



Evaluation of the Nutritional Status of Adult Women with Bone and Joints Diseases

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Article Type

Original Article

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DOI: 10.21608/MKAS.20

24.264837.1279

Cite as:

ElGhazaly, and El-Tahan.,
2024, Evaluation of the
Nutritional Status of
Adult Women with Bone
and Joints Diseases. JHE,
34 (3), 159-173

Received: 23 Jan 2024

Accepted: 11 Aug 2024

Published: 1 July 2024

ABSTRACT:

one is a living, growing tissue that mainly consists of collagen and calcium, which protects soft organs and supports the body, especially for females. Their genetics, environmental factors, diet, and infections were the main factors affecting the flexibility and strength of the bones. These may arise from various sources, including. The objective was to evaluate the nutritional status of 100 female patients with bone diseases aged 20-40 years. Anthropometric measurements (Weight, height, and BMI), dietary assessments (24-hour recall and daily average nutrient intake), and biochemical parameters (Hemoglobin, serum glucose, uric acid, serum calcium, vitamin C, vitamin D, etc.) were determined. Results showed that the female suffered from second-class obesity; the most common problem was osteoporosis, followed by rheumatoid arthritis and osteoarthritis of the knee joint. Patients were observed to consume high caloric foods, sodium, and cholesterol levels, over 100%, while the other nutrients were lower than DRI, especially calcium (under 50%) . Additionally, their hemoglobin, s. vitamin D, s. Vitamin C and s. calcium were lower than the normal level, while their fasting blood glucose levels, Serum CRP, and ASOT were higher than the normal range. So, the studied group should have a balanced, varied, and calcium-rich diet, regular weight-bearing impact exercise for weight reduction, and muscle-strengthening exercise.

Keywords: Female, nutritional assessments, osteoporosis, calcium, Serum CRP

1. INTRODUCTION

Bone is a living tissue that is the hardest among other connective tissues in the body and consists of 50% water. The solid part consists of various minerals, especially 76% of calcium salt and 33% of cellular material. Bones have vascular

tissue and cellular activity products, especially during growth, which are very dependent on the blood supply as a basic source and hormones that greatly regulate this growth process. Bone-forming cells, osteoblasts, and osteoclasts play an important role in

determining bone growth, thickness of the cortical layer, and structural arrangement of the lamellae [1,2].

Bone exerts important functions in the body, such as locomotion, support and protection of soft tissues, calcium and phosphate storage, and harboring of bone marrow [3]. Despite its inert appearance, bone is a highly dynamic organ that is continuously resorbed by osteoclasts and neo formed by osteoblasts. There is evidence that osteocytes act as mechanosensory and orchestrators of this bone remodeling process [4,5]. Bone influences the activity of other organs and the bone is also influenced by other organs and systems of the body [6]. Bone remodeling is a highly complex process by which old bone is replaced by new bone, in a cycle comprised of three phases: initiation of bone resorption by osteoclasts, the transition (or reversal period) from resorption to new bone formation, and the bone formation by osteoblasts. This process occurs due to coordinated actions of osteoclasts, osteoblasts, osteocytes, and bone lining cells which together form the temporary anatomical structure called basic multicellular unit (BMU) [7]. On the other hand, an imbalance of bone resorption and formation results in several bone diseases. For example, excessive resorption by osteoclasts without the corresponding amount of performed bone by osteoblasts contributes to bone loss and osteoporosis, whereas the

contrary may result in osteoporosis. Thus, the equilibrium between bone formation and resorption is necessary and depends on the action of several local and systemic factors including hormones, cytokines, chemokines, and biomechanical stimulation [8,9].

Poor nutrition since childhood and not paying attention to taking adequate needs of nutrients important for the safety and health of the bones causes many problems that affect the bones in adulthood, and bone deterioration begins with advancing age. The common bone diseases as osteoporosis which is a disease characterized by low bone mass and deterioration of bone structure that causes bone fragility and increases the risk of fracture. It has defined as a bone mineral density (BMD) value more than 2.5 standard deviations below the mean for normal young [10]. Rheumatoid arthritis (RA) is a long-term autoimmune disorder that primarily affects joints it typically results in warm, swollen, and painful joints. Pain and stiffness often worsen following rest. Most commonly, the wrist and hands are involved, with the same joints typically involved on both sides of the body. The disease may also affect other parts of the body, including skin, eyes, lungs, heart, nerves and blood. This may result in a low red blood cell count, inflammation around the lungs, and inflammation around the heart. Fever and low energy may also be present.

Often, symptoms come on gradually over weeks to months [11,12].

Therefore, the objective of this study was to evaluate the anthropometric measurement, daily nutrient intake and some biochemical parameters of one hundred adult female, their age in the range of 20-40, suffered from bone and joints disease.

2. SUBJECTS AND METHODS

2.1. SUBJECTS

2.1.1 Sample size

Random one hundred female patients, patient's age from 20 years to 40 years.

2.1.2 Setting of study

This study was conducted the patients who visitors the Orthopedic Clinic at Menoufia University Hospital.

2.1.3 Duration of study

The present study started in 15 october 2022 and ended in 22 march 2023

2.1.4 Inclusion criteria

The following inclusion criteria were used: Bone diseases mainly patients with osteoporosis, rheumatoid arthritis and knee osteoarthritis. Patient with mild to moderate bone disease, Living in rural and urban of Menoufia governorate. Their age was about 30 y. Few of patients suffered kidney problems and diabetes. The diagnosis was established based on clinical data, imaging, and laboratory results [13].

2.1.5 Exclusion criteria

Patients with any disability, hospitalized patients, patients who suffered from end-stage disease (i.e., renal, liver, and

cancer), and patients who refused to sign the consent form.

2.2 METHODS

2.2.1 Experimental design

The patient was interviewed weekly at the Orthopedic clinic. Data was collected from patients using a questionnaire about the following :

2.2.1.1 Socio-demographic data:

Marital status, job, level of education, and residence. [14]

2.2.1.2 Anthropometric assessment:

Including body weight and body height which were measured in kg and cm using beam balance (Beurer BG 42) scale by bioelectric impedance technique with minimum clothing without shoes, reading we taken to the nearest 0.5 kg [15]. Body Mass Index (BMI) was calculated according to the following equation, weight in (kg) / height in metre² (kg/m²) . The participants were considered as overweight when BMI >25-29.9kg/m² and obese class 2 when BMI was 35-39.9kg/m² [16].

2.2.1.3 Dietary assessment:

The 24-hour recall method was used to recall the amounts of foods and beverages (in household measures) consumed in the past 24 hours (in household measures) . All foods and drinks were converted into grams. The 24-hour recall was used for three consecutive days and calculated as the percent from daily requirements intake (DRI) . [17]

2.2.1.4 Biochemical analysis:

Serum samples were analyzed for the determination of the following parameters: Hemoglobin, serum glucose and uric acid were determined using methods of Drabkin [18], Trinder & Baraham [19] and Trinder [20] respectively. Calcium (Ca), vitamin C and vitamin D were determined according to methods described in Nicoli & Diana [21], Klein & Perry [22] and Garget al., [23] respectively. Rheumatoid factor (RFs), Serum C-reactive protein (serum CRP) and antistreptolysin-O titer (ASOT) were measured by the methods of Young [24] (up to 30 IU/mL.), Anderson and McCarty, [25] and Wannamaker and Ayoub, [26] respectively

2.2.2 Statistical analysis

The statistical package for social sciences (SPSS version 17.0) 28 was used to analyze collected data. Results were expressed as the arithmetic mean and standard deviation (SD) . Also, the frequency distribution and percentage were used for string variables (socioeconomic status and healthy status) [27].

2.2.3 Ethical approval

All experiments for this study were ethically approved by Scientific Research Ethic Committee (12-SREC-07-2022) .

3. RESULTS AND DISCUSSION

Data in table (1) showed the socioeconomic status of women with bone diseases. It could be noticed that the majority of sample lived in urban place, married and 34%, postsecondary

as educational level and housewife. The most of samples worked for 5h and the average family income was from 3,000 to 5,000 and 48% of women spent 50% of money. The highest percentage of women family had 4 members, lived in owner house with 3 rooms, have no available transportation way and had healthy condition.

From the results the research based on women. In women, bone loss increases dramatically by increasing the age due to dropping estrogen levels. Prolonged absence of menstruation (amenorrhea) before menopause also increases the risk of osteoporosis. Geographical variation is indeed associated with a number of important factors for human health, including differences in latitude, sun exposure time, and diet. All these factors are found to be associated with vitamin D level and vitamin D deficiency which caused osteoporosis and sarcopenia [28]. Poor marital quality is associated with poor bone health in women. Adults with higher education have lower odds of having bone diseases by increasing intake of calcium and vitamin D, participating in weight bearing exercise, limiting alcohol intake, and medication regimen compliance. Occupational bone diseases are rare although osteoarthritis has some occupational risk associated with it. Having a physical workload is one of the common occupational risk factors for OA. Other job risk factors that contribute to OA include regular kneeling, stair climbing, bending, and repetitive

movements. Also, having a genetic disposition for OA will increase any occupational risk hazard for the condition [29]. Exposure to certain toxins environmental condition can affect bone health. This includes exposure to heavy metals, fungal toxins, asbestos, chlorine, environmental pollutants, nicotine, and occupational chemical exposure. For example, autoimmunity related to inflammatory arthritis is attributed to exposure to toxic chemicals and environmental toxins [30]. People who

spend a lot of time sitting have a higher risk for arthritis and osteoporosis this compared to more active people. In fact, physical inactivity contributes to many chronic diseases and can be detrimental to health. Adult household income's relationship to osteoporosis and resulting fracture is mixed [31,32] uncovered that adults with higher levels of education, and higher SES more broadly, experience lower odds of osteoporosis

Table (1) : The socioeconomic status of women with bone diseases

Variable		Frequency	Percentage
Residence	Rural	45	45.0
	Urban	55	55.0
Marital status	Single	34	34.0
	Married	66	66.0
Educational level	Illiterate	6	6.0
	Read and write	29	29.0
	Secondary school	17	17.0
	University	48	48.0
Job	Employed	30	30.0
	Unemployed (housewife)	70	70.0
Job kind	Teacher	5	5.0
	Engineer	12	12.0
	Company employee	10	10.0
	Nurse	3	3.0
Hours of working/day	5 hours	50	50.0
	8 hours	38	38.0
	10hours	12	12.0
Family income (Egyptian pound)	1000>3000	28	28.0
	3000>5000	48	48.0
	More than 5000	24	24.0
*Money spent on food percentage (Egyptian pound)	25%	42	42.0
	50%	48	48.0
	75%	10	10.0
Home specifications	Familiar	64	64.0
	Residential apartments	36	36.0

Variable		Frequency	Percentage
Number of house's rooms	2	10	10.0
	3	55	55.0
	4	30	30.0
	More than 4	05	05.0
Number of family members	2	20	20.0
	3	30	30.0
	4	45	45.0
	More than 4	05	05.0
Transportation methods	Available	80	80.0
	Not available	20	20.0
Home hygiene	Healthy	61	61.0
	Unhealthy	39	39.0

*Money spent on food calculated as a percent of money spent on food from the total family income

Table (2) showed the mean value of the patient's age and anthropometric measurements. The mean value of their age was 30.43 ± 6.04 whereas the mean value of their weight and height were 105.67 ± 7.95 kg and 163.67 ± 4.86 cm respectively. From the obtained results, it was found that 26% from female suffered from second class of obesity and 74% were over weight.

A progressive degeneration of the tissues is associated with increasing the women age, which has a negative impact on the structure and function of vital organs and is among the most important known risk factors for most chronic diseases. With age, the amount of bone deposited with each cycle of remodeling decreases [33], possibly due to a reduction in the number of cell precursors of osteoblasts, a reduction in the number of stem cells from which these precursors are derived, or a reduction in the lifespan of osteoblasts [34]. Obesity adversely affects

bone health by a variety of mechanisms such as an alteration of bone-regulating hormones, increased oxidative stress and inflammation, and altered bone cell metabolism. The available evidence shows that women with obesity have an increased risk of humeral fractures and osteoporotic fractures of the ankle and lower limb, and a decreased risk of hip, pelvis, and wrist fractures. Obesity is associated with low-grade chronic inflammation; the latter is more pronounced in central and visceral adiposity, which is characterized by higher CRP, TNF- α and IL-6 concentrations. This marked inflammatory response may be responsible for the accelerated bone loss observed in obesity [35,36].

Data in table (3) presented the healthy status of women with bone diseases. It was found that the majority suffered from obesity and problem with bone and join. Osteoporosis was the most common

problem followed by rheumatoid arthritis and osteoarthritis of the knee joint. Most of them didn't follow up with the doctor and the main cause was obesity followed by calcium with vitamin D deficiency and diabetes. Painful movement was the common symptoms and this due to their bad lifestyle (physical activates) for the majority of patients. About 45% performed walking exercises. The highest percentage was negative smoker (78%) and follow a special diet (58%) and 21% from this percentage too low fat low carbohydrates diet, 74%take supplements (vitamins and minerals), especially after the prevalence of bone disease.

Table (2-a) : Age and anthropometric measurements of studied patients (n=100).

Age and anthropometric measurements	Mean±SD
Age	30.43±6.04
Weight (kg)	105.67±7.95
Height (cm)	163.67±4.86
Body Mass index (BMI)	39.28±8.65

Data presented as mean ±SD

Table (2-b) : Classification of studied patients according BMI

BMI classification	Percentage
Overweight	74%
Obese class 2	26%

Obesity adversely affects bone health by a variety of mechanisms such as an alteration of bone-regulating hormones, increased oxidative stress and

inflammation, and altered bone cell metabolism. The available evidence shows that women with obesity have an increased risk of humeral fractures and osteoporotic fractures of the ankle and lower limb, and a decreased risk of hip, pelvis, and wrist fractures especially postmenopausal women. Bone diseases refer to conditions that alter the strength or flexibility of bones. They can result in symptoms such as bone pain, difficulty moving, and a higher risk of bone fractures [37]. These conditions can have many potential causes, including aging, genetics, hormonal changes, and nutritional deficiencies especially vitamin D and calcium. The nicotine in cigarettes slows the production of bone-forming cells (osteoblasts) so that they make less bone. Smoking decreases the absorption of calcium from the diet. Calcium is necessary for bone mineralization, and with less bone mineral, negative smoke can develop fragile bones (osteoporosis) . Walking may be a safe way to introduce some physical activity which can improve bone health, muscle strength, or balance. Studies show that eating more vegetables and fruits can improve bone health. These foods are generally lower in calories and fat, and they are high in fiber and essential vitamins and minerals. They also contain phytochemicals, which are substances that can protect against various diseases, including osteoporosis [38].

Table (3) : The healthy status of women with bone diseases

Variable		Frequency	Percentage
Suffer of chronic diseases	Yes	76	76.0
	No	24	24.0
Type of chronic diseases	Obese	26	26.0
	Diabetes	3	3.0
	Hypertension	2	2.0
	Kidney problem	5	5.0
	Liver problem	2	2.0
	Bone and join problem	62	62.0
Type of bone and join problem	Osteoporosis	37	37.0
	Fractures frequency	04	04.0
	Rheumatoid arthritis	32	32.0
	Knee Osteoarthritis	27	27.0
Follow up with doctor	Yes	46	46.0
	No	54	54.0
Cause of diseases	Heredity	07	07.0
	Calcium and vitamin Deficiency	25	25.0
	Obesity	42	42.0
	Diabetes	23	23.0
	Hormones	03	03.0
Symptoms of bone diseases	Swelling	14	14.0
	Stiff or enlarged joint	5	5.0
	Numbness	10	10.0
	Noisy joints when moving the joint	13	13.0
	Painful movement	30	30.0
	Difficulty bending or straightening the joint	14	14.0
	Loss of motion	9	9.0
	Hot red and swollen joint	5	5.0
Exercise	Yes	38	38.0
	No	62	62.0
Type of exercise	Walking	45	45.0
	Gymnastic dance	36	36.0
	Muscle contraction forces machines	19	19.0
Cigarette smoking	Yes	0	0.0
	No	100	100.0
Negative smoking	Yes	78	78.0
	No	22	22.0
Follow special diet	Yes	58	58.0
	No	42	42.0
Type of diet	Low fat low carbohydrates	21	21.0
	High calcium and protein	19	19.0
	Keto diet	08	08.0

Variable		Frequency	Percentage
Take supplementation	Yes	74	74.0
	No	26	26.0
Type of supplementation	Vitamins and minerals	93	93.0
	Hormones	05	05.0
	Soy isoflavones	02	02.0

Data in table (4) revealed to the mean values of nutrient intake and the percentage of nutrient intake as compared to DRI. It could be observed that studied sample consumed high levels of caloric foods, sodium and cholesterol over 100%. The other nutrients were lower than DRI especially calcium (under 50%) while the other nutrients were lower but the percentage was in the range between 60-98%. When fat accumulates in bones, it replaces bone marrow cells. Because fat cells are less dense, bones with more fat in their marrow also have a lower density, which makes them weaker. This means that though cutting calories may lead to weight loss, it can also make the skeletal system more fragile. Also, foods high in sugar or salt, red meat, and caffeine cause body to pull nutrients from the bones. Metabolic bone disorders result from abnormally low levels of calcium and phosphorus, minerals that support the growth and strength of the bones. Also, vitamin D deficiency cause the body isn't able to properly absorb calcium and phosphorus, which increased risk of bone pain, bone fractures, muscle pain and muscle weakness [39].

The biochemical parameters of women with bone diseases were discussed in table (5). From the obtained data, it was found that hemoglobin, vitamin D and calcium were lower than the normal level. Participated women had RF which was 2.83 ± 0.32 and had level of uric acid in the normal range. From the same table, it was observed that participators had higher level of fasting blood glucose, Serum CRP, and ASOT than the normal range. Vitamin C was in low level but was in the normal range.

Low Hb levels were associated with increased odds of osteoporosis in the adult population. The association of low Hb levels with osteoporosis was verified in the model adjusted for many potential confounders, including obesity, smoking, laboratory findings, and comorbidities [40]. 20 ng/mL as normal level of vitamin D is adequate for most people for bone and overall health. Levels equal or below 12 ng/mL might weaken bones and affect health.

Reduced supplies of calcium are associated with a reduced bone mass and osteoporosis, whereas a chronic and severe vitamin D deficiency leads to osteomalacia, a metabolic bone disease

characterized by a decreased mineralization of bone. Individuals with RA are at increased risk of developing osteoporosis.

Table (4) : Daily average nutrient intake as compared with DRI

Nutrients	Daily average intake (male)	%DRI
Protein g	38.43±7.82	122.67
Fat g	98.54±4.85	151.6
Carbohydrates g	430.97±6.93	120.52
Total calorie Kcal	2764.46±10.66	125.66
Fiber g	16.76±3.81	74.49
Na mg	3523.11±9.86	153.18
K mg	1592.43±8.04	61.24
Ca mg	430.62±13.72	43.06
Pmg	692.33±17.29	98.90
Mg mg	221.93±9.54	71.59
Fe mg	14.65±6.01	81.39
Zn mg	5.56±2.77	69.5
Cu mcg	1.24±0.44	95.38
Se mcg	43.86±9.27	79.75
Vit.Amcg	563.82±20.31	80.55
Vit. D mcg	11.03±4.65	73.53
Vit.C mg	49.57±9.84	66.09
Vit. B1mcg	0.98±0.03	89.09
Vit.B2mg	0.94±0.11	72.31
Cholesterol ml	285.45±13.54	114.18

Data presented as mean ±SD., DRI: Daily requirements intake

Chronic inflammation associated with RA, medications used to treat the disease, particularly prednisone and other corticosteroid ("steroids") drugs, all contribute to this risk [38]. Behind mineral metabolism, bone related to regulation of insulin sensitivity, glucose homeostasis, and energy metabolism. So, diabetes mellitus (DM) increases osteoclast function but decreases osteoblast function, thereby leading to accelerated bone loss, osteopenia and osteoporosis

[41-43]. Serum high-sensitivity C-reactive protein (hsCRP), a marker of immune activation, is widely viewed as a significant and independent predictor of low bone mineral density and fracture risk. The highest tertile of hsCRP has been linked to low BMD, elevated bone resorption, bone loss, and increased fracture risk. Increased ASO Titre levels in the blood may harm the heart and joints. Values of 0.4 to 2.0 mg/dL indicates adequate supply. Inadequate vitamin C consumption inhibits collagen synthesis and increases the risk of osteoporosis and fractures. Vitamin C is an antioxidant that has been shown to lower inflammation and VCAM-1 levels. Vitamin C beneficially affects bone metabolism by its effects on osteoblast and osteoclast activity [44-46].

Table (5) :Biochemical analysis of women with bone diseases

Biochemical analysis	Mean±SD	Normal level
Vitamin D ng/mL	12.52±2.04	20
Total Calcium mg/dl	8.41±1.93	8.5: 10.5
Rheumatoid factor (U/ml)	2.83±0.32	0: 20
Uric acid (mg/dl)	4.82±0.96	3.5:7.2
Blood glucose mg/dL	248.87±8.9	100 : 125
Hemoglobin (g/dl)	11.31±1.07	12.1: 15.1
Serum CRP mg/dL	11.65±2.02	0.3 : 1.0
ASOT	435.87±9.0	< 200
Vitamin C mg/dL	0.32±0.65	0.2 : 1.1

Data presented as mean ±SD

4. CONCLUSION

From the obtained results, it could be concluded that the women who participated had the risk factors that caused bone diseases such as obesity,

low diet in calcium and vitamin D, negative smoking, low hemoglobin, serum CRP, and low physical activity. So, they should have some of the most important aspects of preventing osteoporosis, including maintaining a reasonable weight by eating a healthy diet, exercising regularly, and avoiding smoking.

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تقييم الحالة التغذوية للنساء المصابات بأمراض العظام

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<p>الملخص العربي:</p> <p>العظام عبارة عن نسيج حي يتكون بشكل رئيسي من الكولاجين والكالسيوم الذي يحمي الأعضاء الرخوة ويدعم الجسم خاصة عند النساء . كانت الوراثة والعوامل البيئية والنظام الغذائي والالتهابات هي العوامل الرئيسية التي تؤثر على مرونة وقوة العظام. لذلك كان الهدف هو تقييم الحالة التغذوية لـ 100 مريضة تعاني من أمراض العظام وتتراوح أعمارهن بين 20-40 سنة . تم تحديد القياسات البشرية (الوزن والطول ومؤشر كتلة الجسم) ، والتقييمات الغذائية (متوسط المتناول في 24 ساعة السابقة ومتوسط استهلاك المغذيات اليومي) والمعايير الكيميائية الحيوية (الهيموجلوبين، الجلوكوز في الدم، حمض البولييك، الكالسيوم في الدم، فيتامين C وفيتامين D وما إلى ذلك) . أظهرت النتائج أن الأنثى تعاني من السمنة من الدرجة الثانية، وكانت المشكلة الأكثر شيوعاً هي هشاشة العظام يليها التهاب المفاصل الروماتويدي والتهاب مفاصل الركبة . وقد لوحظ أن المرضى يستهلكون مستويات عالية من الأطعمة ذات السعرات الحرارية والصوديوم والكوليسترول بنسبة تزيد عن 100% بينما كانت العناصر الغذائية الأخرى أقل من الـ DRI وخاصة الكالسيوم (أقل من 50 . %) بالإضافة إلى ذلك، الهيموجلوبين الخاص بهم، فيتامين د، فيتامين ج و ايضا الكالسيوم كانت أقل من المستوى الطبيعي بينما كان مستوى الجلوكوز في الدم الصائم، ومصل CRP ، و ASOT أعلى من المعدل الطبيعي . لذلك نستنتج ان هذه المجموعه من السيدات تحتاج إلى الغذاء المتوازن والغني بالكالسيوم والأنشطة الرياضيه .</p> <p>الكلمات الكاشفة: الإناث، التقييمات الغذائية، هشاشة العظام، الكالسيوم، مصل CRP</p>	<p>نوع المقالة بحوث اصلية</p> <p>المؤلف المسئول فاتن الغزالي alghzalyfaten@gmail.com الحوال: +2 01024962469</p> <p>DOI:10.21608/MKAS.2024.264837.1279</p> <p>الاستشهاد الي: ElGhazaly, and El-Tahan., 2024, Evaluation of the Nutritional Status of Adult Women with Bone and Joints Diseases. JHE, 34 (3), 159-173</p> <p>تاريخ الاستلام: ٢٣ يناير ٢٠٢٣ تاريخ القبول: ١١ اغسطس ٢٠٢٤ تاريخ النشر: ١ يوليو ٢٠٢٤</p>
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