tea and human health: role of flavonoids in the diet. Overview of dietary flavonoids: nomenclature, occurrence and intake. *J Nutr*. 2003;Supplement:3248-3254. doi:10.1136/bmj.332.7541.614.
  14. Agung A, Oka G, Made L, et al. Identifikasi Senyawa Kimia Ekstrak Etanol Daun Kelor (*Moringa oleifera*). Agung A, Oka G, Made L, Pendidikan M, Dokter P, Hewan FK, et al. Identifikasi Senyawa Kimia Ekstrak Etanol Daun Kelor (*Moringa oleifera* L) di Bali (IDENTIFICATION. 2016;5(5):464-73. *nga oleifera*. 2016;5(5):464-473. doi:2477-6637.
  15. Kristina NN, Siti FS. Pemanfaatan tanaman kelor (*Moringa oleifera*) untuk meningkatkan produksi air susu ibu. *War Penelit dan Pengemb Tanam Ind*. 2014;20(3):27.
  16. Kadar K S, Francis K SK. Ageing in Indonesia – Health Status and Challenges for The Future. *Ageing Int*. 2013;38:261-270.