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Assessment of Calcium Intake among a Palestinian Elderly Population: Development of a Calcium Intake Mobile Application

By:

Razan Ata

Supervisor:

Dr. Yousef Mimi

Co-Supervisor:

Dr. Hala Allabadi

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Thesis Approval

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By: Razan Ata

This thesis was defended successfully on October 3rd ,2022 and approved by:

Supervisor: Dr. Yousef Mimi

Signature: 

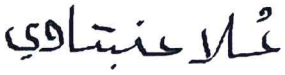
Co-supervisor: Dr. Hala Allabadi

Signature:---------- 

Internal Examiner: Dr. Mohammad Awad

Signature:---------- 

External Examiner: Dr. Ola Anabtawi

Signature:----- 

Dedication

To my deceased mother, Sirin

Who is celebrating in Heavon

I dedicate this work

with rejoice and eternal love

Abstract

The research work addresses calcium nutrition and bone health among the elderly (Ages 51-99) in Palestine, specifically those living in elderly homes and attending elderly clubs that are located in Ramallah and Bethlehem. The elderly is an important part of the society, and it is really important to concentrate on this class of the society as they are the most prone to chronic diseases including calcium-related diseases such as osteoporosis, bone fractures, vitamin D deficiency and lactose intolerance. The elderly is at risk for calcium deficiency for many reasons like low calcium intake with aging, medication interactions that may decrease the absorption of dietary calcium and osteoporosis chronic disease which interferes with bone strength and formation. The research study would be based on a sample of the elderly which is both stratified and random in nature. The stratified sampling is based on region and gender; otherwise it is random in nature. That should enable a fair regional and gender comparison between the elderly in Ramallah and Bethlehem, as well as between males to females. Calcium status will be estimated by the amount of calcium containing food that is consumed by the elderly, which is mainly found in dairy products like milk, yogurt and others foods like almonds, broccoli and sardines with bones. The Recommended Dietary Allowances (RDA) required for the elderly is 1200 mg/day for elderly females and 1000mg/day for elderly males aged between 50-71 years old. Above that age category, it is 1200 mg/day for both genders. The study will also focus on barriers that the elderly face which prevent them from adequate calcium intake.

The outcome of the study is to show the adequacy of calcium intake among the elderly, mainly from food and possibly compare the results with other studies done on calcium intake and other elderly groups in regional and global parts of the world. It will hopefully raise awareness among the elderly to prevent the consequences of untreated symptoms of hypocalcemia like

numbness in the fingers, muscle cramps, poor appetite, abnormal heart rhythms which if left untreated could be lethal. Also, a mobile application was developed to calculate calcium intake, it is a faster approach that will help dieticians assess calcium among different groups of the society especially the elderly.

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Declaration

This thesis was submitted in partial fulfillment of the requirement of a Master's Degree in Health Informatics.

I declare that the content of this thesis has not been submitted for a higher degree to any other university or institution.

Student Name: Razan Osama Ata

Signature:

Date: / /2022

Acknowlegments

I would like first to acknowledge, with deep affection and love, my family , especially my father, for their continued care, support and encouragement throughout all my studies.

My deep gratitude and appreciation goes out to my supervisor, Dr. Yousef Mimi and Co-supervisor, Dr. HalaAllabadi, for guidance and supervision throughout this work.

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Finally, the managers of the elderly houses in Bethlehem and Ramallah and the cooperation of the elderly are greatly acknowledged for providing necessary data.

CHAPTER ONE

Introduction

The researcher reports, in this chapter, the background of the problem, the problem statement, the significance of theresearch, the study objectives, the research hypothesis/questions and the expected outcomes of the research.

1.1. Background

Dairy foods comprise a range of products with varying nutritional content mainly calcium. The intake of dairy products has been shown to have beneficial effects on bones, mainly because of their calcium content(Heaney R.P., 2006).Consequently, Calcium is important for optimal bone health throughout our lives. Although diet is the best way to get calcium, calcium supplements may be an option if the diet falls short.

Our body needs calcium to build and maintain strong bones (Pravina, P**.**, 2013).The heart, muscles and nerves also need calcium to function properly. Some studies suggest that calcium, along with vitamin D, may have benefits beyond bone health; perhaps protecting against cancer, diabetes and high blood pressure (Pravina, P**.**, 2013). Not getting enough calcium makes people prone to facing health problems related to weak bones.Children may not reach their full potential adult height. In addition, adults may have low bone mass, which is a risk factor for osteoporosis. Many Palestinians do not get enough calcium in their diets. Children and adolescent girls are at

particular risk, and so are adults aged 50 years and above.This is shown in chapter 2 (Literature Review)

The human body does not produce calcium, so it must be obtained from other sources. Calcium can be found in a variety of foods, including:

- Dairy products, such as cheese, milk and yogurt.
- Dark green leafy vegetables, such as broccoli and kale.
- Fish with edible soft bones, such as sardines and canned salmon.
- Calcium-fortified foods and beverages, such as soy products, cereal and fruit juices, and milk substitutes.

Even if people eat a healthy and balanced diet, it might be difficult to get enough calcium if individuals (Daily, R. D. A., 2020):

- Follow a vegan diet.
- Have lactose intolerance and limit dairy products.
- Consume large amounts of protein or sodium, which can cause your body to excrete more calcium.
- Have osteoporosis.
- Are receiving long-term treatment with corticosteroids.
- Have certain bowel or digestive diseases that decrease your ability to absorb calcium, such as inflammatory bowel disease or celiac disease.

To absorb calcium, the body also needs vitamin D. A few foods naturally contain small amounts of vitamin D, such as canned salmon with bones and egg yolks. Vitamin D can be obtained from fortified foods and sun exposure. The recommended dietary allowance (RDA) for vitamin D is 600 international units (15 micrograms) a day for most adults. (Nair R, 2012)

Vitamin D deficiency is common among older persons particularly in elderly homes, nursing homes and among patients with hip fractures.This is mainly explained by the fact that older persons do not often go out in the sunshine and dietary vitamin D intake becomes low. Vitamin D deficiency causes secondary hyperparathyroidism, which leads to cortical bone loss, osteoporosis and fractures (Nair R, 2012).Vitamin D supplementation combined with calcium decreases body falls, as well as other non-vertebral fractures.

1.2 Statement of the Problem

The elderly group sector; an important part of the society, is at risk for calcium deficiency for many reasons and are the most prone to chronic diseases including calcium-related diseases such as osteoporosis, bone fractures, vitamin D deficiency and lactose intolerance. The calcium deficiency is a natural consequence of low calcium intake with aging, medication interactions that may decrease the absorption of dietary calcium and the osteoporosis chronic disease which interferes with bone strength and formation.

1.3 Nature and Significance of the Problem

Many studies were done on calcium nutrition and bone health among the elderly. Most of the studies showed that there is a lack of calcium intake among the elderly populations. The Recommended Dietary Allowances of calcium intake (RDA) (Ross, A.C., 2011), which is required

for the elderly is 1200 mg/day for elderly females and 1000mg/day for elderly males aged between 50-71 years old. Above that age category, it is 1200 mg/day for both genders. So our study will accordingly determine quantitatively whether or not our elderly communities are getting sufficient intake of calcium before submitting recommendations to the responsible parties to take measures and interfere in modifying any insufficient quantities of calcium rich nutrients that would prevent or control aging-related diseases and reduce life-threatening symptoms.

1.4 Objectives of the Research

Primary Objectives:

- To determine the adequacy of calcium intake among the elderly, by measuring the daily amount of calcium intake from food .
- To assess the association of calcium intake with socio-demographic factors such as residence type, place of living, gender and age.
- To compare calcium intake among the elderly in Ramallah and Bethlehem and see whether or not they reach the *Recommended Dietary Allowance (RDA)*.
- To develop a mobile application that is able to calculate daily calcium intake from various food groups like meat, dairy, grains, fruits and vegetables.

Secondary Objectives:

- To raise awareness among the elderly about the importance of consuming sufficient calcium intake to prevent the consequences of untreated symptoms of hypocalcaemia like numbness in the fingers, muscle cramps, poor appetite, abnormal heart rhythms which if left untreated could be lethal.

- To compare the results with other studies done on calcium intake and elderly groups in regional and global parts of the world.Also, to use the outcomes of this study to form an official recommendation policy paper for policy makers.

1.5 Hypotheses and/or *Research Question(s)*

Hypotheses are built in relation to six elderly houses and clubs located in two Palestinian cities; Ramallah and Bethlehem.

1- There is a general deficiency in calcium intake in elderly houses and clubs in the selected locations, in Palestine.

2- There are no significant statistical differences in calcium intake among the elderly in Palestine according to:

A- The place of living.

B- The gender.

C- The age (a- men, b-women c- mixed)

D- The sun exposure

E- The medical disease

1.6 The expected outcomes

- A mobile application that is able to calculate daily calcium intake for the elderly.
- There is a general calcium intake deficiency in elderly houses and clubs in the selected locations, in Palestine.

- A general recommendation to the policy makers and public health sectors on the importance of calcium intake among the elderly to prevent consequences and unwanted symptoms such as osteoporosis and other diseases.
- Raising awareness about the importance of calcium intake and the possible adverse results for the elderly who are at risk of calcium deficiency.

In thisresearch work, a sample of the elderly sector was chosen for my research work, since itconstitutes an important part of the community. Elderly has been defined as 60 years old and above. Old age is a sensitive phase; elderly people need care and comfort to lead a healthy life without worries and anxiety. The elderly are the most prone to calcium deficiency**.** As people grow old, changes in their dietary patterns happen which lead to low intake of nutrients specifically calcium. Hence, the elderly are the most vulnerable to calcium and vitamin D deficiency because the body changes with advancing age.

Calcium and bone health among the elderly in Palestine is a really important topic to consider, as with aging. The decrease in the dietary calcium intake is usually a result of decreased overall calorie intake and a poor appetite or illnesses. There are social and economical factors that contribute to malnutrition among the elderly and in particular to calcium intake. The consequences may be adecrease in the intestinal absorption of calcium which happens with aging especially if vitamin D is low, combined to a decrease in the capacity of intestinal cells to adapt to a low calcium intake as the healthy younger people would. In addition, the elderly are less frequently exposed to sunlight; less sun exposure may lead to poor vitamin D status. With aging, there is also a decrease in the efficiency with which kidneys can retain calcium that leads to an increased calcium loss in the urine.

To conclude, low calcium intake is a big risk to bone health. Calcium deficiency is a major cause for bone-related diseases such as osteoporosis, osteopenia, and bone fractures which may lead to a calcium deficiency disease known as hypocalcaemia. People, in general, with low calcium levels and deficiency are known to experience mild to life-threatening symptoms and conditions like: fainting, numbness in feet and face, depression, dry skin, memory loss, heart failure, miscarriages, seizures and even cancer which can be fatal. (National Institutes of Health, 2021).

The thesis structure is devided into six chapters, followed by a list of references and appendices. These are tabulated and detailed under the OULINE section.

1.7 Thesis Outline

Chapter 1: It includes the background, problem statement, research significance, objectives of the study, research hypothesis/questions, research expected outcomes and the thesis outline.

Chapter 2: It includes previous studies on calcium nutrition and bone health among the elderly in addition to the variables and conceptual framework.

Chapter 3: It includes the research design, study tools & data collection, fieldwork, study setting, population and sample size, privacy and confidentiality, method of data analysis, etihical consideration and study limitations.

Chapter 4: This chapter includes the flowchart of the mobile application (RazanCalciumCalc), feautures of RazanCalciumCalc and a journey through the mobile application.

Chapter 5: It includes the results and discussion.

Chapter 6: It includes conclusions, recommendations, strength of the research and future work.

CHAPTER TWO

Literature Review

In this chapter, the researcher demonstrates a literature review containing previous and recent studies related to the thesis title. The studies comprise of calcium intake and the elderly in Palestine and other parts of the world, in addition to studies on mobile applications that calculate calcium intake and other nutrients. This chapter also contains the conceptual framework that includes independent and dependent variables used in this thesis.

2.1 Literature Review

In Palestine

One of the studies done in Palestine (Abu Elhawa, M., 2013) showed that "support services targeting the elderly are limited. Only 3% of the elderly are supported by the government, while the rest are cared for by their children." However, the number of working women has risen. This will limit the extent in which the elderly will be cared for by their children. "Although there are only a few nursing homes in Palestine, the services and the capacity of the staff are really limited" (Abu Elhawa, M., 2013).

The distribution of elderly homes in Palestine is uneven. "Nursing homes are mainly distributed in the north and center and become much fewer in the south and even nonexistent in the city of Hebron" (Brodsky, J., 2003). There is a true gap in health and social services among the elderly in Palestine due to limited resources. "Further, the developing world is experiencing

increases in long term care needs at levels of income that are far lower than that which existed in the industrialized world when these needs emerged (Brodsky, J., 2003)."

A study by (Imam, A., 2011)was conducted to assess the health and quality of among 402 elderly women located in the West Bank in Palestine. The study showed that 60% of the elderly women were illiterate, which meant that elderly people lacked proper knowledge about sources of calcium and the importance of it to their health. Also 56.7% of the elderly women were widowed, which may have not had caregivers that would be responsible to provide them adequate amount of calcium-rich food.

Regional Studies

A study was conducted to review the status of global calcium intake for adults but not specifically the elderly (Balk, E. M., 2017).The study included adults from many countries in the middle east like: Morocco (age > 16), Kuwait (age >19), Jordan (age >18), Ethiopia (age >18) while other countries had age categories which included mixed adults and elderly between 20-66.

- Algeria (age 41-66), Calcium Intake 600-700 mg/day
- Palestine (age 31-50), Calcium Intake 500-600 mg/day
- Egypt (age 20-60), Calcium Intake 400-500 mg/day
- Israel (age 25-64), Calcium Intake 400-500 mg/day

Global Studies

Another study by (Smith, T. L., 2003) focused on the barriers and strategies for improving calcium intake among elderly African Americans. Researchers gathered 56 seniors aged 60 years

old and older from a large senior center located in the mid-south region of the USA. The study showed “eight barriers to dietary calcium intake: concern for health and disease states, lack of nutrition knowledge, behaviors related to dairy products, limited food preferences and availability, financial concerns, lack of food variety and food sanitation concerns (Smith, T. L., 2003).”

A study by (Gennari, C., 2001) that evaluated calcium intakes among the elderly and its effects on bone mass and fractures was set to evaluate the daily average calcium intake within the “SENECA study (Survey in Europe on Nutrition and the Elderly; a Concerted Action) with regards to the diet of elderly people from 19 towns in 10 European countries”. In about one third of the population, the dietary calcium intake was“very low, between 300 and 600 mg/day in women, and 350 and 700 mg/day in men.”

In Canada, (Papaioannou, A., 2010) conducted a study which showed high incidence of osteoporosis due to low intakes of calcium. The percentage of inadequate calcium intake from food among Canadian women aged 50 and older, and men aged 71 and older was 80%. The Canadian elderly were at risk of calcium deficiency.

(Montomoli M., 2002), in their article, evaluated a food frequency questionnaire assessing calcium intake in women. “Estimates of calcium intake from the food frequency questionnaire were compared with those from 14 day records from 206 Caucasian women aged 25–75 yrs in Siena, Italy.” The mean difference in intake by the questionnaire and the 14 day record methods did not differ significantly from zero, which suggested the questionnaire as a reliable method, provided that the questions were clear, specific and conform to the objectives of the study.

(Angbratt M., 1999), in their article, proposed the design of two questionnaires; Questionnaire A contained eight questions concerning consumption of dairy foods, while

Questionnaire B contained 52 questions on consumption of calcium-rich food groups and dishes, and also included the eight questions. “Questionnaire A was sent to 467 randomized women aged 20–30 and 50–60 years. Women with a low calcium intake also answered Questionnaire B. In total 363 women answered Questionnaire A, 118 of who had a calcium intake below the recommended amount. Ninety-six women completed questionnaire B. Twenty two women were interviewed with the dietary history. Statistical analyses using t-tests of the differences between answers to the same questions in two questionnaires and the interview, gave the following results. Questionnaire A provides reliable information about those who do not reach the recommended level of calcium intake. Questionnaire B does not provide any more information than questionnaire A.” The authors concluded it was not possible to rank calcium levels in the diet with the questionnaires and that Questionnaire A was useful in discriminating between subjects with low and high calcium intake.

A study”(Marshall, K., 2020) showed that “poverty may be a barrier to obtaining optimal nutritional levels for osteoporosis prevention. Osteoporosis is caused by a combination of variables, including age and food intake.” This study looked at the link between poverty markers, calcium/vitamin D intake, and osteoporosis. The National Health and Nutrition Examination Survey (NHANES) data from 2007–2010 and 2013–2014 for older US people (n = 3,901 participants, 50 years and older) were used to conduct a cross-sectional analysis of the US population.“In general, women over the age of 50 have insufficient calcium consumption, regardless of their socioeconomic status, including poverty. While women have a higher prevalence of inadequate calcium intake, markers of poverty increased the risk of inadequate calcium intake in all men and the risk of osteoporosis in various subgroups, with the exception of those who participated in the SNAP (Supplemental Nutrition Assistance Program) program. Over

a quarter of non-Hispanic black men in the United States are poor. Approximately half of this population consumes insufficient calcium (58.9%) and vitamin D (46.7%)"(Marshall, K., 2020).

Another study titled "The Role of Calcium in Human Aging" (Beto, J. A.. 2015)showed that calcium is a vital nutrient that is required for a variety of bodily activities. "Calcium is the most prevalent mineral in the body, accounting for 99 % of all calcium in teeth and bones. Serum contains only 1% of the total. A sophisticated metabolic process keeps track of serum calcium levels to ensure they stay within normal limits"(Beto, J. A.. 2015).Other nutrients, including protein, vitamin D, and phosphorus, are involved in calcium metabolism. The process of bone development and maintenance lasts a lifetime. Early emphasis on strong bones in childhood and maturity will result in more stable bone mass as people age. In some groups, adequate calcium intake has been found to lessen the incidence of fractures, osteoporosis, and diabetes. Calcium and other associated nutrients have slightly different dietary requirements around the world. "The goal of this narrative review was to a) investigate the role of calcium in human health, b) compare calcium nutrient requirements across lifecycle groups and global populations, c) examine the links between calcium intake, chronic disease risk, and fractures, and d) discuss diet deficiencies and lactose intolerance strategies."

Moreover, a study titled " Nutrition and bone health" (Weaver, C. M. ,2017) focused on how fractures are more likely when bone mass is low. "Over 10% of the population and one out of every two women over the age of 50 suffer from osteoporosis. More than half of bone mass is predicted by genetics." Diet and weight-bearing activity are two lifestyle factors that can affect fracture risk. The structural ingredients of bone are nutrients. Because bone is a living tissue that changes over at a slower rate than other tissues, it loses minerals on a daily basis that must be supplied through nutrition. To compensate for these losses, three servings of dairy products per

day are recommended. Tofu, calcium-fortified orange juice, plant-based beverages, and calcium-fortified orange juice are all good sources of minerals for bone health. Supplements can help with nutrients like calcium and vitamin D that are at risk of being deficient.

A more recent study (Ishikawa, M., 2021) used a comparison with the dietary reference intakes for the Japanese population (DRIs J) to estimate the distribution of usual intakes in protein, sodium, potassium, and calcium by age group and assess whether proportions of deficiencies/excesses of each nutrient would occur more in older age. A database of the 2-day nutrient consumption of 361 Japanese persons aged 65–90 years was used to conduct a cross-sectional analysis. To estimate typical intake, the AGEVAR MODE was utilized. The AGEVAR MODE technique is a model that can describe age-related within- and between-individual variations in nutrient intake as well as the average value of that information. Despite employing small sample sizes and data from dietary surveys that lasted at least two days, the technique was able to overcome these drawbacks and showed less standard errors than the other models and less biased. The Dietary Reference Intakes (DRIs) for the Japanese population were compared to percentile curves based on estimated distributions by sex and age, as well as normal nutrient intake.With increasing age, male and female protein intake, as well as potassium and calcium intake (female), decreased. Protein ($p = 0.037$) and calcium ($p = 0.008$) within-individual variance were significantly reduced as participants got older. Protein (male and female), potassium (female), and calcium (female) deficits were all found to be more common as people became older. However, there was no difference in the proportion of those with too much salt (converted from sodium; male and female). The changes discovered here could help researchers better understand how nutritional consumption differs by age.

(Bristow, S.M., 2017) concluded in a conducted study that strategies to increase calcium intake were unlikely to impact on the prevalence of and morbidity from male osteoporosis. (Li, K., 2018) reported in a review that calcium supplementation is a double-edged sword in promoting bone formation or preventing osteoporosis, as it also may have a potential negative impact. In a very recent study, (Coy, A., 2020) concluded that the calcium intake of 450 participants in a randomly selected Columbian group was low; 726 mg/day, and was even lower in the low-income group; 566 mg/day.

Another (Bristow, S. M., 2021) showed that many older persons do not consume the required amount of calcium, which raises concerns about the impact on bone health. The goal of the study was to look at evidence from cohort studies on the association between calcium consumption and changes in bone mineral density (BMD) in older persons, which had not been done in the previous two decades. Ovid Medline, Embase, and PubMed were used as data sources, as well as references from retrieved reviews and articles. In February 2021, the final search was completed. Cohort studies of calcium intake in people over 50 years old with a change in BMD over a year were considered.“The majority of research revealed no link between calcium intake and changes in BMD in both men (71%) and women (71%). There was no evidence of a link between calcium consumption and BMD change in women over the age of 60 in any study.”

Moreover a study (Arnold, M., 2021) focused on how the senior population is growing globally, with 1.5 billion people expected by 2050. The elderly quality of life must be considered, for example, in the development of functional meals for the elderly. The creation of functional food to minimize the risk of osteoporosis in the elderly is discussed in this article. One of the causes that worsens osteoporosis is oxidative stress. Various antioxidants, such as vitamin C, vitamin E, polyphenols, and lycopene, have been shown to have antioxidant action in previous

research, and hence may lessen the risk of osteoporosis. Additionally, using eggshell powder in various food products has been shown to increase calcium intake, and its use is environmentally friendly because it can help reduce food waste. The use of both antioxidants and calcium may be beneficial, but the amount of antioxidants used must be monitored to ensure that calcium bioavailability is not harmed. As a result, "the goal of this review is to look into functional foods for the elderly that can help them minimize their risk of osteoporosis, particularly those that contain antioxidants and calcium from chicken eggshells"(Arnold, M., 2021).

An article (Yao, X., 2021) showed that calcium is an important mineral for bone health. For osteoporosis prevention, a high calcium intake has been suggested. The link between dietary calcium intake and bone mineral density (BMD) in the elderly, on the other hand, has remained a point of contention. The study shows how they are related in elderly people. The link of dietary calcium intake with lumbar BMD in older persons was investigated using data from the Nutrition and Health Examination Survey (NHANES, 2001–2006). There were also subgroup analyses done.For this study, 2904 older persons over the age of 60 (43.63 % of whom were men) were included. After controlling for other factors, higher dietary calcium intake was linked to higher lumbar BMD. This favorable connection was found in women, but not in males, in a subgroup analysis stratified by sex. In conclusion, higher dietary calcium intake is linked to a higher lumbar BMD in women but not in males above the age of 60.

Moreover, a study titled "Calcium Intake and Health" (Cormick, G., 2019) showed that calcium intake differs dramatically between the wealthy and the poor. Appropriate calcium intake has been linked to a number of health benefits, including reduced hypertensive disorders of pregnancy, lower blood pressure, especially in young people, prevention of osteoporosis and colorectal adenomas, lower cholesterol levels, and lower blood pressure in the offspring of mothers

who consumed enough calcium during pregnancy. Some calcium supplements negative effects, such as iron deficiency, renal stone formation, and myocardial infarction in the elderly, have been debunked in studies. Following calcium supplements discontinuation, postpartum women should be monitored for bone resorption. Low calcium intake raises intracellular calcium in vascular smooth muscle cells, leading to vasoconstriction, which is one of the mechanisms associating low calcium intake and high blood pressure.At the population level, a calcium consumption increase of 400–500 mg/day could narrow the gap between high- and middle-income countries. Food and water fortification appears to be a viable technique for achieving this goal.

Studies Related to Mobile Applications

As for calcium intake mobile applications, a study (Shinozaki, N., 2020) examined how popular Japanese diet-tracking apps estimated energy and food consumption (apps). During August 2020, five diet-tracking apps were discovered on iTunes. The nutritional data was entered into each app by a researcher using a one-day paper-based dietary record (DR) previously gathered from seemingly healthy free-living adults (15 males and 15 females; 22–65 years). The apps' projected energy and nutrient intakes were compared to those computed using the Japanese Standard Tables of Food Composition, which were based on the paper-based DR (reference method). There were 17 different dietary factors to choose from, ranging from one (energy in Mogutan) to one hundred (FiNC). MyFitnessPal, Asken, Calomiru, and Mogutan all overstated median energy consumption when compared to the DR-based estimations.

Furthermore, Asken and Calomiru overestimated nutritional intakes whereas MyFitnessPal underestimated them. The Spearman correlation coefficient between the DR and the apps for energy intake was lowest for Mogutan (0.76) and greatest for FiNC (0.96). MyFitnessPal had a

lower median correlation coefficient for nutrient intakes (0.50) than the other three apps (0.80 in Asken, 0.87 in FiNC, and 0.88 in Calomiru). These findings show that different apps calculate intake differently. In free-living environments, where participants input their own food intake, more research is needed.

A study (Tay, I., 2017) clarified that interventions to prevent osteoporosis in young women by increasing dairy diet or physical exercise have been confined to raising osteoporosis awareness and knowledge. However, research has revealed that this does not necessarily result in a shift in behavior. In behavioral therapies, self-monitoring with mobile devices has shown significant and good results. Despite this, there is unawareness of any studies that have employed mobile self-monitoring as an intervention technique to enhance calcium intake, particularly in young women, for better bone health outcomes.Calci-app, a nutritional software for self-monitoring calcium consumption, was tested for acceptability and usability in this study. Calci-app development followed 4 steps: "(1) conceptualization, (2) development and pretesting, (3) pilot testing, and (4) mixed methods evaluation." (Tay, I., 2017).Calci-app was generally easy and convenient to use, however it was time-consuming for the participants.

Moreover, a study (Lee, J. E., 2017) showed that the growing social and economic burden of chronic disease, as well as the need for effective techniques to prevent and cure chronic disease, has prompted a focus on the use of information and communication technology (ICT)-based health care. Diet-A, a mobile application, was tested for feasibility and to see if it could be used to track nutritional consumption among adolescents. 9 male and 24 female high school students aged 16–18 years consented and participated in a three-month pre–post intervention study. Participants were advised to use voice or text mode input to record all foods and beverages ingested. Pre- and post-

intervention nutrient intake was evaluated using 24-hour recalls. It compared nutrient consumption data from the Diet-A application to data from 24-hour recalls.

When compared to the results of two 24-hour recalls, participants tended to underreport nutrient consumption. Between pre- and post-intervention, there were substantial reductions in sodium ($p = 0.04$) and calcium ($p = 0.03$) intake. 61.9 percent of participants who completed feasibility questionnaires ($n = 24$) said they were satisfied with the app's ability to track their food consumption, and 47.7% said they valued getting personal information about their dietary intake from it. More than 70% of participants, on the other hand, said that using the app was difficult or that they had problems remembering to report their food intake. Diet-A is a mobile application that allows users to track their nutritional consumption in real time. Diet-A, on the other hand, may not provide accurate information on teenage food intake, mainly because the recording burden.

In addition to previous studies, a (Rangan, A. M., 2016) demonstrated electronic Dietary Intake Assessment (e-DIA). The study showed that by reducing participant and researcher workload, automation of nutritional evaluation can help to overcome the constraints of existing approaches. The electronic Dietary Intake Assessment (e-DIA) is a dietary record in the form of a mobile phone application that was created as a research tool. The goal of this study was to compare the relative validity of the e-DIA with the 24-hour recall approach for estimating food category intake. During this 5-day period, a group of 80 university students aged 19–24 years old completed 5 days of e-DIA and 3 days of recall. For the analysis, the three days of dietary data that were matched were used. Data on food consumption was disaggregated and assigned to one of eight food groups. The approaches had similar median intakes of dietary groups, and strong relationships were discovered (mean: 0.79, range: 0.69–0.88).

Cross-classification by tertiles resulted in a high level of exact agreement (mean: 71%, range: 65–75%) and moderate to good weighted values (range: 0.54–0.71). Although mean differences (e-DIA–recall) were small (range: –13 to 23 g), limits of agreement (LOA) were very substantial (e.g., mean difference: –4 g, LOA: –159 to 151 g for vegetables). The Bland–Altman plots revealed a high level of agreement with minimal bias. The utility of e-DIA as an alternative to the repeated 24-hour recall approach for ranking people's food group intake is supported by this study.

Moreover a study (Lee, M., 2018) looked into the characteristics and utility of mobile app-based health promotion programs for the general public. Utilizing the PubMed, Embase, and CINAHL databases, a systematic bibliographic search of research on health promotion programs using mobile apps in peer-reviewed publications published in English up to November 2017 was conducted. The researchers looked for (1) randomized control trial designs and (2) examined mobile app-based therapies to improve adult health issues; in the end, 12 papers were found to meet the requirements. Diet and physical activity (n = 8) and general healthy lifestyle development (n = 4) were the most popular subjects. The apps were designed to provide feedback on one's health condition (n = 9) and to track one's health status or behavior change (n = 9).

Health outcomes for mobile app users were found to be superior in all trials when compared to non-users. Mobile app-based health interventions could be a good way to improve health-promoting behaviors in people who don't have any ailments. This study reveals that, in addition to physical activity and weight control, mobile app use is becoming more widespread for a variety of health-promoting habits. The practicality and effectiveness of deploying mobile apps for health promotion in developing nations should be investigated more in the future.

In addition to previous studies, a (Sharp, D. B., 2014) showed that Traditional nutritional assessment methods have constraints that limit the establishment of diet–disease correlations and the efficacy of dietary interventions. Technology, particularly the usage of mobile phones, may aid in the resolution of methodologic flaws, hence boosting the validity of nutritional evaluation and study, as well as the conclusions that result. The purpose of this study is to investigate the validity, feasibility, and acceptability of dietary assessment methodologies used on mobile phone platforms. In August 2013, a hand search of available relevant publications from universities and government entities was combined with an electronic database search for English, peer-reviewed, full-text articles published from January 1, 2001 forward.

There were no restrictions on study design, length, location, or population group. Twelve publications out of 194 met the requirements for inclusion: use of a mobile phone as a dietary recording platform and comparison of energy and macronutrient intake to another dietary or biological reference method. Electronic food diary, food photograph-assisted self-administered, 24-hour recall, food picture analysis by professional dietitians, and automated food image analysis were all verified on mobile phone platforms. When compared to traditional approaches, all mobile phone dietary assessment methods demonstrated similar, but not higher, validity and reliability. The satisfaction and preferences of participants for mobile phone dietary assessment methods were higher than for traditional approaches, indicating the need for more research.Toassess the efficacy of these methodologies in nutritional research, validity testing in bigger and more diverse populations over longer periods of time is required.

Another study (Mescoloto, S. B., 2017) examined the Nutrabem (Sao Paulo, Brazil) smartphone app as a tool for measuring food intake among university students.

A cross-sectional study was conducted at the Universidade Federal de So Paulo, Campus BaixadaSantista, on a random sample of 40 undergraduate students. The Nutrabem app and the 24-hour dietary recall were used to estimate food intake. Energy, carbohydrate, protein, fats, calcium, iron, and vitamin C intakes were all determined. The Diet Quality Index, which is linked to the Digital Food Guide, was used to assess food group intake and diet quality. The Pearson's correlation coefficient and the Student's t-test were used to assess the methodologies' agreement.

Energy (0.77), carbs (0.82), and protein (0.82) all showed strong connections (0.83). The following food groups exhibited significant correlations: poultry, fish, and eggs; beef and pork; refined grains and breads; and fruits and legumes (between 0.76 and 0.85). Sugars and sweets, whole grains, tubers and roots, milk and dairy products, animal fats, and the Diet Quality Index were all found to have moderate associations (0.59 and 0.71) with the Digital Food Guide scores. Weak relationships were found between vegetables and leafy greens, nuts, and vegetable oils (0.31 and 0.43). The outcomes of both approaches were found to be equivalent ($p>0.05$) when homogeneity was assessed. Because it gives results that are similar to those produced by the 24-hour dietary recall method, the Nutrabem app can be used to assess food consumption among university students.

Finally, a study (Lieffers, J. R., 2012) Nutrition apps for mobile devices (e.g., PDAs, smartphones) are becoming more widely available, and they can help with the arduous chore of documenting intake for nutritional assessment and self-monitoring. This review compiles and discusses research on this technique for documenting dietary intake in healthy people and those seeking to reduce weight. The goal is to compare this tool to more traditional ways (e.g., 24-hour recall interviews, paperbased food records).

Healthy or weight-loss populations, use of a mobile device nutrition application, and inclusion of at least one of three measures, which were the ability to capture dietary intake in

comparison to conventional methods, dietary self-monitoring adherence, and changes in anthropometrics and/or dietary intake, were all searched in research databases between January 2000 and April 2011. There are a total of eighteen studies addressed in this article. Users can choose food and amount sizes from databases in two types of apps: those that allow them to picture their food and those that allow them to select food and portion sizes from databases. Applications received mostly positive responses.

In comparison to traditional approaches, both application types demonstrated moderate to good correlations for assessing energy and nutritional intakes. In the case of self-monitoring, using apps instead of traditional methods (typically paper records) resulted in higher self-monitoring adherence and changes in nutritional intake and/or anthropometrics. The use of nutrition apps on mobile devices in dietetic practice has a lot of promise.

2.2 Variables and Conceptual Framework

The conceptual framework gives an overview of this research on Calcium Nutrition and Bone Health among the elderly in Palestine. It shows the relationship between the various variables. Variables to be studied regarding the elderly include age, gender, mobility, city (Ramallah/Bethlehem) and chronic diseases, while variables to be studied that affect calcium intake are calcium rich food (fruits, vegetables, grains, nuts & seeds, dairy, meat & fish & eggs and desserts), sun exposure , that in turn affect calcium absorption, vitamins and medications intake, and food allergies. The outcome of the study would be either a deficiency or an adequacy in calcium intake according, to the RDA of calcium intake. Fig. 2.1 shows the Conceptual Framework block diagram.

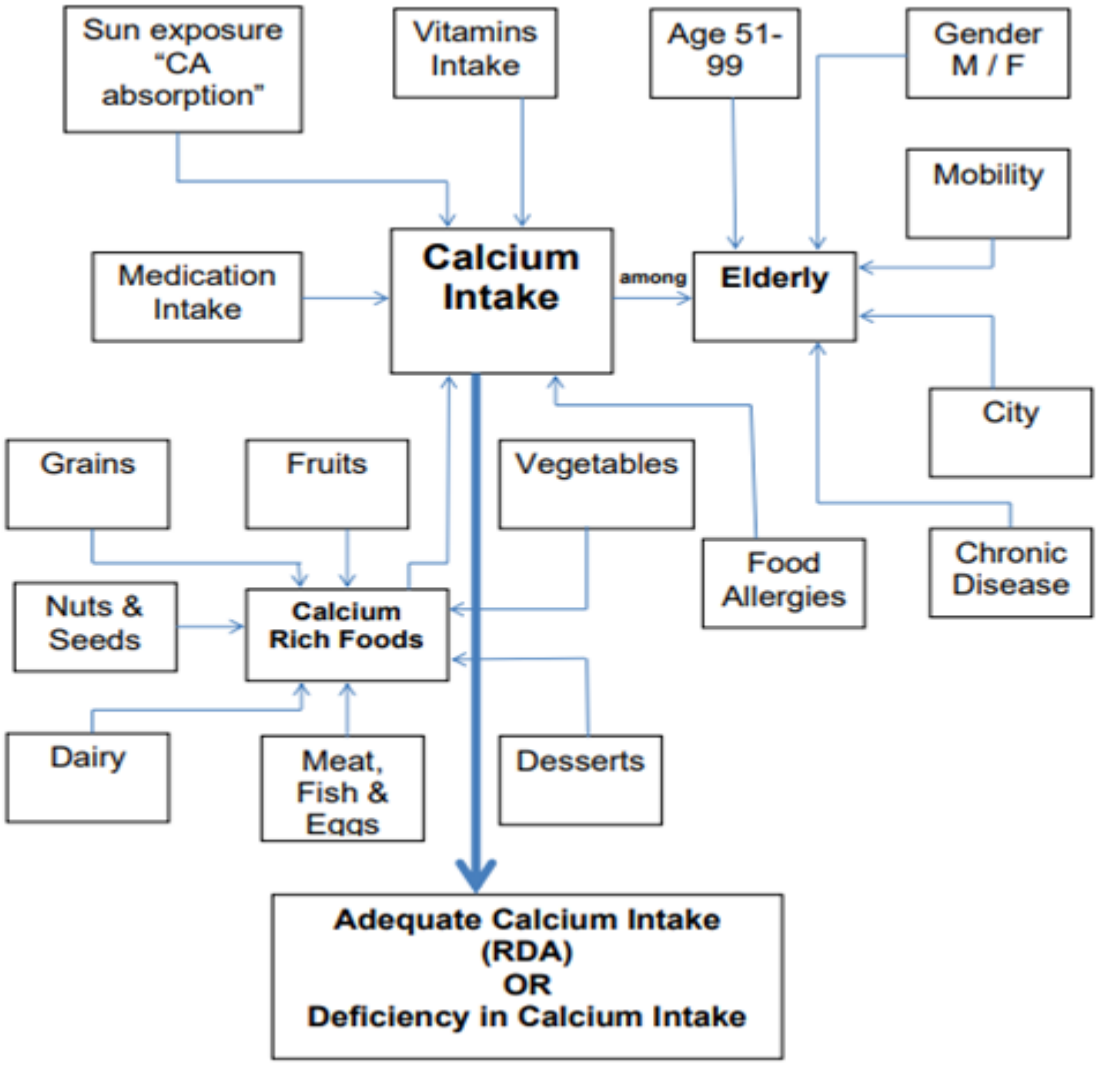


Fig. 2.1: Conceptual framework block diagram

CHAPTER THREE

Methodology

In this chapter, the researcher displays the study design, study tools and data collection, fieldwork, settings and different phases of the research study, population and sample size, privacy and confidentiality, data analysis methods, ethical consideration and study limitations.

3.1Research Design

The design of this research work is descriptive, quantitative and cross sectional. The design is descriptive because it does not intervene experimentally in the studied sample. It is quantitative as the objective is to quantify the amount of calcium intake per elderly per day. Moreover, it is cross sectional because the sample contains several characteristics ;for example, age, gender, mobility, location, chronic disease state., that would be studied through a short period of time. It uses a sample survey (which is based on designing a questionnaire that contains several questions of quantitative nature that respond to the mentioned objectives. The questions investigate the amount of calcium based dietary food from which calcium intake amounts could be calculated. Some questions investigatevitamin and calcium supplement intakes, and the daily exposure to the sun. The questionswere followed up, and conducted. The answers were recorded in the form of individual interviews by the research with an assistant with Nutrtion background. This way, there would be a higher certainty in getting the answers than leaving them freely with the elderly to fill. The disadvantage would be that interviews take longer time but with a small sample, not exceeding 100 elderly men and women, the process should be manageable .

3.2 Study Tools and Data Collection

A questionnaire was designed with the specific questions that respond to the objectives and research questions of this work. The questionnaire layout is shown in the Appendix A. It was directed to the random sample per home/club of total 100 elderly in six elderly homes/ clubs; three of which are located in Ramallah and three in Bethlehem.This is because they have the most known elderly houses/clubs in Palestine. The three in Ramallah included Caritas, Birzeit Elderly Club and the Arab Women Union Society, while the other three elderly clubs in Bethlehem area included Beit-Sahour Elderly club, Dar Al- Shuyoukh Association -Beit-Jala and Saint Mart Elderly club -

Bethlehem. The questionnaire was disseminated and filled out, pending face to face interviews, conducted by the author and a volunteering assistant, with the elderly and the home/ club managers for clarification and verification. The questions focused on food items and quantities consumed per week from which calcium intake was calculated (Quantitative nature questions) . The food covered dairy, grains, vegetables, fruits, fish, meat and eggs, nuts and seeds, desserts. There were other questions that had qualitative nature such as chronic diseases, allergies, names of drugs and vitamins taken, as well as the duration of sun exposure.

The questionnaire was revised by Dr. Ola Anabtawi (Nutritionist) and Dr. Mohammad Awad (Computer Engineering/ Artificial Intelligence) for validity and reliability. Also the questionnaire was successfully tested by the researcher through a pilot study (10 elderly participants) which were counted within the study sample.

Finally, a mobile phone application was developed, that calculated daily calcium intake for patients from various food groups taking into consideration the chronic diseases, medications, sun exposure, movement and more. The mobile application is fully described in Chapter four.

3.3 Fieldwork

The fieldwork took place in six elderly clubs; three in Ramallah and three others in Bethlehem , as mentioned in Section 3.3.

Phase 1: The “elderly clubs in Ramallah” fieldwork required 2 weeks; estimated to start from March 20th 2022 till April 3rd 2022. The fieldwork included face to face interviews, in addition to filling out the calcium intake questionnaire form.

Phase 2: The “elderly clubs in Bethlehem” required 2 weeks starting from April 5th 2022 till April 18th 2022. Likewise, face to face interviews were conducted, in addition to filling out the questionnaire form.

The researcher, assisted by a friend with an educational background in Nutrition, followed up with all those questions, conducted and recorded the answers in the form of individual interviews.

3.4 Study setting

Three elderly clubs in Ramallah including Caritas, Birzeit Elderly Club and the Arab Women Union Society and three other elderly clubs in Bethlehem area which included Beit-SahourElderly club, Dar Al- Shuyoukh Association in Beit-Jala and Saint Mart Elderly club in Bethlehem.

3.5 Population and Sample Size

"In mid-year 2020, the number of the elderly aged 60 years and above, in Palestine, reached 269,346 persons (5%): 177,836 persons (6%) in the West Bank and 91,510 persons (5%) in the Gaza Strip." (PCBS, 2020), while each elderly home/ club was estimated to host 40-60 elderly people. The six homes/ clubs are hence estimated to have 300 residents. RAOSOFT software was used to calculate the sample size. For that, we estimated for the relatively low population, a higher margin error than 5% which was 8%. The sought confidence level was assumed at 95%. The sample size was hence calculated as 101 elderly; around 50 of which were located in Bethlehem and 50 were located in Ramallah. The sample is both stratified and random in nature. The stratified sampling is based on region and gender. Otherwise each regional gender sample was randomly selected, in terms of age, general health and background. That should enable a fair regional, gender and age comparison between the elderly in Ramallah and Bethlehem.

3.6 Privacy and Confidentiality

A consent form (Appendix D) "Human subject" approval form (Appendix E) were completed in the research, for protecting personal data and maintaining confidential privacy of the elderly person.

3.7Method of Data Analysis

The data, from the questionnaire forms, was collected and entered in a tabulated form for analysis using the Statistical Package for the Social Sciences (SPSS), which is a tool developed by IBM to perform statistical analysis of data. The IBM SPSS® software platform offers advanced statistical analysis, a vast library of machine-learning algorithms, text analysis, open-source extensibility, integration with big data and seamless deployment into applications. Its ease of use, flexibility and scalability make SPSS accessible to users with all skill levels. Calculating the mean, the standard deviation and the error in the mean is central in the analysis process (Field, A. , 2013). Bivariate analysis was used to compare the Ramallah and Bethlehem elderly populations. It included

description of the study populations and comparative statistics. The analyzed data included the mean, standard deviation, P-value, SEM and standard error to compare whether there was statistical differences in calcium intake among the elderly in accordance to the place of living, the gender, the age (a- men, b-women c- mixed), the sun exposure and the disease. The mean compared the average intake of calcium from calcium rich food among the elderly in both populations (Bethlehem & Ramallah). The standard deviation was shown to assess the reliability of the obtained data. A reasonable standard deviation was expected in both populations. The P-value is a statistical measure that helps to determine whether the hypothesis can be accepted or rejected. The p -value is a number between 0 and 1 and is interpreted in the following way: A small p -value (typically ≤ 0.05) indicateda strong evidence against the null hypothesis, so the null hypothesis was rejected. A large p -value (> 0.05), on the other hand, indicateda weak evidence against the null hypothesis, which failed to reject the null hypothesis. The standard error of the mean, or simply the standard error, indicated how different the population mean is likely to be from a sample mean. It shows how much the sample mean would vary if a study was repeated using new samples from within a single population.

3.8 Ethical Consideration

The ethical approval from, duly filled and signed, was obtained from the Arab American University , to formally justify permission access for the affiliate researcher, to interview the elderly in the elderly houses and clubs.

3.9 Study Limitations

The research study was subject to the following restrictions:

- The population sample was restricted to only two locations; Ramallah and Bethlehem.
- The sample was selected from six elderly houses and clubs.

- The sample size constituted of 100 elderly which were distributed equally in both cities. Hence our sample is not representative about the entire population in Palestine.

CHAPTER FOUR

Mobile Application

RazanCalciumCalc is a mobile application developed to calculate calcium intake, as a faster approach that would help dieticians assess calcium among different groups of the society especially the elderly. It can calculate daily calcium intake from various food groups like dairy, grains, fruits and vegetables, meat, fish, eggs, nuts & seeds and desserts. Amounts of calcium from each food group are calculated, based on its consumption, where calcium intake can be calculated on weekly and daily basis.

The mobile application was developed with the help of an IT specialist. RazanCalciumCalc was developed using the programming language "Dart" through flutter framework (Tashildar, A., 2020). The application helps the user compare the average daily calcium consumption to recommended levels of the elderly. The application starts by asking the elderly demographics such as name, institute's name, city, gender, age, mobility status, sun exposure, education, occupation, place of living, monthly salary, chronic diseases, food allergies, medications and vitamins supplement intake.

After the demographics are filled in, a list of calcium rich foods appears. The food list is categorized into 7 food groups: dairy, grains, fruits, vegetables, fish, meat and eggs, nuts & seeds and desserts. The elderly is asked about the amounts of food he/she consumes from each food group per week. The application afterwards would calculate both total calcium intake per week and daily calcium intake. The recommended daily calcium intakes differs between males and females and depends on the age category, too.

The RDA (Recommended Dietary Allowance) for elderly men, aged 51-70, is 1000 mg/day and the RDA for women, aged 51-70, is 1200 mg/day, whereas the RDA for elderly aged 71 and above is 1200 mg/day, regardless of the gender.

The application shows three different colors in terms of whether the elderly are reaching the recommended daily calcium amount or not:

1- Red: less than 95% of recommended daily calcium intake which means deficiency.
2- Green : 95%-105% of recommended daily calcium intake which means normal.

3- Yellow: More than 105% of recommended daily calcium intake which means excess.

If the color appears red or green, suggestions are given to reach the recommended daily calcium intake. The suggestions take into consideration a variety of food and is not concentrated on one or two food items in order to allow sufficient amounts of protein, carbs, fats, omega 3, vitamins and minerals.The application also generates reports which summaize all elderly entered into the application such as their demographics, their weekly and daily calcium intake.

4.1 Flowchart

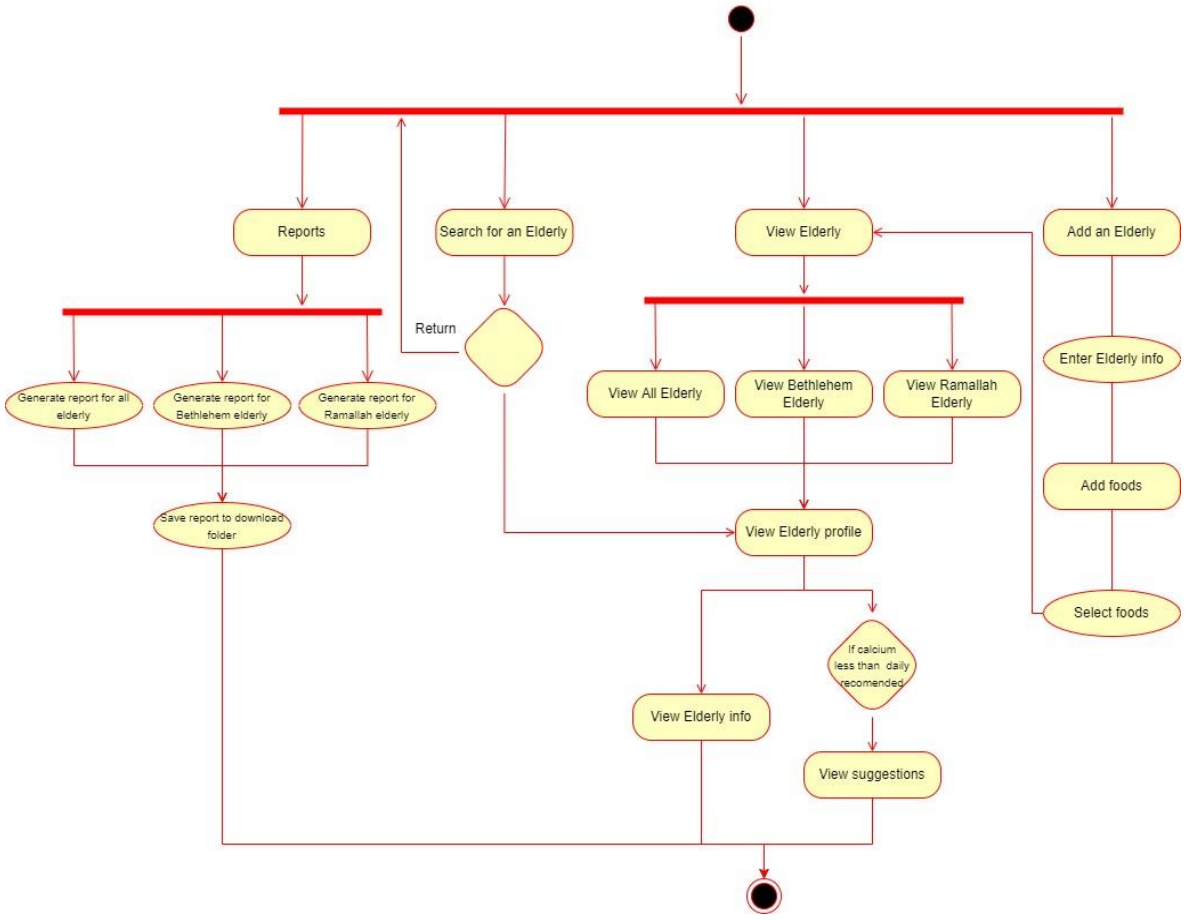


Fig. 4.1: Flowchart of RazanCalciumCalc Application

The flowchart starts with the“start” point, and there are 4 options in the application:

1- Generate reports (for Ramallah only, for Bethlehem only, for both)
2- Search for an elderly. The diamond shapes is for decision; either return to start point orview elderly profile (view elderly info), if calcium intake is less than recommend then view suggestions.
3- View elderly (view all elderly or view Ramallah elderly or view Bethlehem elderly), they all lead to view elderly profile (View elderly info) and if calcium is less than recommended then view suggestion to reach daily recommended calcium intake.
4- Add an elderly which requests to enter elderly information, add food and select food. Then the elderly can be viewed as in step 3.

The application reaches the “end” point.

4.2. Features of RazanCalciumCalc Application

1. User can add and store elderly in the internet cloud.
2. User can search for elderly by their name.
3. User can filter elderly depending on their city.
4. User can view elderly details.
5. User can add food to elderly.
6. User can delete an elderly record.
7. System calculates the recommended amount of calcium for each elderly.
8. System calculates the consumed amount of calcium per week for each elderly.
9. System can generate reports for all elderly, elderly who live in Bethlehem, or elderly who live in Ramallah.
10. The generated report contains elderly details, consumed food, recommended calcium per day, and consumed calcium per day.
11. System can provide food suggestions, if elderly has not reached the recommended daily calcium intake.
12. Each elderly record will have a color that indicates its status, whether he/she takes their recommended amount of calcium. The red color means that the elderly has not consumed

the recommended daily calcium (deficiency) , the green color means the elderly has reached the normal daily calcium intake, and the yellow means the he/she takes more than the recommended calcium (excess).

4.3. A journey through RazanCalciumCalc Application

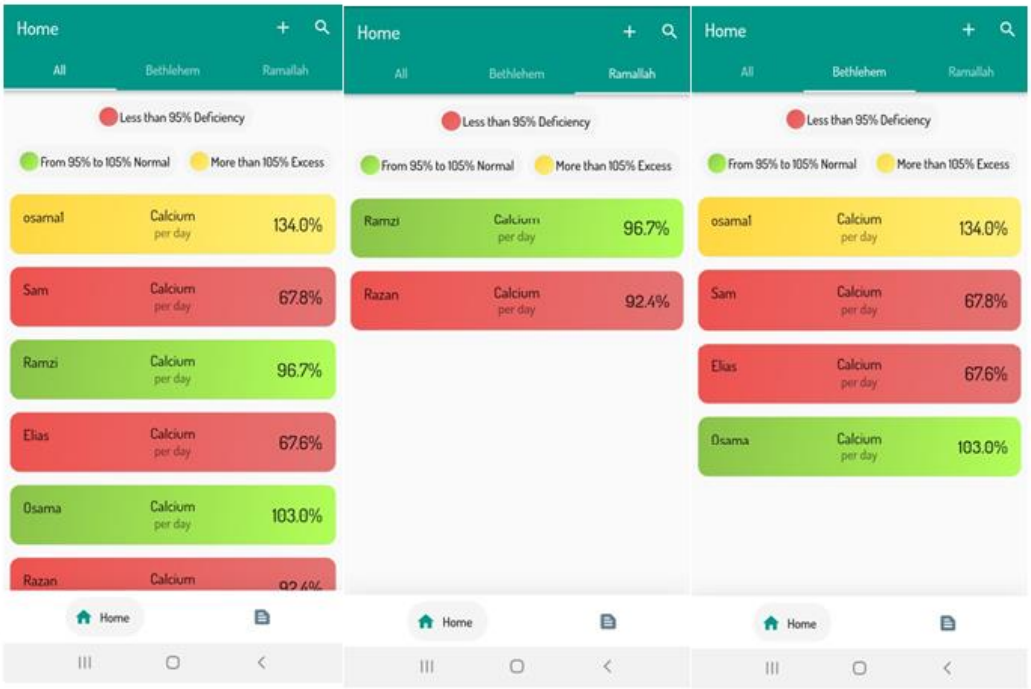


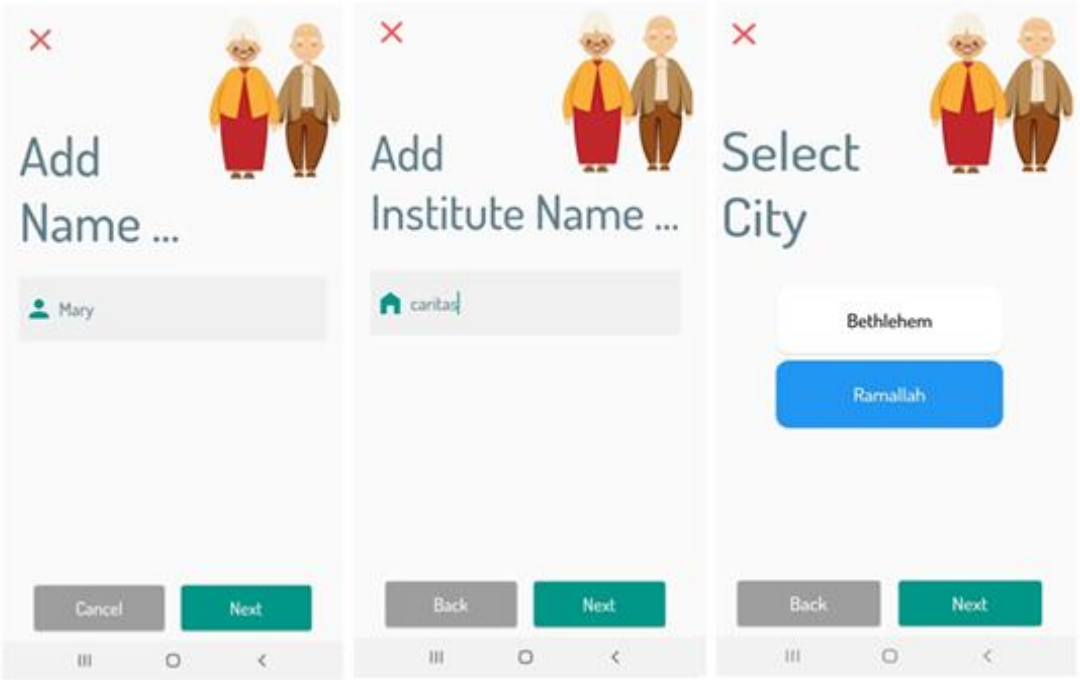
Fig. 4.2: Home Screen of RazanCalciumCalc

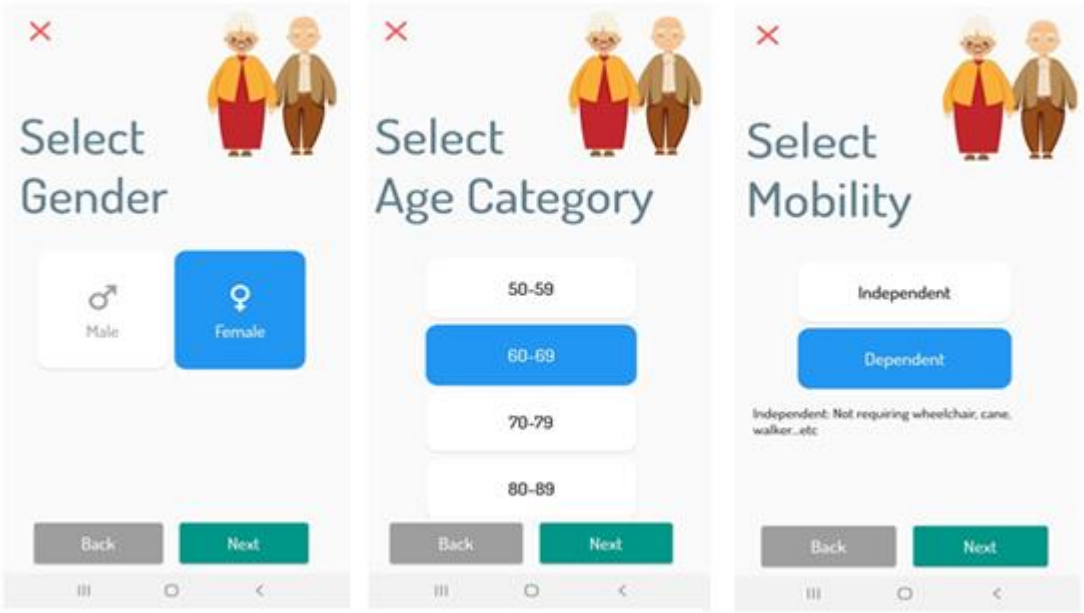
Example: Mary is an Elderly between the age of 60-69 years and she is from Ramallah. Her Daily Calcium Intake is calculated as the following:

1- First her demographics are filled in RazanCalciumCalc Application.
2- The consumed quantity of calcium rich foods from the 7 food groups are calculated per week.
3- The App. will calculate weekly and daily calcium intake.
4- RazanCalciumCalc and show suggestions to reach RDA of Calcium intake.
5- It also generates a report.

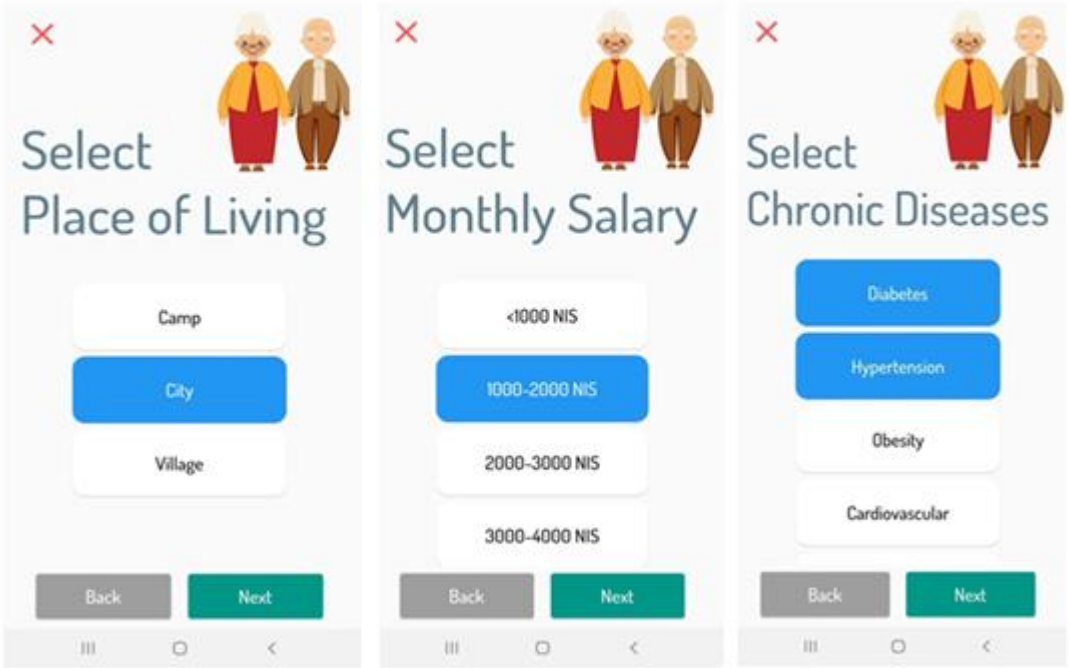
4.3.1. Elderly Demographics

This describes name, institute's name, city, gender, age, mobility status, sun exposure, education, occupation, place of living, monthly salary, chronic diseases, food allergies, medications and vitamins.

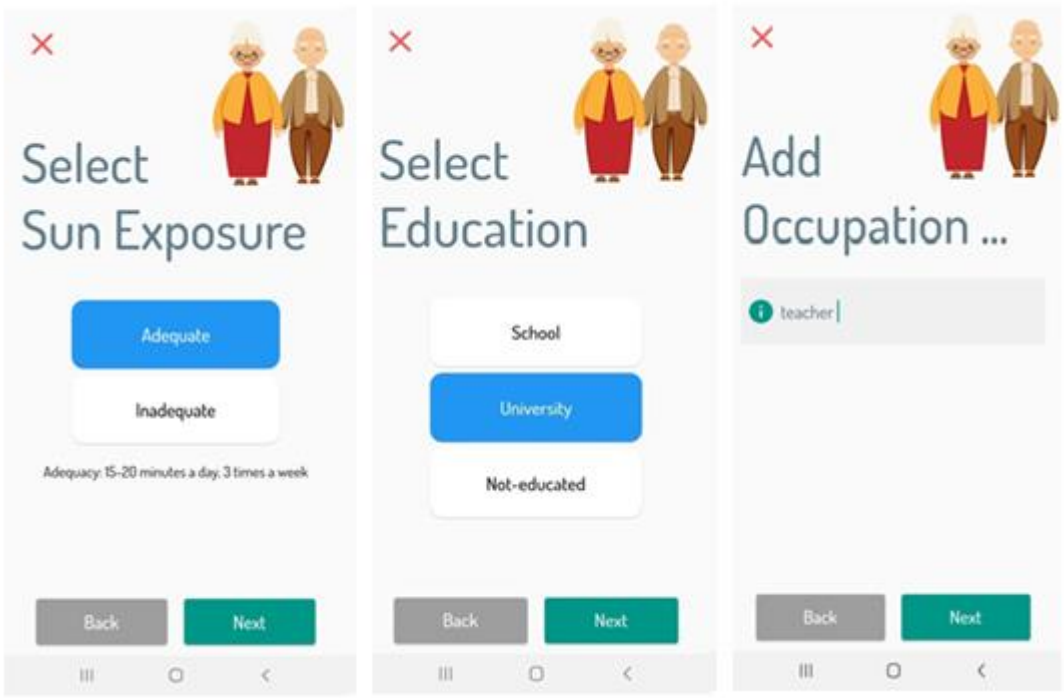




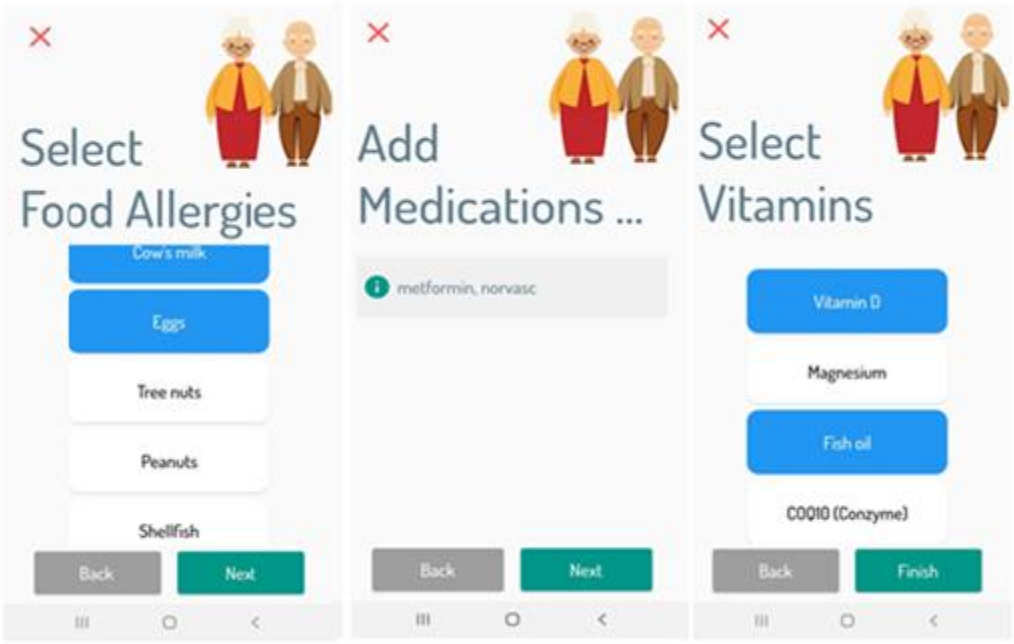
The demographics, shown above, appear at the beginning of RazanCalciumCalc once it's opened. The screen shot shows gender, age category and mobility status options.



Here , place of living, monthly salary and chronic diseases of the elderly can be selected.



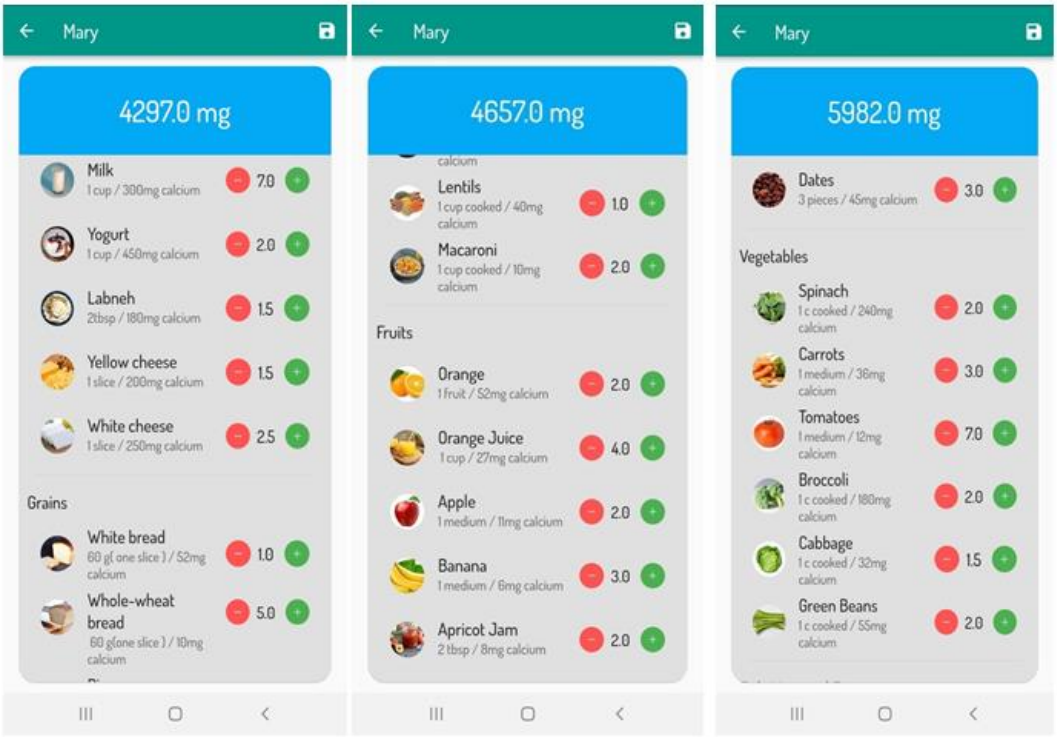
The adequacy of sun exposure, level of education and occupation can be selected, as shown above.

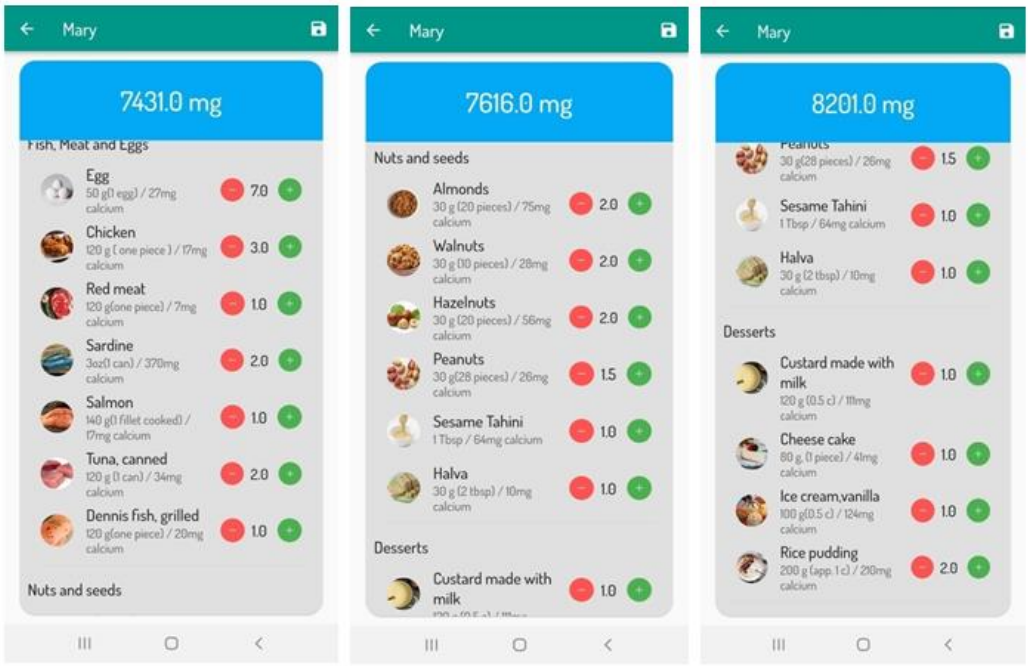


Here, any food allergy, medications and Vitamins are entered for the elderly.

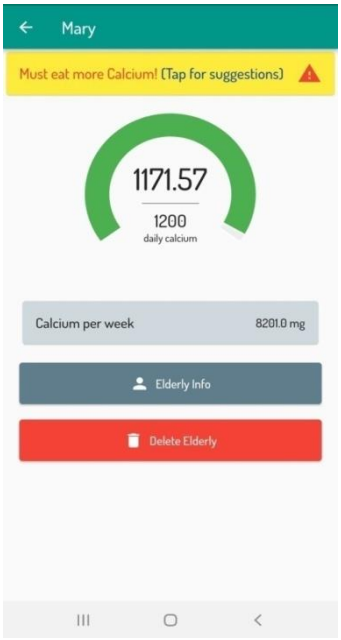
4.3.2. Seven calcium rich food groups to choose from

After the demographics are entered, the seven groups of calcium rich food appear. Elderly are asked the quantity of calcium rich foods they consume from each food item in a group per week.





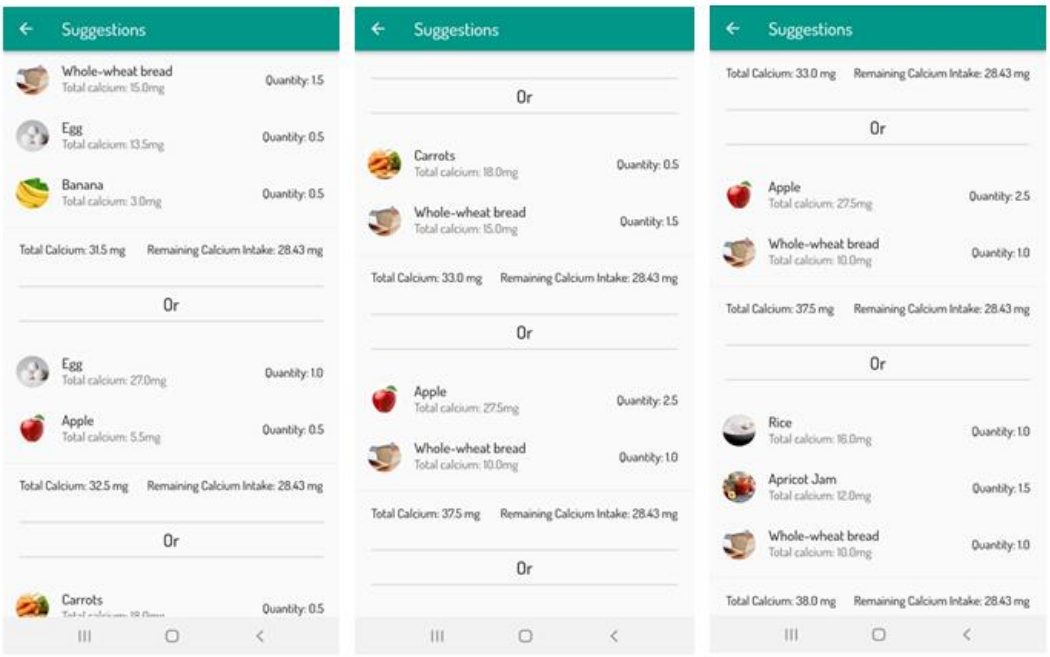
The seven groups range from dairy, grains, fruits, vegetables, fish/meat/eggs, nuts/seeds and desserts.



Once all data entry is completed, the application calculates the weekly and average daily calcium intake. Further, the green color surrounding the average daily intake indicates a normal consumption of calcium.

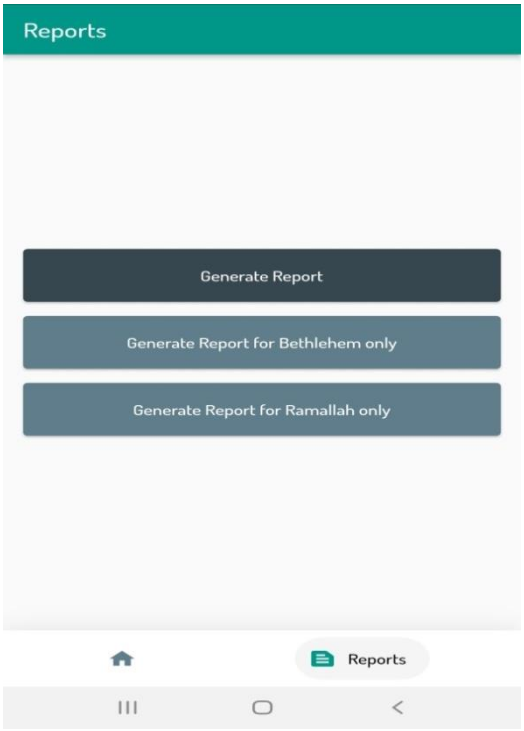
4.3.3. Added suggestions

RazanCalciumCalc provides a number of group suggestions to compensate for any calculated defficiency in calcium intake. This would allow the elderly to reach their Recommended Dietary Allowance (RDA) , subject to his/her optional groups of suggestions.

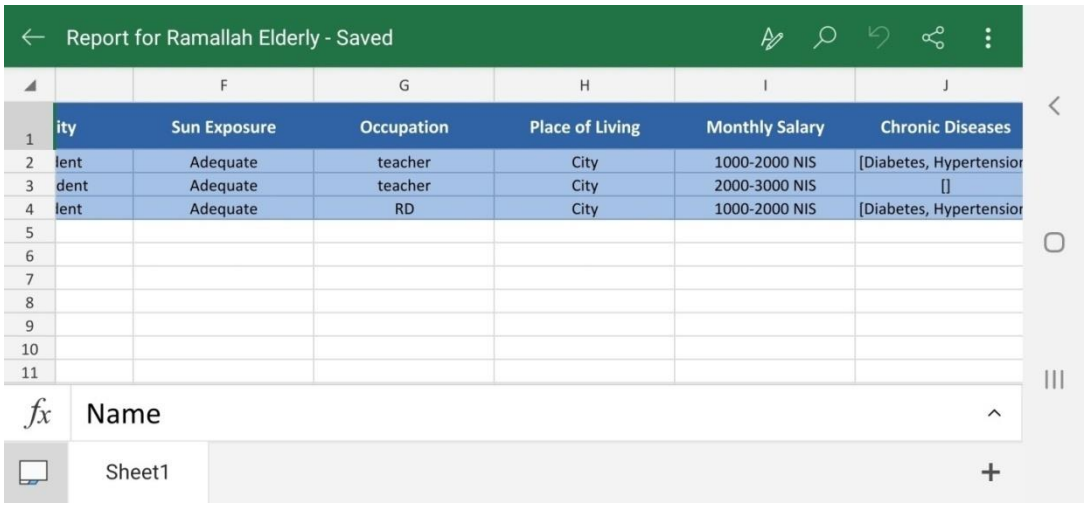


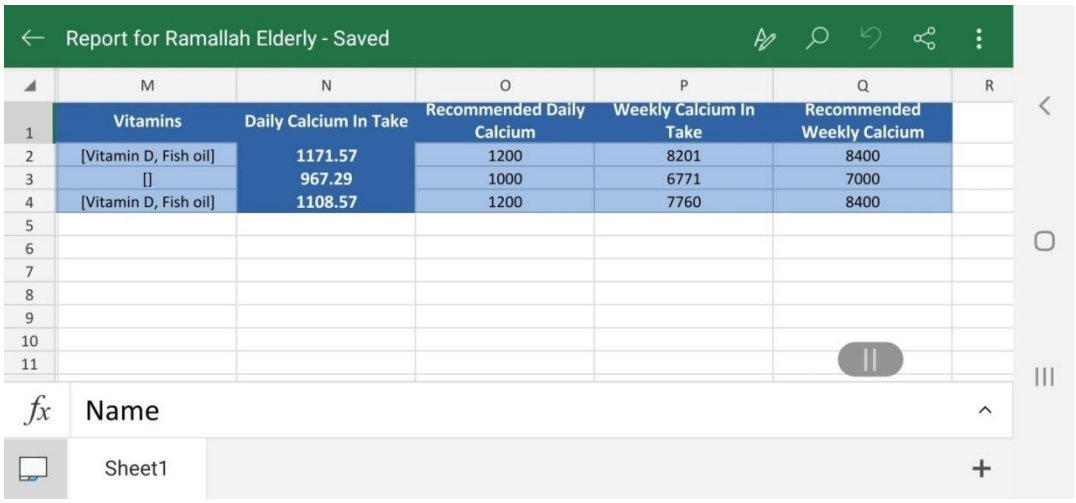
4.3.4. Reports generated

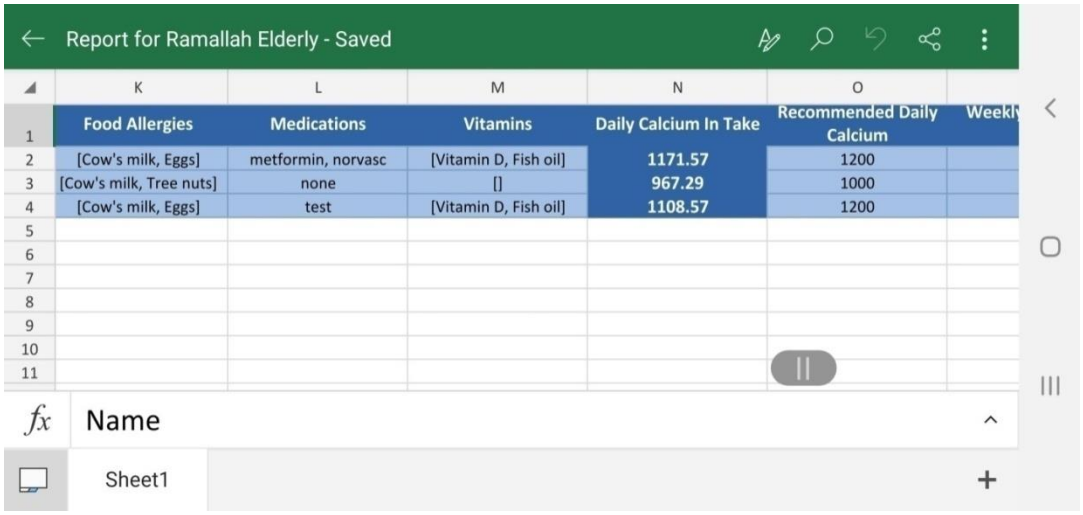
RazanCalciumCalc generates reports for the whole group of elderly per each city; Bethlehem, or Ramallah or both cities. This would summarize whether the elderly home, in general supplies sufficiently calcium rich food to the elderly. It also summarizes data information per elderly person.




Report for Ramallah Elderly - Saved
Name
City/Town
Gender
Age Category
Mobility
Mary
Ramallah
Female
60-69
Dependent
Ramzi
Ramallah
Male
50-59
Independent
Razan
Ramallah
Female
50-59
Dependent
Name
Sheet1


Report for Ramallah Elderly - Saved
Sun Exposure
Occupation
Place of Living
Monthly Salary
Chronic Diseases
Adequate
teacher
City
1000-2000 NIS
Adequate
teacher
City
2000-3000 NIS
[]
Adequate
RD
City
1000-2000 NIS
Name
Sheet1


Report for Ramallah Elderly - Saved
Vitamins
Daily Calcium In Take
Recommended Daily Calcium
Weekly Calcium In Take
Recommended Weekly Calcium
[Vitamin D, Fish oil]
1171.57
1200
8201
8400
[]
967.29
1000
6771
7000
[Vitamin D, Fish oil]
1108.57
1200
7760
8400
Name
Sheet1



Seven elderly were tested using RazanCalciumCalc Application. All elderly were female and came to Caritas/ Ramallah elderly club. There were differences in their daily calcium intake. Some had food allergies, colon conditions and others don't prefer dairy which is known to be calcium rich food.

Caritas is an elderly club, the elderly come and spend a few hours for entertainment and socializing. The application calculated their daily and weekly calcium intake based on what they eat at their homes. Due to CoronaVirus, the number of elderly attending Caritas decreased as most elderly have a weak immune system and are prone to such viruses. Therefore, only a few attend the elderly club while others have the Caritas staff visit them such as doctors and nurses.

The following table summarizes the daily and weekly calcium intake of the 7 elderly tested by RazanCalciumCalc Application:

Name	City/Town	Gender	Age Category
Samia	Ramallah	Female	70-79
Mary	Ramallah	Female	60-69
Randa	Ramallah	Female	70-79
Suad	Ramallah	Female	60-69
Suhad	Ramallah	Female	60-69
Nuha	Ramallah	Female	70-79
Sylvia	Ramallah	Female	60-69

Mobility	Sun Exposure	Occupation	Place of Living

Dependent	Adequate	Deaf School	Village
Dependent	Adequate	Teacher	City
Dependent	Adequate	None	City
Dependent	Adequate	Dressmaker	City
Dependent	Adequate	Jewelry Center	City
Dependent	Inadequate	Clothes Seller	City
Dependent	Adequate	Math and Science teacher	City

MonthlySalary	Chronic Diseases	FoodAllergies	Medications
1000-2000 NIS	[]	[]	Cholesterol
1000-2000 NIS	[Diabetes, Hypertension]	[Cow's milk,Eggs]	metformin,norvasc
<1000NIS	[]	[]	None
<1000NIS	[Hypertension]	[]	Aspirin,lipidex
<1000NIS	[]	[]	None
1000-2000 NIS	[Other]	[]	Colon med.
<1000 Nis	[]	[]	[]

Vitamins	Daily Calcium InTake	RecommendedDaily Calcium	Weekly Calcium In Take	Recommended Weekly Calcium
[VitaminD,Fish oil,B12]	1169.57	1200	8187	8400
[Vitamin D,Fish oil]	1171.57	1200	8201	8400
[Vitamin D,Fish oil,Other	1301.57	1200	9111	8400
[Fish oil]	685.57	1200	4799	8400
[Vitamin D,Fish oil,Other]	1346	1200	9422	8400
[Vitamin D,Fish oil,Vitamin C]	589.43	1200	4126	8400
[VitaminD,Fish oil,B-complex]	1415.86	1200	9911	8400

Mean of daily calcium intake = sum/total = 1097.08 mg/day which is fairly adequate as these elderly women require 1200 mg/day according to their gender and age category.

CHAPTER FIVE

Results and Discussion

5.1. Results

The following tables and associated figures show the characteristics of the sample in the study.

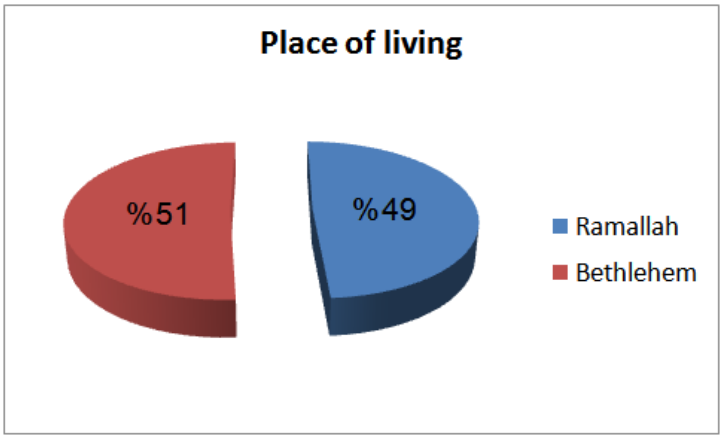


Fig. 5.1: The distribution of the participants according to Place of Living

Figure 5.1 shows the distribution of 100 elderly (sample) according to the place of living. 51% are from Bethlehem and 49% are from Ramallah.

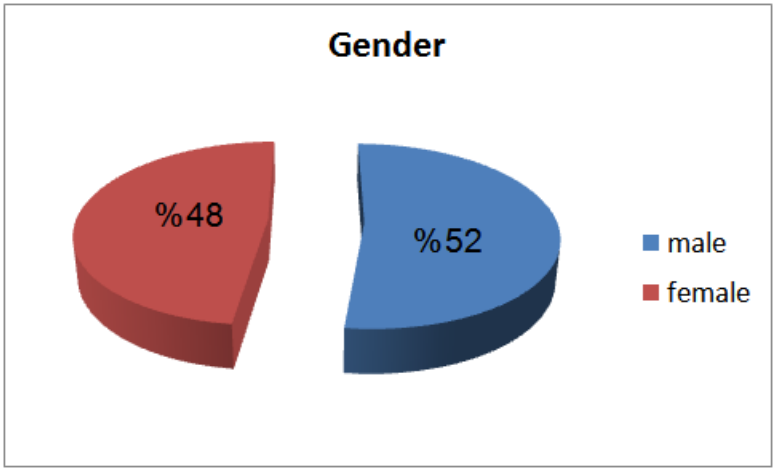


Fig. 5.2: The distribution of the participants according to Gender

Figure 5.2 shows the distribution of the elderly sample according to Gender. 48% are female and 52% are male.

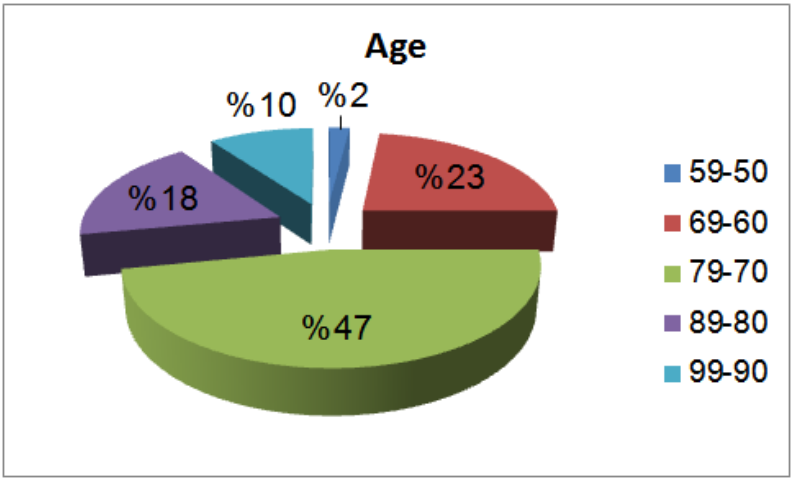


Fig. 5.3: The distribution of the particpants according to Age

Figure 5.3 shows the distribution of the elderly participants according to age. 2% are in the age category 50-59, 10% are in the age category 90-99. 18% are in the age category 80-89, 23% are in the age category 60-69, 47% are in the age category 70-79.

Table 5.1: The distribution of the participants according to Mobility

Mobility	Frequency	Percent
Independent	87	87%
Cane	12	12%
Walker	1	1%
Total	**100**	**100%**

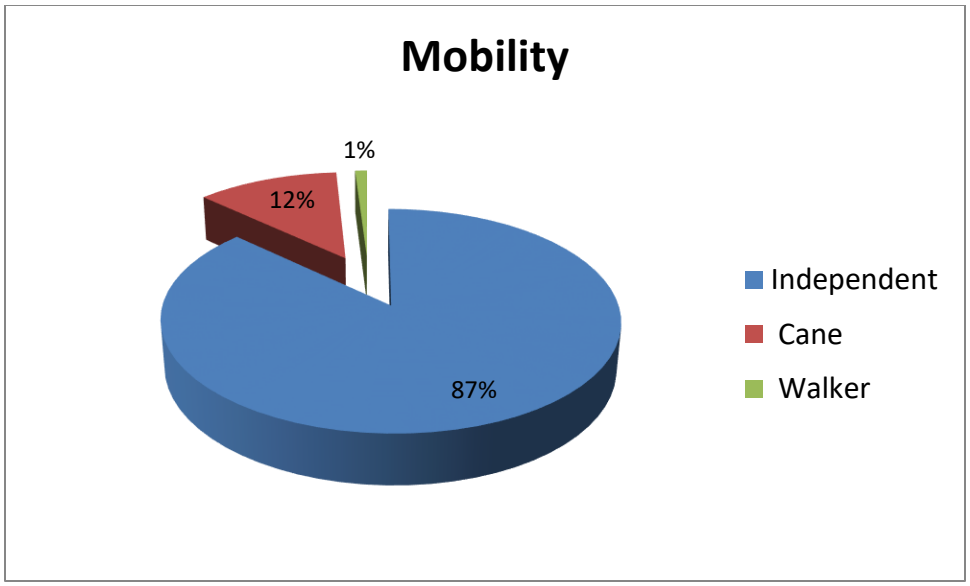


Fig. 5.4: Mobility of the elderly

Fig. 5.4 shows the mobility of the elderly participants. 87% were independent, 12% used a cane and 1% used a walker.

Table 5.2: The distribution of the participants according to Sun exposure

Sun exposure	Frequency	Percent
Low	65	65.0%
Moderate	35	35.0%
Total	**100**	**100.0%**

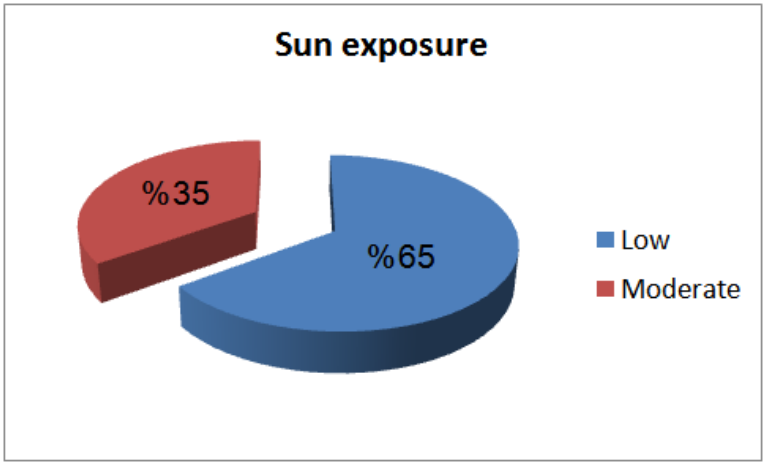


Fig.5.5 : Sun exposure of the elderly

Figure 5.5 shows the distribution of the participants according to sun exposure. 35% had moderate sun exposure and 65% had low sun exposure.

Moderate means that exposure to sun would be 3 times a week for a period of 20 minutes, each, according to Dr. Elias Saba, Orthopedic Doctor, Palestinian Osteoporosis Prevention Society, Bethlehem, in a recently conducted interview by myself.

Table 5.3: The distribution of the participants according to diseases

Diseases	Frequency	Percent
mental illness	3	3%
Diabetes and Hypertension	55	55%
Heart disease	7	7%
Arthritis	3	3%
No diseases	32	32%
Total	**100**	**100%**

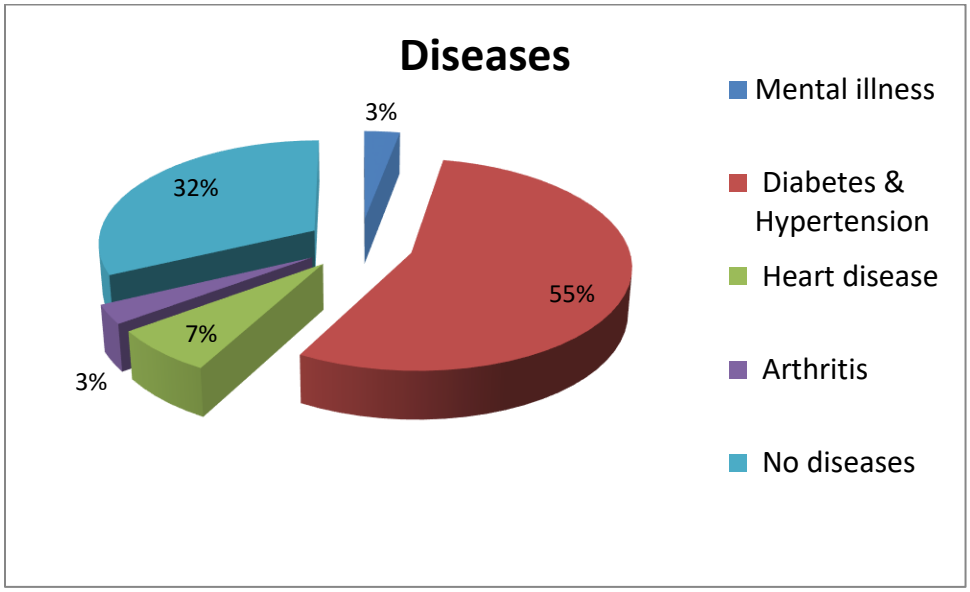


Fig. 5.6: Diseases of the elderly

Figure 5.6 shows the districation of the elderly participants according to diseases. 3% had Arthritis, 3% had mental illness, 7% had heart disease 55% had Diabetes and Hypertension and 32% had no diseases.

Table 5.4: The distribution of the participants according to Food allergies

Allergies	Frequency	Percent
Bread	2	2%
Citrus	1	1%
Tomato	2	2%
Egg	1	1%
Been	1	1%
No allergies	93	93%
Total	**100**	**100%**

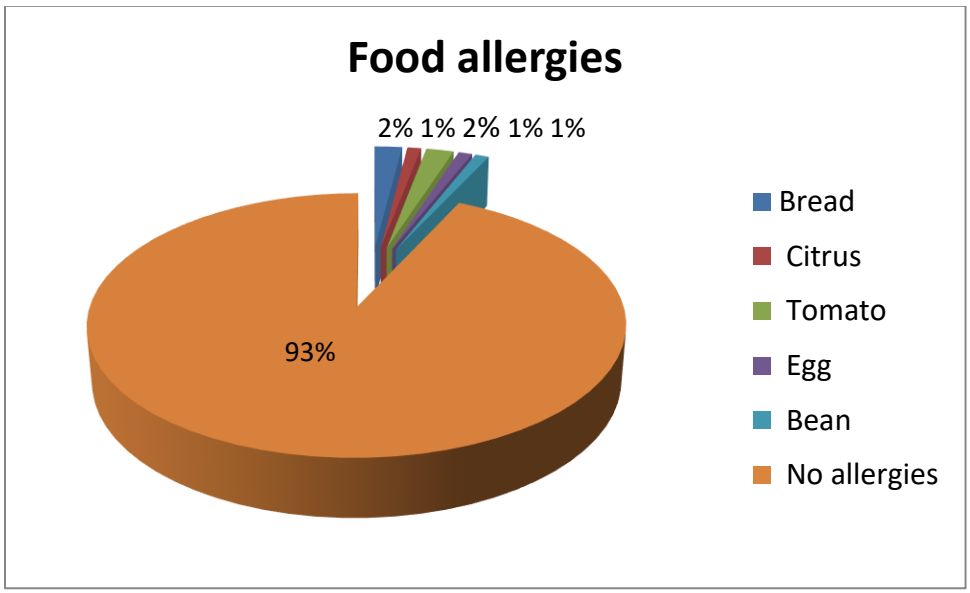


Fig.5.7: Allergies related to food

Figure 5.7 shows the food allergies distribution of the elderly participants out of the sample with allergies. 93 participants had no allergies.1% had allergy from eggs, 1% had allergy from beans, 1% had allergy from citrus, 2% had allergy from tomatoes and 2% had allergy from bread.

Table 5.5: The distribution of the participants according to Medications

Medications	**Frequency**	**Percent**
Psychological medications	4	4%
Diabetes	35	35%
Cardiovascular	8	8%
Stress	14	14%
Bone	1	1%
Cancer	1	1%
No medications	37	37%

Total	100	100%

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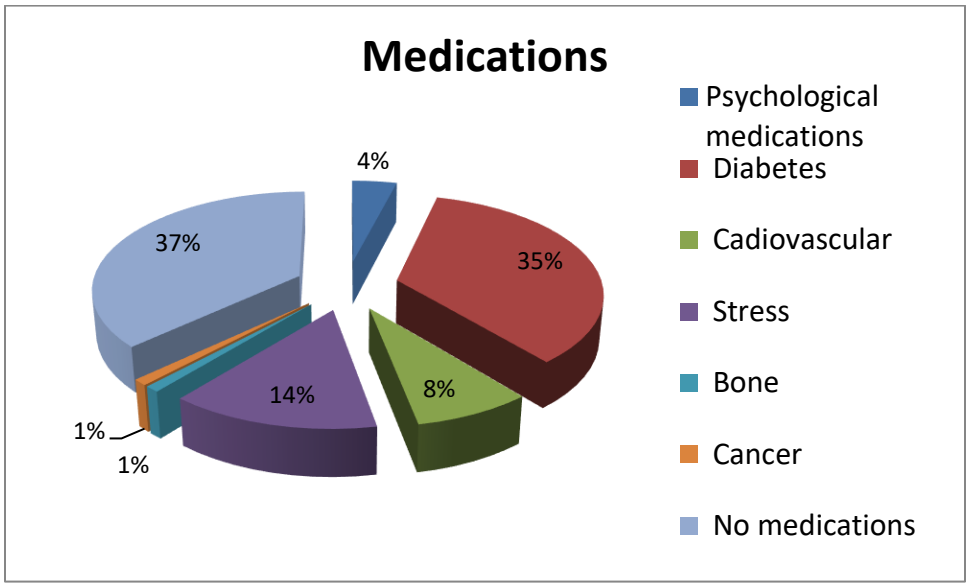

Fig. 5.8: Medications taken by the elderly

Figure 5.8 shows the medicatins that elderly participants took. 4% took psychological medication, 35% took medication for Diabetes and Hypertension, 8% took Cardiovascular medication, 14% took stress medication, 1% took bone medication, 1% took cancer medication and 37% took no medications.

Table 5.6: The distribution of the participants according to Vitamin supplement

Vitamins	Frequency	Valid Percent
Calcium	5	5%
Iron	1	1%
Vitamin D	4	4%
Fish oil	17	17%
Centrum	1	1%
B12	3	3%
No vitamins	69	69%
Total	**100**	**100%**

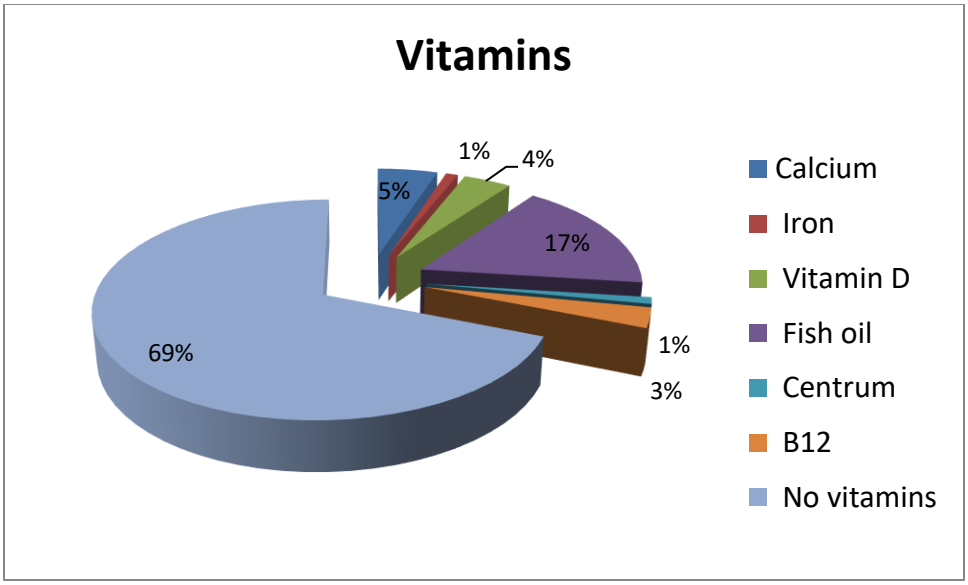

Fig. 5.9: Vitamins taken by the elderly

Fig. 5.9 shows the vitamins that elderly participants took. 5% took Calcium, 1% took Iron, 4% took Vitamin D, 17% took Fish Oil, 1% took Centrum, 3% took B12 and 69% took no vitamins.

Hypotheses #1: There is a general calcium intake deficiency in elderly houses and clubs in the selected locations, in Palestine.

Table 7 shows that elderly have sufficient calcium intake which in 1124.92 mg/day.

Table 5.7: Means,Standard Deviation and standard error in the mean of the calcium intake among the elderly in Palestine for the different kinds of foods they take.

Food	N	Mean	Std. Deviation	SEM
Dairy	100	705.33	365.82	36.58
Grains	100	73.30	46.29	4.62
Fruits	100	55.35	41.39	4.13
Vegetables	100	109.76	102.06	10.20
Fish, Meat and Eggs	100	72.04	76.83	7.68
Nuts and seeds	100	60.30	58.36	5.83
Desserts	100	48.84	50.98	5.09
Total calcium intake	**100**	**1124.92**	**429.77**	**42.98**

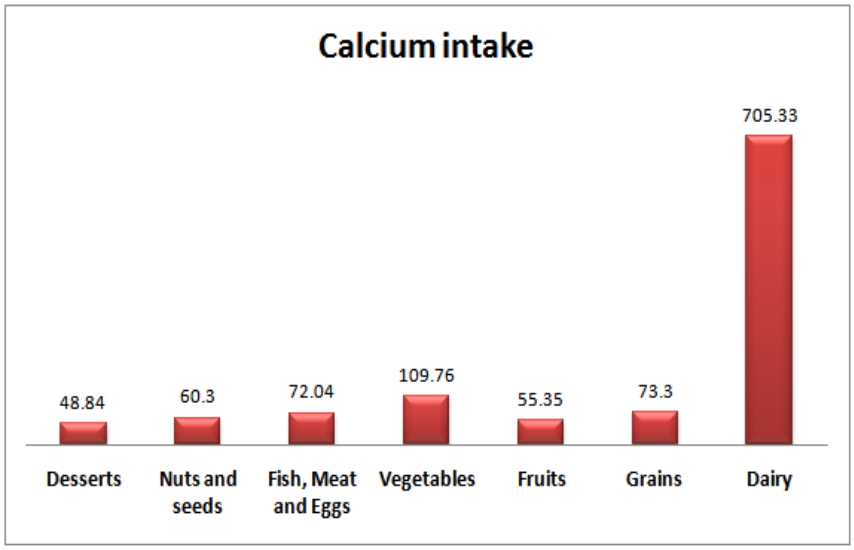

Fig. 5.10: Calcium intake of the elderly from 7 food groups

Hypotheses #2 A: there are no significant statistical differences at (P≤0.05) in calcium intake among the elderly in Palestine according to the place of living

Table 5. 8: Results of (t-test) for the differences in calcium intake among the elderly in Palestine according to the place of living

Food	Place	N	Mean (mg)	Std. Deviation	SEM	P-value
Dairy	Ramallah	49	716.41	325.81	46.54	0.768
	Bethlehem	51	694.68	403.53	56.51	
Grains	Ramallah	49	82.60	52.85	7.55	0.050
	Bethlehem	51	64.36	37.35	5.23	
Fruits	Ramallah	49	60.15	44.69	6.38	0.257
	Bethlehem	51	50.73	37.82	5.29	
Vegetables	Ramallah	49	72.47	53.66	7.67	0.000
	Bethlehem	51	145.58	123.24	17.26	
Fish, Meat and Eggs	Ramallah	49	61.89	71.21	10.17	0.197
	Bethlehem	51	81.79	81.38	11.39	
Nuts and Seeds	Ramallah	49	60.59	64.34	9.19	0.962
	Bethlehem	51	60.03	52.62	7.37	
Desserts	Ramallah	49	45.79	42.03	6.00	0.558
	Bethlehem	51	51.78	58.59	8.20	
Total Ca intake	Ramallah	49	1099.91	391.92	55.99	0.571
	Bethlehem	51	1148.95	465.89	65.24	

The results of t-test indicate that there are no significant statistical differences at (P≤0.05) in the total calcium intake among the elderly in Palestine according to the place of living. (P-value>0.05 = 0.571).

But, there were significant differences in calcium intake from vegetables and grains among the elderly in Palestine, according to the place of living (P-value ≤0.05).

The differences in the Grains were higher for Ramallah area, with mean of calcium intake equal to (82.60 mg/day), compared to (64.36 mg/day) for Bethlehem.

There was a difference in calcium intake from vegetables for Bethlehem with a mean of calcium intake equal to (145.58 mg/day), compared to (72.47 mg/day) for Ramallah area.

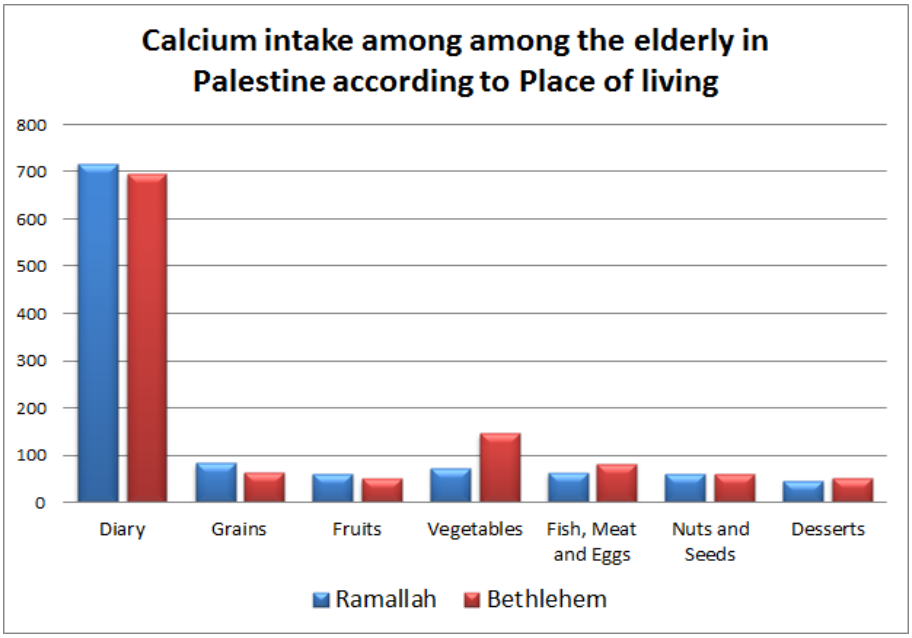

Fig. 5.11: Calcium intake among the elderly in Ramallah/ Bethlehem according to place of living

Hypotheses #2 B: there are no significant statistical differences at (P≤0.05) in calcium intake among the elderly in Palestine according to Gender

Table 5.9: Results of (t-test) for the differences in calcium intake among the elderly in Palestine according to gender

Food	Gender	N	Mean	Std. Deviation	SEM	P-value
Diary	Male	52	732.34	376.56	52.22	0.445
	Female	48	676.07	355.45	51.30	
Grains	Male	52	71.37	41.80	5.79	0.668
	Female	48	75.38	51.08	7.37	
Fruits	Male	52	48.55	34.30	4.76	0.087
	Female	48	62.71	47.17	6.81	
Vegetables	Male	52	114.49	116.28	16.13	0.632
	Female	48	104.63	84.95	12.26	
Fish, Meat and Eggs	Male	52	73.86	79.81	11.07	0.807
	Female	48	70.07	74.26	10.72	
Nuts and Seeds	Male	52	69.03	63.44	8.79	0.120
	Female	48	50.85	51.29	7.40	
Desserts	Male	52	45.81	52.03	7.21	0.538
	Female	48	52.13	50.17	7.24	
Total Calcium intake	Male	52	1155.45	439.60	60.96	0.462
	Female	48	1091.85	420.96	60.76	

The results of t-test indicate that there are no significant statistical differences at ($P \leq 0.05$) in the total calcium intake among the elderly in Palestine according to gender. (P-value >0.05 = 0.462).

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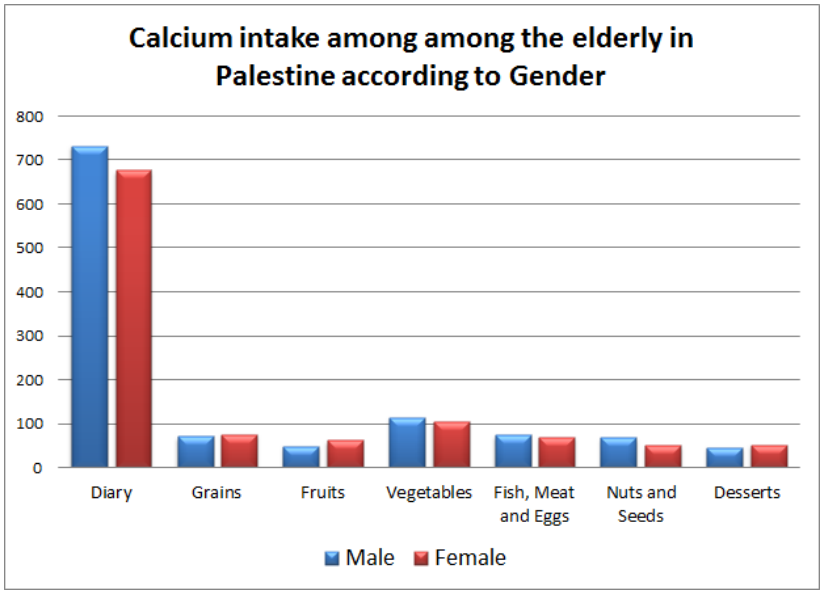

Fig. 5.12: Calcium intake of the elderly in Palestine according to gender

Hypotheses #2 C: there are no significant statistical differences at (P≤0.05) in calcium intake among the elderly (Men) in Palestine according to Age

Table 5.10 A: results of one way analysis of variance (ANOVA) test for the differences in calcium intake among the elderly men in Palestine according to the age

Food	Groups (Between or Within)	Sum of Squares	Df	Mean Square	F	P-value
Diary	Between Groups	307042.567	3	102347.522	0.709	0.551
	Within Groups	6924643.265	48	144263.401		
	Total	7231685.832	51			
Grains	Between Groups	3268.419	3	1089.473	0.609	0.612
	Within Groups	85820.731	48	1787.932		
	Total	89089.149	51			
Fruits	Between Groups	3724.637	3	1241.546	1.059	0.375
	Within Groups	56293.311	48	1172.777		
	Total	60017.948	51			
Vegetables	Between Groups	83013.988	3	27671.329	2.190	0.101
	Within Groups	606598.763	48	12637.474		
	Total	689612.752	51			
Fish, Meat and Eggs	Between Groups	9323.056	3	3107.685	0.473	0.703
	Within Groups	315538.678	48	6573.722		
	Total	324861.734	51			
Nuts and Seeds	Between Groups	19774.166	3	6591.389	1.706	0.178
	Within Groups	185452.256	48	3863.589		
	Total	205226.422	51			
Desserts	Between Groups	3027.960	3	1009.320	0.359	0.783
	Within Groups	135023.457	48	2812.989		
	Total	138051.417	51			
Total Calcium intake	Between Groups	836661.179	3	278887.060	1.484	0.231
	Within Groups	9019153.597	48	187899.033		
	Total	9855814.776	51			

The results of one way analysis of variance (ANOVA) test indicate that there are no significant statistical differences at (P≤0.05) in the total calcium intake among the elderly men in Palestine according to the age. (P-value >0.05 = 0.231).

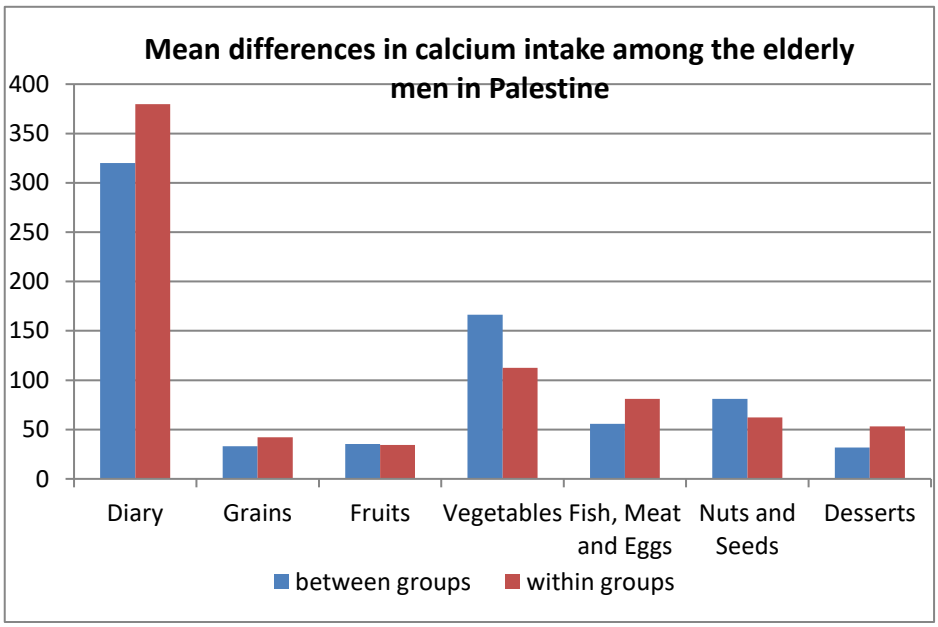

Fig. 5.13: Mean differences inCalcium intake among the elderly men in Palestine

Table 5.10 B: means, Std. Deviation for the differences in the total calcium intake among the elderly men in Palestine according to the age

Food	age	N	Mean	Std. Deviation	Std. Error
Diary	60-69	13	640.00	326.13	90.45
	70-79	20	824.00	406.99	91.00
	80-89	12	684.29	329.10	95.00
	90-99	7	724.29	467.24	176.60
Grains	60-69	13	61.05	26.15	7.25
	70-79	20	70.46	43.85	9.81
	80-89	12	74.95	41.64	12.02
	90-99	7	87.02	60.55	22.89
Fruits	60-69	13	46.97	32.63	9.05
	70-79	20	56.07	36.96	8.27
	80-89	12	48.87	30.52	8.81
	90-99	7	29.43	34.90	13.19
Vegetables	60-69	13	103.45	79.98	22.18
	70-79	20	159.43	154.99	34.66
	80-89	12	93.14	78.37	22.62
	90-99	7	43.20	31.18	11.78
Fish, Meat and Eggs	60-69	13	54.40	32.11	8.90
	70-79	20	86.21	108.28	24.21

	80-89	12	67.75	55.41	16.00
	90-99	7	85.20	88.14	33.31
Nuts and Seeds	60-69	13	84.36	60.62	16.81
	70-79	20	71.71	64.60	14.45
	80-89	12	35.58	46.08	13.30
	90-99	7	90.24	80.31	30.35
Desserts	60-69	13	53.11	60.73	16.84
	70-79	20	47.14	55.40	12.39
	80-89	12	46.25	40.97	11.83
	90-99	7	27.69	48.31	18.26
Total Calcium intake	60-69	13	1043.34	341.47	94.71
	70-79	20	1315.01	445.43	99.60
	80-89	12	1050.83	355.28	102.56
	90-99	7	1087.08	640.53	242.10

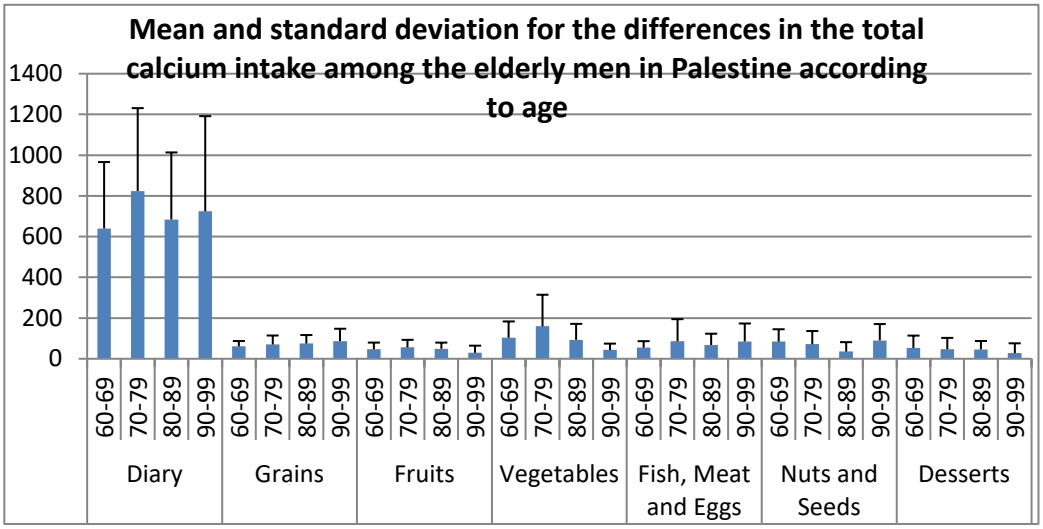

Fig. 5.14: Mean and standard deviation for differences in total Calcium intake among the elderly men in Palestine according to age

Hypotheses # 2 C: there are no significant statistical differences at (P≤0.05) in calcium intake among the elderly (Women) in Palestine according to Age

Table 5.11 A: Results of one way analysis of variance (ANOVA) test for the differences in calcium intake among the elderly women in Palestine according to the age

Food	Between Groups/ Within Groups	Sum of Squares	Df	Mean Square	F	P-value
Diary	Between Groups	108374.135	4	27093.534	0.200	0.937
	Within Groups	5829795.253	43	135576.634		
	Total	5938169.388	47			
Grains	Between Groups	1662.174	4	415.544	0.148	0.963
	Within Groups	120959.594	43	2813.014		
	Total	122621.769	47			
Fruits	Between Groups	9622.796	4	2405.699	1.090	0.374
	Within Groups	94946.755	43	2208.064		
	Total	104569.551	47			
Vegetables	Between Groups	23747.882	4	5936.970	0.809	0.526
	Within Groups	315404.846	43	7334.996		
	Total	339152.728	47			
Fish, Meat and Eggs	**Between Groups**	**105004.661**	**4**	**26251.165**	**7.322**	**0.000**
	Within Groups	**154172.318**	**43**	**3585.403**		
	Total	**259176.979**	**47**			
Nuts and Seeds	Between Groups	200.029	4	50.007	0.017	0.999
	Within Groups	123449.457	43	2870.918		
	Total	123649.486	47			
Desserts	Between Groups	9164.001	4	2291.000	0.903	0.471
	Within Groups	109130.278	43	2537.913		
	Total	118294.279	47			
Total Calcium intake	Between Groups	334838.075	4	83709.519	0.450	0.772
	Within Groups	7994015.714	43	185907.342		
	Total	8328853.789	47			

The results of one way analysis of variance (ANOVA) test indicate that there are no significant statistical differences at (P≤0.05) in the total calcium intake among the elderly women in Palestine according to the age.(P-value >0.05 = 0.772).

But, there were differences in calcium intake among the elderly women in Palestine, according to the age category related to Fish, Meat and Eggs. (P-value ≤0.05).

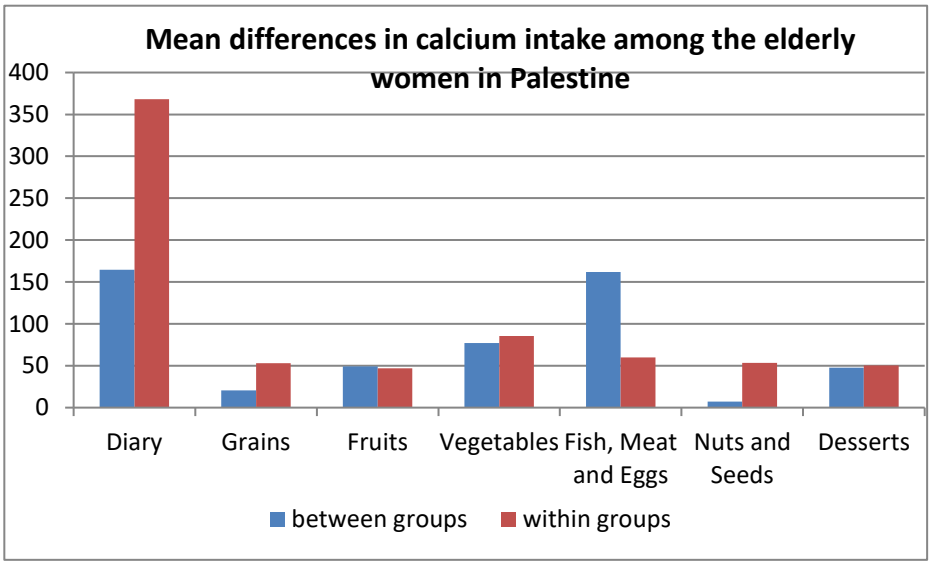

Fig. 5.15: Mean differences inCalcium intake among the elderly women in Palestine

Table 5.11 B: Tukey's test was used to determine differences in the calcium intake concerning (Fish, Meat and Eggs) among the elderly women in Palestine according to the age

Food	comparisons	50-59	60-69	70-79	80-89	90-99
Fish, Meat and Eggs	50-59		-10.900	-14.190	-38.548	-205.667*
	60-69			-3.290	-27.648	-194.767*
	70-79				-24.357	-191.476*
	80-89					-167.119*
	90-99					

The differences were between the elderly women category (50-59) and the category (90-99), and the differences were for the age category of (90-99), which have more calcium intake from (Fish, Meat and Eggs) than the age categories of (50-59).

Also, there were differences between the elderly women category (60-69) and the category (90-99), and the differences were for the age category of (90-99), which have more calcium intake from (Fish, Meat and Eggs) than the age categories of (60-69).

Moreover, there were differences between the elderly women category (70-79) and the category (90-99), and the differences were for the age category of (90-99), which have more calcium intake from (Fish, Meat and Eggs) than the age categories of (70-79).

There were also differences between the elderly women category (80-89) and the category (90-99), and the differences were for the age category of (90-99), which have more calcium intake from (Fish, Meat and Eggs) than the age categories of (80-89).

Table 5.11 C: means, Std. Deviation for the differences in the total calcium intake among the elderly women in Palestine according to the age

Food	Age	N	Mean	Std. Deviation	Std. Error
Diary	50-59	2	467.14	296.98	210.00
	60-69	10	649.71	426.60	134.90
	70-79	27	698.36	368.83	70.98
	80-89	6	684.29	295.81	120.77
	90-99	3	686.19	254.24	146.78
Grains	50-59	2	91.29	48.29	34.14
	60-69	10	76.03	36.10	11.42
	70-79	27	73.13	56.66	10.90
	80-89	6	70.57	51.99	21.22
	90-99	3	92.48	70.39	40.64
Fruits	50-59	2	113.36	35.46	25.07
	60-69	10	44.60	38.81	12.27
	70-79	27	67.36	51.41	9.89
	80-89	6	62.36	44.26	18.07
	90-99	3	48.24	28.52	16.46
Vegetables	50-59	2	82.71	4.85	3.43
	60-69	10	82.24	52.81	16.70
	70-79	27	101.47	69.94	13.46
	80-89	6	129.64	163.71	66.83
	90-99	3	172.33	120.61	69.64
Fish, Meat and Eggs	**50-59**	**2**	**42.14**	**43.23**	**30.57**
	60-69	**10**	**53.04**	**43.96**	**13.90**
	70-79	**27**	**56.33**	**39.96**	**7.69**
	80-89	**6**	**80.69**	**32.66**	**13.33**
	90-99	**3**	**247.81**	**209.83**	**121.14**
Nuts and Seeds	50-59	2	55.07	73.84	52.21
	60-69	10	51.56	75.32	23.82
	70-79	27	49.43	48.02	9.24
	80-89	6	51.76	32.60	13.31

	90-99	3	56.62	28.89	16.68
Desserts	50-59	2	87.86	124.25	87.86
	60-69	10	48.39	48.17	15.23
	70-79	27	46.19	44.61	8.59
	80-89	6	80.60	63.91	26.09
	90-99	3	37.33	17.97	10.38

Total Calcium intake	50-59	2	939.57	459.42	324.86
	60-69	10	1005.57	457.49	144.67
	70-79	27	1092.27	437.34	84.17
	80-89	6	1159.90	360.26	147.07
	90-99	3	1341.00	372.41	215.01

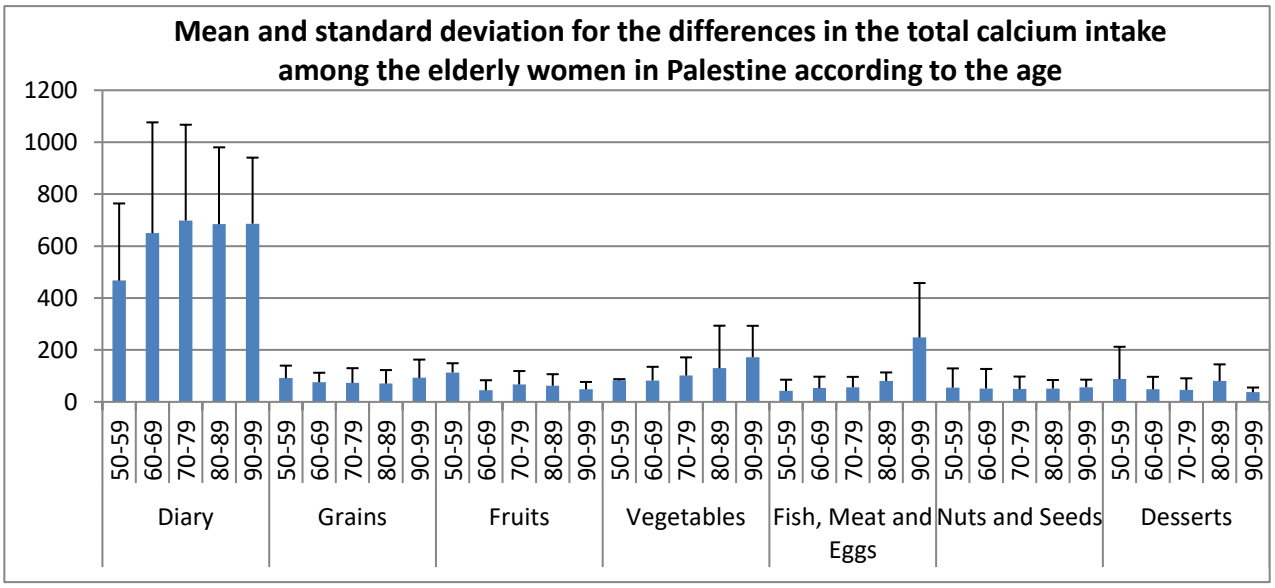

Fig. 5.16: Mean and standard deviation for differences in total Calcium intake among the elderly women in Palestine according to age

Hypotheses #2 C: there are no significant statistical differences at (P≤0.05) in calcium intake among the elderly in Palestine according toAge

The results of one way analysis of variance (ANOVA) test indicate that there are no significant statistical differences at (P≤0.05) in the total calcium intake among the elderly in Palestine according to the age. (P-value >0.05 = 0.605).

Table 5.12: means, Std. Deviation for the differences in the total calcium intake among the elderly in Palestine according to age

Food	Age	N	Mean	Std. Deviation	SEM
Dairy	50-59	2	467.14	296.98	210.00
	60-69	23	644.22	363.99	75.90
	70-79	47	751.82	386.33	56.35
	80-89	18	684.29	309.54	72.96
	90-99	10	712.86	400.30	126.59
Grains	50-59	2	91.29	48.29	36.58
	60-69	23	67.57	31.05	34.14
	70-79	47	71.99	51.10	6.47
	80-89	18	73.49	43.83	7.45
	90-99	10	88.66	59.60	10.33
Fruits	50-59	2	113.36	35.46	18.85
	60-69	23	45.94	34.62	4.63
	70-79	47	62.56	45.72	25.07
	80-89	18	53.37	34.96	7.22
	90-99	10	35.07	32.79	6.67
Vegetables	50-59	2	82.71	4.85	8.24
	60-69	23	94.23	68.89	10.37
	70-79	47	126.13	116.30	4.14
	80-89	18	105.31	110.32	3.43
	90-99	10	81.94	88.16	14.36
Fish, Meat and Eggs	50-59	2	42.14	43.23	16.96
	60-69	23	53.81	36.79	26.00
	70-79	47	69.05	77.26	27.88
	80-89	18	72.06	48.37	10.21

	90-99	10	133.99	145.37	30.57
Nuts and seeds	50-59	2	55.07	73.84	7.67
	60-69	23	70.10	67.84	11.27
	70-79	47	58.91	56.14	11.40
	80-89	18	40.98	41.81	45.97
	90-99	10	80.16	68.91	7.68
Desserts	50-59	2	87.86	124.25	52.21
	60-69	23	51.06	54.46	14.14
	70-79	47	46.60	48.91	8.19
	80-89	18	57.70	50.65	9.86
	90-99	10	30.59	40.61	21.79
Total Calcium intake	50-59	2	939.57	459.42	5.84
	60-69	23	1026.92	386.77	87.86
	70-79	47	1187.05	449.95	11.36
	80-89	18	1087.19	350.21	7.13
	90-99	10	1163.26	565.14	11.94

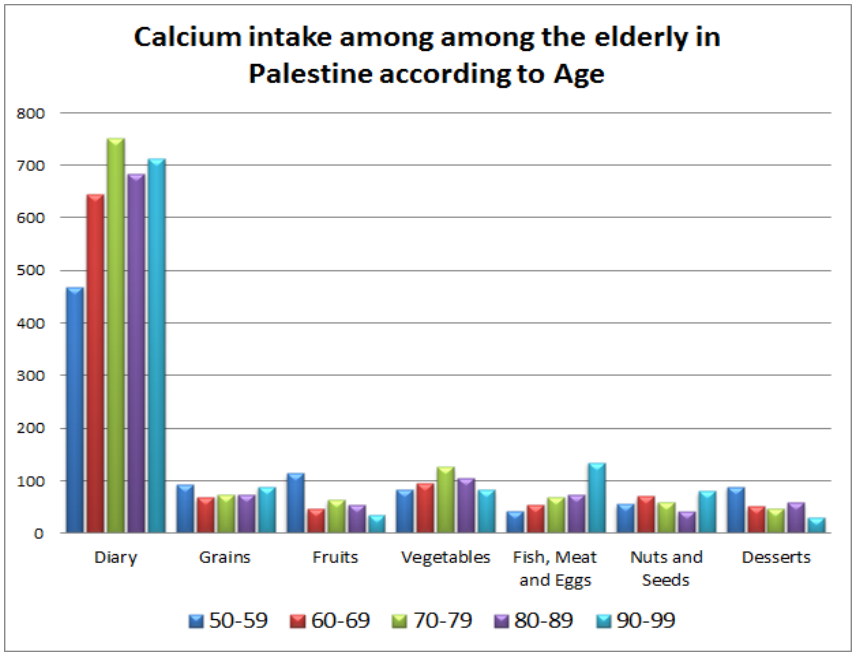

Fig 5.17: Calcium intake of the elderly in Palestine according to age

Hypotheses #2 D: there are significant statistical differences at (P≤0.05) in calcium intake among the elderly in Palestine according to Sun exposure

Table 5.13: Results of (t-test) for the differences in calcium intake among the elderly in Palestine according to the Sun exposure

Food	Sun exposure	N	Mean	Std. Deviation	SEM	P-value
Diary	Low	65	626.13	364.23	45.18	0.003
	Moderate	35	852.41	325.10	54.95	
Grains	Low	65	65.15	40.09	4.97	0.016
	Moderate	35	88.42	53.39	9.02	
Fruits	Low	65	50.05	39.29	4.87	0.081
	Moderate	35	65.19	43.92	7.42	
Vegetables	Low	65	119.21	109.93	13.63	0.209
	Moderate	35	92.20	84.23	14.23	
Fish, Meat and Eggs	Low	65	70.42	72.01	8.93	0.775
	Moderate	35	75.05	86.11	14.55	
Nuts and Seeds	Low	65	61.24	54.66	6.78	0.829
	Moderate	35	58.57	65.48	11.07	
Desserts	Low	65	52.44	56.55	7.01	0.286
	Moderate	35	42.18	38.45	6.49	

Total Calcium intake	Low	65	1044.64	434.35	53.87	0.010
	Moderate	35	1274.02	384.04	64.52	

*SEM = standard error of the mean

The results of t-test indicate that there are significant statistical differences at (P≤0.05) in the total calcium intake among the elderly in Palestine according to Sun exposure. (P-value < 0.05 = 0.010).

The differences were in Diary products, Grains, and the Total Calcium intake.

The differences in Dairy products were for the elderly who are exposed to the sun moderately, by mean of calcium intake equal to 852.41 mg/day ± 54.95 compared to 626.13 mg/day ±45.18forthe elderly who are exposed to the sun at low period of time.

Also, the differences in Grains products were for the elderly who are exposed to the sun moderately, by mean of calcium intake equal to (88.42 mg/day), compared to (65.15 mg/day) for the elderly who are exposed to the sun at low period of time.

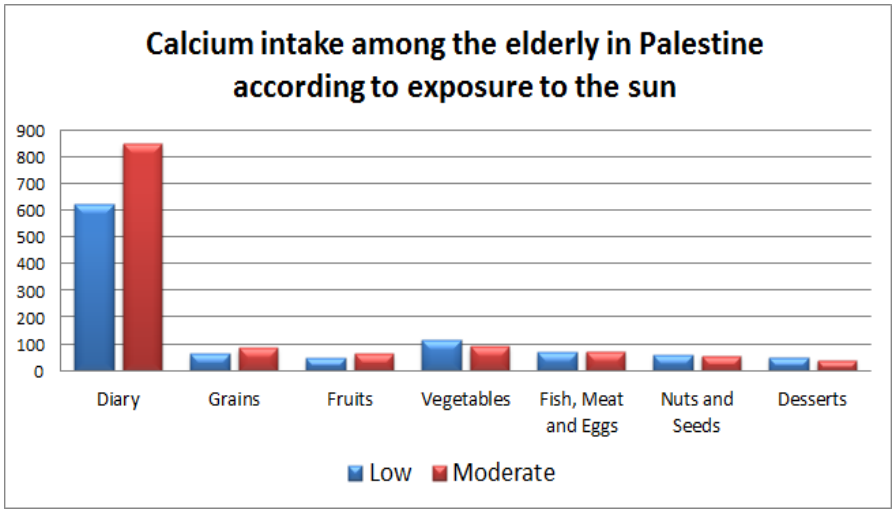

Fig. 5.18: Calcium intake of the elderly in Palestine according to exposure to sun

And in the Total Calcium intake, the differences were for the elderly who are exposed to the sun moderately, by mean of calcium intake equal to (1274.02 mg/day), compared to (1044.64 mg/day) for the elderly who are exposed to the sun at low period of time.

Hypotheses #2 E there are no significant statistical differences at (P≤0.05) in calcium intake among the elderly in Palestine according to medical disease

Table 5.14A: Results of one way analysis of variance (ANOVA) test for the differences in calcium intake among the elderly in Palestine according to the disease

Food		Sum of Squares	df	Mean Square	F	P-value
Diary	Between Groups	178640.958	3	59546.986	0.409	0.747
	Within Groups	9308666.455	64	145447.913		
	Total	9487307.413	67			
Grains	Between Groups	8818.845	3	2939.615	1.176	0.326
	Within Groups	159968.030	64	2499.500		
	Total	168786.875	67			
Fruits	Between Groups	6240.313	3	2080.104	1.299	0.283
	Within Groups	102509.129	64	1601.705		
	Total	108749.441	67			
Vegetables	Between Groups	24753.775	3	8251.258	0.793	0.502
	Within Groups	665760.324	64	10402.505		
	Total	690514.099	67			
Fish, Meat and Eggs	Between Groups	3611.377	3	1203.792	0.186	0.906
	Within Groups	414889.985	64	6482.656		
	Total	418501.362	67			
Nuts and Seeds	Between Groups	8975.474	3	2991.825	0.945	0.424
	Within Groups	202549.012	64	3164.828		
	Total	211524.486	67			
Desserts	Between Groups	1996.395	3	665.465	0.243	0.866
	Within Groups	175306.187	64	2739.159		
	Total	177302.582	67			
Total Calcium intake	Between Groups	372924.503	3	124308.168	0.657	0.582
	Within Groups	12113745.227	64	189277.269		
	Total	12486669.730	67			

The results of one way analysis of variance (ANOVA) test indicate that there are no significant statistical differences at (P≤0.05) in the total calcium intake among the elderly in Palestine according to the disease. (P-value >0.05 = 0.582).

Table 5.14B: means, Std. Deviation for the differences in the total calcium intake among the elderly in Palestine according to the disease

Food	Disease	N	Mean (mg)	Std. Deviation
Dairy	mental illness	3	478.57	325.84
	Diabetes and Hypertension	55	724.55	400.79
	Heart disease	7	742.24	234.11
	Arthritis	3	699.05	215.99
Grains	mental illness	3	82.67	55.78
	Diabetes and Hypertension	55	81.48	52.81
	Heart disease	7	46.24	16.62
	Arthritis	3	58.76	27.47
Fruits	mental illness	3	41.19	22.92
	Diabetes and Hypertension	55	52.30	38.78
	Heart disease	7	77.04	57.47
	Arthritis	3	80.10	14.43
Vegetables	mental illness	3	60.90	23.06
	Diabetes and Hypertension	55	106.70	107.43
	Heart disease	7	83.29	60.94
	Arthritis	3	176.81	98.00
Fish, Meat and Eggs	mental illness	3	55.29	35.29
	Diabetes and Hypertension	55	72.07	86.68
	Heart disease	7	52.88	27.46
	Arthritis	3	53.48	32.56
Nuts and seeds	mental illness	3	21.90	16.86
	Diabetes and Hypertension	55	54.20	55.31
	Heart disease	7	81.45	59.45

		Arthritis	3	72.19	88.20
Desserts		mental illness	3	41.43	15.25
		Diabetes and Hypertension	55	49.46	53.90
		Heart disease	7	54.65	54.56
		Arthritis	3	25.90	7.09
Total Calcium intake	mental illness	3	781.95	315.76	
	Diabetes and Hypertension	55	1140.76	453.72	
	Heart disease	7	1137.80	327.97	
	Arthritis	3	1166.29	275.88	

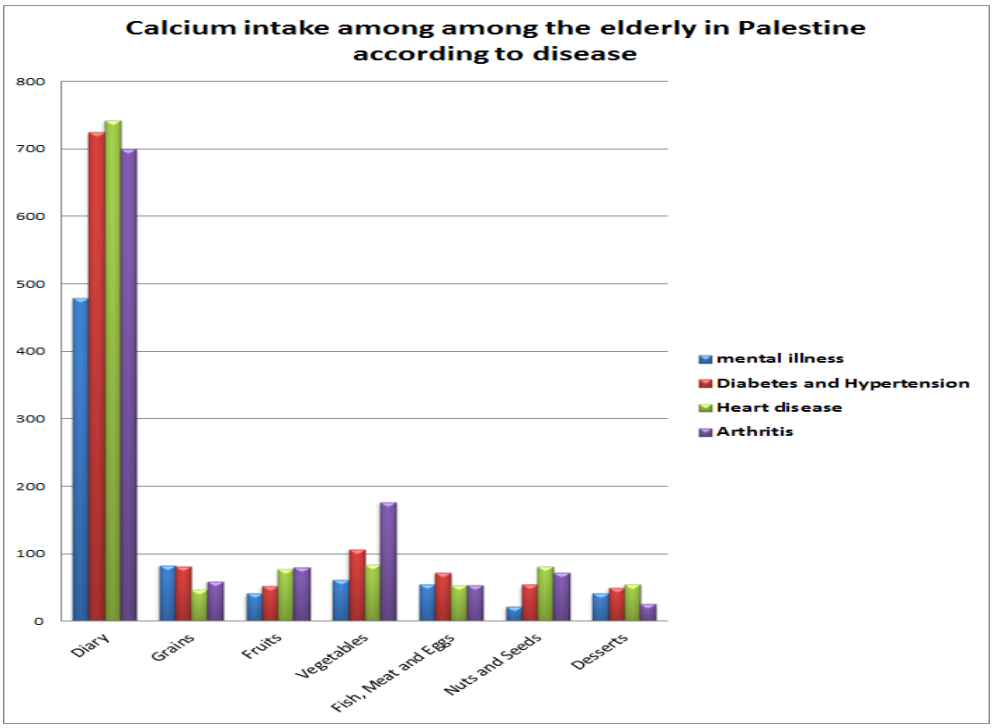

Fig 5.19: Calcium intake of the elderly in Palestine according to disease

5.2. Discussion

The results in (Table # 7) showed that the mean for total daily calcium intake among the total elderly sample in Palestine specifically Ramallah and Bethlehem was 1124.92 mg/day ± 42.98.This is considered within the recommended average. As the RDA (Recommended Dietary Allowance) for elderly men aged 51-70 is 1000 mg/day and the RDA for women aged 51-70 is 1200 mg/day, whereas the RDA for elderly aged 71 and above is 1200 mg/day, regardless of the gender.

There was no significant statistical difference in calcium intake among the elderly between Ramallah and Bethlehem. The mean of total calcium intake for both men and women in Ramallah was 1099.91 mg, while the mean of calcium intake for both genders in Bethlehem was 1148.95 mg/day. Ostensibly, the elderly in Bethlehem had approximately 50 mg of daily calcium intake higher than in Ramallah. But statistically it showed insignificance with a P-value equal to 0.571 (P-value >0.05).

There was a difference in calcium intake among the elderly between Ramallah and Bethlehem in relation with calcium intake from grains and vegetables In Ramallah area, mean calcium intake from grains was equal to 82.6 mg/day compared to 64.36 mg/day in Bethlehem. This showed statistical significance with a P value equal to 0.05 (P-value ≤0.05). This is because the elderly at Ramallah elderly clubs consumed high amounts of grains per week at lunch given in the elderly clubs in combination to high grain intake at their homes.

However, the mean of calcium intake from vegetables for Bethlehem area was 145.58 mg/day compared to 72.47 mg/day for Ramallah area. This also showed statistical significant difference with a P-value equal to 0.000 (P-value≤0.05). This is because elderly consumed calcium rich vegetables in elderly clubs provided at lunch, mainly spinach, beans and cabbage. In addition to the high consumption of calcium rich vegetables like tomatoes, carrots and broccoli at their own homes.

There was no significant difference in calcium intake according to the gender as shown in Table 9. The mean intake of calcium for males was 1155.45 mg/day where the mean intake of calcium for females was 1091.85 mg/day. Ostensibly, males had approximately a 64 mg higher intake of calcium than females, but statistically it showed no significant statistical difference in

total calcium intake among the elderly in Palestine in relation to gender as the P-value which was equal to 0.462 indicated no significance.

Elderly between the ages 70-79 had the highest mean of calcium intake which is equal to 1187.05 mg/day. Elderly between the age categories 50-59 had a mean calcium intake of 939.57 mg/day, but they only make up 2% of the whole sample. Calcium intake of the elderly aged 80 and above was lower than elderly aged 70-79. Also, elderly aged between 60-69 had total calcium intake of 1026.9 mg/day which is significantly lower than elderly aged 70-79. However, the difference was not significant.

Results showed that elderly between the age categories 70-79 had the highest calcium intake from dairy products and vegetables. This proves that this age category is taken care of in terms of calcium rich food consumption at both their homes and elderly clubs, in addition to having the frequent sun exposure. However, elderly aged between 60-69 are at a relatively early age of retirement and appear to care relatively less about calcium rich foods than the 70-79 years age category. Moreover, results showed a low daily calcium intake with aging above 80 years.

As for the relation between calcium intake among the elderly and sun exposure, there was a significant statistical difference in calcium intake in relation to sun exposure with P-value of 0.010 (P-value <0.05) as shown in Table 13. The differences were in Diary products, Grains, and the Total Calcium intake.

Elderly people with moderate sun exposure had 36% more calcium intake from dairy products than those who are exposed mildly to sun light and the difference was statistically significant with a P-value equal to 0.003. Moreover, that elderly with moderate sun exposure had 35% more calcium intake from grainsthan those exposed mildly to sun light and the difference was also significant with a P-value equal to 0.016. There is correlational association between calcium intake and sun exposure.

With regards to total Calcium intake and sun exposure, there was a significant difference with a P value equal to 0.010. Elderly who were exposed to sun moderately had 22% more of the total calcium intake in comparison with those who had mild sun exposure. This can be explained by the fact the healthier elderly people are more able to move and go outside for a walk in the sun compared to bedridden elderly who are unable to eat properly and move. Many studies have shown

the role of Vitamin D from the sunlight in enhancing the absorption of calcium in the gut and maintaining adequate serum calcium and phosphate concentrations. (Nair R, 2012)

Elderly with mental illnesses had a mean of daily calcium intake of 781.95 mg/day. While the elderly with Diabetes and Hypertension, heart disease and Arthritis had a daily calcium intake of 1140.76 mg, 1137.80 mg and 1166.29 mg respectively. 55% of the total sample had Diabetes and hypertension, but their daily calcium intake was adequate and equal to 1140.76 mg/day.

Many of the elderly had Diabetes and high blood pressure and took medications for treatment. Others had food allergies to foods like eggs, milk, lentils and more.

The highest calcium intake was among elderly men at ages 70-79, with a total daily calcium intake of 1315 mg/day. Approximately 38% out of the total elderly men had a daily calcium intake of 1315 mg/day which is higher than the RDA required at this age category (1200 mg/day). This is because they are taken care of in terms of calcium rich food consumption at lunch meals in elderly clubs and their homes. Also, this age category is moderately exposed to the sun light (3 times a week for a period of 20 minutes). Sun light means vitamin D which helps in calcium absorption of the food. However, the difference was not significant p value 0.321.

Many studies showed low calcium intake from food in comparison with the recommended amounts. In a study titled “Profile of Food and Nutrient Intake Among Indonesian Elderly Population and Factors Associated with Energy Intake: a Multi-center Study” (Setiati S,2013) , the average calcium intake of the 387 elderly was equal to 800 mg/day which is below recommended dietary allowances. Also, an Australian study titled “Calcium Intake in Elderly Australian women” showed low calcium intake among elderly women and it was equal to 852 mg/day. (Meng X, 2010)

Similar results were found for elderly women with nostatistical significant relationship between calcium intake and age P-value is equal to 0.772 (P-value>0.05). However, ostensibly, the intake of daily calcium among elderly women was inadequate 1091.85 mg/day as shown in Table 9 in comparison with the recommended dietary allowances which is 1200 mg/day.

It is worth reporting at this point, how calcium intake of the elderly in Palestine compares to similar categories in the studied literature. Table (15) shows a calcium intake comparative summary of other studied groups in the world. (Balk, E. M., 2017)

Table5.15 :Calcium Intake comparative Summary in various regions and countries.

Country	Sample	Calcium Intake	Year
African Americans	56 seniors (Ages 60 or older)	Below the new calcium goals (Dietary Reference Intakes) for the American population	2003
Europe	Elderly people from 19 towns in 10 European countries	• In about one third of the population, the dietary calcium intake was “very low, • Women: 300 - 600 mg/day • Men: 350 - 700 mg/day	2003

Country	Sample	Calcium Intake	Year
Israel	**N=2782 elderly (Age 25-64)**	**492 mg/day**	**2001**
Palestine	**N=149 (Age 31-50)**	**507 mg/day**	**2012**
Palestine	**N= 100 (age 50-99)**	**1124 mg/day**	**2022***
Algeria	**N= 176 (Age 41-66)**	**616 mg/day**	**2009-2010**
Egypt	**N= 1090 (Age 20-60)**	**495 mg/day**	**2004**
Russia	**N= 9098 (Age 45-69)**	**788 mg/day**	**2005**
Japan	**N= 22,712 (Age 18-74)**	**533 mg/day**	**2003-2007**

5.3 Strength of the study

To conclude the discussion, our study is probably the first of its kind that addresses the calcium consumption of the elderly category between 50 to above 90 years of age. The shown age categories in the table are a mix between adults and elderly with no account to those above 70 years of age. It further provides realistic data for government and elderly homes/clubs about the level of balance and suffiency in providing calcium rich food to their elderly. The mobile

application of the studied methodology in calculating the calcium intake level is a third added strength to our study due to its flexibility, speed of calculation and potential to extend the application to the young and adult categories. Further, thegenerated reports, by the application, help keep track of the elderly calcium intake and gives advice on how to reach the recommended daily calcium intake by suggesting food items and by showing the remaining calcium intake.

On a different front, there are limitations in our study in that our population sample was restricted to only two locations; Ramallah and Bethlehem and more specifically to six elderly houses, with a sample of 100 subjects. The study could provide a vital basis to future studies that would incorporate other elderly homes in various other cities in Palestine. The sample could even be expanded to study the status of calcium consumption of the elderly sector in the country.

CHAPTER SIX

Conclusion and Recommendations & Future Work

In this chapter, the researcher gives a conclusion regarding the daily calcium intake of the elderly based on the results. Also, the researcher gives recommendations that should be taken into consideration regarding this subject matter. These are also suggested future works.

6.1. Conclusion

Elderly clubs in Ramallah and Bethlehem do provide sufficient amounts of calcium rich food to the elderly mainly in the daily lunch dish which included a variety of calcium rich foods like spinach, green beans, chicken, rice, meat, yogurt, cheese and more. The mean intake of calcium among elderly in both regions regardless of the gender was 1124 mg/day. The intake of calcium rich foods was from both the elderly clubs and their own homes. This is considered within the recommended daily amount calcium intake for the general elderly population. This contradicts previous studies that showed that elderly calcium intake is deficient and does not meet the recommended dietary allowances.

As far as age category related to gender, the results ostensibly show that calcium intake is higher for men than women. Elderly men apparently consume more dairy than elderly women for all ages. Compared figures for both genders are shown in Fig. 5.12.

The research study also showed a significant association of calcium intake with sun exposure.

Filling out questionnaires with the elderly at elderly homes/ clubs was not a straight forward and easy task. Some, at the elderly homes, were with severe cases like Alzheimer's disease, brain strokes, depression and psychological issues elderly people who were capable to communicate, remember and interact. The elderly weren't able to fill in the questionnaire by themselves, as the researcher had to sit with each and every one of the hundred elderly in both Ramallah and Bethlehem. The majority of them were illiterate and some had problems in hearing. Others, who could write, had various diseases and did not feel like writing.

Therefore, the development of a calcium intake mobile application would be an easier and faster approach for both the dietician as well as the interviewee (the elderly) who were not able to

fill out the questionnaire. The elderly demographics, consumed calcium rich foods can be easily filled in and the application automatically calculates the weekly and daily calcium intake. This will save time and effort rather than doing it manually.

The suggestions and generated reports help keep track of the elderly calcium intake and gives advice on how to reach the recommended daily calcium intake by suggesting food items and by showing the remaining calcium intake. This will help elderly clubs and the elderly themselves to keep track of their calcium intake and the generated reports can be considered as a record for them to make sure they are reaching the RDA and therefore get adequate daily and weekly calcium intake.

6.2. Recommendations

Elderly at Elderly clubs in Bethlehem should increase their intake of calcium from calcium rich foods other than vegetables. While elderly at elderly clubs in Ramallah should increase calcium intake from foods other than grains. Nutrition is about the quality, variety and quantity of food.

The majority of the elderly had low sun exposure. Elderly men and women should increase their exposure to sun light. Vitamin D from the sunlight aids in calcium absorption and also contributes to a higher calcium intake from food. 65 % of the total elderly sample had mild sun expose (meaning less than 3 times a week for a period of 20 minutes).

Elderly women should increase their total calcium intake to reach the RDA of 1200 mg/day as the total calcium intake of elderly was 1091.85 mg/day. This can be accomplished by increasing the intake of calcium rich foods like dairy products, fruits, vegetables, grains, nuts and seeds and meat products including red meat, chicken and fish. Exercising moderately can help in maintaining strong bones as we grow older. Exercise works on bones much like it works on muscles.

Elderly men aged 80-89 and 90-99 should increase their calcium intakes from fruits, vegetables, grains, meat, fish and eggs. As these food products contributed the least out of the total daily calcium intakes as shown in Table 10 B. This led to a lower total calcium intake than the RDA (1200 mg/day). As a result the total calcium intake for elderly men aged 80-89 and 90-99 were 1050.83 mg/day and 1087.08 mg/day respectively.

Previous results in Table 12, showed optimum calcium intake among the total elderly sample at age category 70-79 regardless of the gender. The total calcium intake was 1187.05 mg/day. Other age categories had lower calcium intakes from foods. It is recommended that elderly aged 60-69 and 80-89 should increase their calcium intakes. As the age 60 is a critical age where aging starts in addition to that bone density and bone mineralization decreases. Elderly at this stage of life become prone to bone fractures and osteoporosis. Also elderly aged between 80-89 should increase their calcium intake to 1200 mg/day instead of having a total daily calcium intake of 1087.19 mg/day. Aging requires more calcium intakes from food. The older people become, the more prone they are to bone fractures and the more calcium is required to meet RDA.

Calcium intake becomes an important aspect in disease prevention. Studies have shown calcium's contribution in disease prevention. It has been shown in controlled trials to lower the risk of osteoporotic fractures, kidney stones, obesity, and hypertension. (Heaney RP., 2006)

6.3 Future Work

As far as future work, in regard to RazanCalciumCalc application, it can be developed so that it includes calculations of other nutrients other than calcium such as: Calories, carbohydtates, protein, fat…etc. Also, younger age categories can be added in addition to elderly like adolescents, adults, pregnant women, athletes. This will make it more beneficial and comprehensive as it would includes all the community.

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Appendices

Appendix A

Questionnaire
Dietary Calcium Intake among the Elderly

English Version

Dear Citizen,
This questionnaire is prepared for the purpose of a research study within a master's degree in health informatics. The questionnaire aims to measure the extent of calcium-rich food intake among the elderly in clubs and homes for the elderly located in Ramallah and Bethlehem. Filling out the questionnaire takes only a few minutes. Please read the questions carefully and answer them objectively, knowing that the answers will be treated confidentially and will only be used for research purposes.

Name of elderly institute: _____

City/town: _____

Number of Elderly people: _____

Gender:

M		F	

AgeCategory:

50-59	60-69	70-79	80-89	≥90

Mobility:

Independent	Cane	Walker	Wheelchair	In bed

Sun exposure:

Adequate	Non-adequate

Adequacy: 15-20 minutes a day, 3 times a week

Chronic diseases: _____

Food Allergies: _____

Medications: _____

Vitamins: _____

Questionnaire
Dietary Calcium Intake among the elderly

Foods	Total per week	Multiplied by	Total mg calcium	
Dairy				
Milk, 1 cup		300mg		
Yogurt, 1 cup		450mg		
Labneh,2tbsp		180 mg		
Yellow cheese, 1 slice		200mg		
White cheese, 1 slice		250mg		
Grains				
White bread, 60 g(one slice)		52mg		
Whole-wheat bread, 60 g(one slice)		10mg		
Rice, 1 cup cooked		16mg		
Lentils, 1 cup cooked		40mg		
Macaroni, 1 cup cooked		10mg		
Fruits				
Orange, 1 fruit		52mg		
Orange Juice, 1 cup		27mg		
Apple, 1 medium		11mg		
Banana, 1 medium		6 mg		
Apricot Jam, 2 tbsp		8 mg		

Dates, 3 pieces		45 mg		
Vegetables				
Spinach, 1 c cooked		240 mg		
Carrots, 1 medium		36mg		
Tomatoes, 1 medium		12mg		
Broccoli, 1 c cooked		180 mg		
Cabbage, 1 c cooked		32mg		
Green Beans, 1 c cooked		55mg		
Fish, Meat and Eggs				
Egg, 50 g(1 egg)		27mg		
Chicken, 120 g (one piece)		17mg		
Red meat, 120 g(one piece)		7mg		
Sardine, 3oz(1 can)		370mg		
Salmon, 140 g(1 fillet cooked)		17mg		
Tuna, canned, 120 g (1 can)		34mg		
Dennis fish, grilled,120 g(one piece)		20 mg		
Food	**Total per week**	**Multiplied by**	**Total calcium (mg)**	
Nuts and seeds				

Almonds, 30 g (20 pieces)		75mg		
Walnuts, 30 g (10 pieces)		28mg		
Hazelnuts, 30 g (20 pieces)		56mg		
Peanuts, 30 g(28 pieces)		26mg		
Sesame Tahini, 1 Tbsp		64mg		
Halva, 30 g (2 tbsp)		10mg		
Desserts				
Custard made with milk,120 g (0.5 c)		111mg		
Cheese cake,80 g, (1 piece)		41mg		
Ice cream,vanilla,100 g(0.5 c)		124 mg		
Rice pudding,200 g (app. 1 c)		210mg		
		TOTAL per week		
		Divide by 7		
		for daily intake		

Appendix B

Arabic Version

استبيان حول مدى تناول الاغذية الغنية بالكالسيوم لدى المسنين

أخي المواطن/أختي المواطنة

هذا الاستبيان معد لغرض دراسة بحثية ضمن درجة الماجستير في المعلوماتية الصحية، يهدف الاستبيان الى قياس مدى تناول الاغذية الغنية بالكالسيوم لدى المسنين في نوادي و بيوت المسنين الموجودة في رام اللة و بيت لحم.
تعبئة الأستبيان تستغرق بضعة دقائق فقط، أرجو قراءة الاسئلة بدقة والإجابة عليها بموضوعية علماً بأن الأجوبة سوف تعامل بسرية تامة ولن يتم استخدامها إلا لأغراض البحث.

لك جزيل الشكر والعرفان

.رزان أسامة عطا

اسم المؤسسة (بيت/نادي المسنين):----------

اسم المدينة/البلدة:----------

عدد المسنين في المؤسسة:----------

الجنس

ذكر	انثى

الفئة العمرية:

50-59	60-69	70-79	80-89	90 ≥

امكانية التنقل:

مستقل	عكازة	مشاية	كرسي متحرك	في السرير

مدى التعرض للشمس:

كافي	غير كافي

معنى كافي: 15-20 دقيقة في اليوم, 3 مرات في الاسبوع

امراض مزمنة:----------

حساسيات لاغذية معينة: ----------

اسماء الادوية المتناولة:----------

نوع الفيتامين المتناول(ان وجد):----------

استبيان حول مدى تناول الاغذية الغنية بالكالسيوم لدى المسنين

أرجو تعبئة الخانة الثانية "الكمية المتناولة في الاسبوع" فقط.

الاغذية	الكمية المتناولة في الاسبوع	مضروب ب	مجموع كميات الكالسيوم في الاغذية (ملغم)
الالبان			
حليب, كأس واحد		ملغم300	
لبن, كأس واحد		ملغم 450	
لبنة, ملعقتين		ملغم 180	
جبنة صفراء, شريحة واحدة		ملغم 200	
جبنة بيضاء, شريحة واحدة		ملغم 250	
الحبيبات			
خبز أبيض, 60 غم, شريحة واحدة		ملغم 52	
خبز اسمر, 60 غم, شريحة واحدة		ملغم 10	
أرز, كأس واحد, مطبوخ		ملغم 16	
عدس, كأس واحد, مطبوخ		ملغم 40	
معكرونة, كأس واحد, مطبوخ		ملغم 10	
الفواكة			
برتقال, واحدة متوسطة		ملغم 52	
عصير برتقال, كأس واحد		ملغم 27	
تفاح, واحدة متوسطة		ملغم 11	
موز, واحدة متوسطة		ملغم 6	

مربى مشمش, ملعقتين		ملغم 8	
تمر, 3 حبات		ملغم 45	
خضراوات			
سبانخ, كأس واحد مطبوخ		ملغم 240	
جزر, واحدة متوسطة		ملغم 36	
بندورة, واحدة متوسطة		ملغم 12	
بروكلي, كأس واحد مطبوخ		ملغم 180	
ملفوف, كأس واحد مطبوخ		ملغم 32	
فاصولياء خضراء, كأس واحد مطبوخ		ملغم 55	
أسمك,لحوم و بيض			
بيض, 50 غم (بيضة واحدة)		ملغم 27	
دجاج, 120 غم (قطعة واحدة)		ملغم 17	
لحوم حمراء, 120 غم(قطعة واحدة)		ملغم 7	
ساردين ,3 اوقية, (علبة واحدة)		ملغم 370	
سالمون, 140 غم (قطعة فيليه واحدة)		ملغم 17	
تونا, 120 غم(علبة واحدة)		ملغم 34	
سمك دينيس , مشوي,120 غم(قطعة واحدة)		ملغم 20	
الاغذية	**الكمية المتناولة في الاسبوع**	**مضروب ب**	**مجموع كميات الكالسيوم في الاغذية (ملغم)**
المكسرات والبذور			
لوز, 30 غم(20 حبة)		ملغم 75	
جوز,30 غم(10 حبات)		ملغم 28	
بندق ,30 غم(20 حبة)		ملغم 56	
فستق,30 غم(28 حبة)		ملغم 26	

طحينية, ملعقة كبيرة		ملغم 64	
حلاوة, 30 غم, ملعقتين كبيرتين		ملغم 10	
الحلويات			
كسترد بالحليب, 120 غم,(نصف كأس)		ملغم 111	
تشيز كيك,80 غم (قطعة واحدة)		ملغم 41	
بوظة فانيلا, 100 غم(نصف كأس)		ملغم 124	
أرز مع حليب,200 غم(كأس واحد تقريبا)		ملغم 210	
		كمية الكالسيوم في الاطعمة المتناولة اسبوعيا	
		قسمة على 7	
		كمية الكالسيوم المتناولة في اليوم	

Appendix C

Arab American University
Ramallah Site

الجامعـــة العربيـــة الأمريكيـــة
موقع رام الله

March 29th, 2022

To Whom It May Concern

The Faculty of Graduate Studies at Arab American University certifies that ***Ms. Razan Osama Wade' Ata*** holding a student No. of **(202012282)** is a student in the master program of Health Informatics. Ms. Ata is conducting her master thesis entitled:
" Assessment of Calcium intake among a Palestinian elderly population: Development of a Calcium intake mobile application". under the supervisor of Dr. Yousef Mimi, Joint with Dr. Dr. Halal Allabadi, for your kind actions to help her to obtain the necessary information for the study, noting that the information will be used for the purpose of research only and will be dealt with the utmost confidentiality.

This certificate was given upon her request.

Dean of Graduate Studies
Dr. Nouar Qutob

كلية الدراسات العليا
FACULTY OF GRADUATE STUDIES

Appendix D

Informed Consent Form

Title: Assessment of Calcium Intake among a Palestinian Elderly Population: Development of a Calcium Intake Mobile Application.

Investigator: Razan O. Ata, MSc Graduate Student

Arab American University AAUP

Department of Health Science

AlRehan Neighborhood Ramallah

022941999

Description: The study will investigate calcium intake among the elderly in Palestine specifically in Ramallah and Bethlehem. You will be assigned to complete a questionnaire on calcium intake. It consists of question on calcium intake from various food groups whether it's grains, meat, dairy, fruits, vegetables and desserts. In addition to questions on medication intake, supplements intake, chronic disease, sun exposure and more.

Risks and benefits: The benefits includes contributing to the knowledge of the elderly on the importance of calcium intake through campaigns and therefore help in preventing correlated diseases such as osteoporosis. There are no anticipated risks to participating in this study.

Voluntary Participation: Your participation in this research is completely voluntary. There are no payments or compensation to those participating in the study.

Confidentiality: All information will be recorded anonymously. Only the researcher will know your name and will not identify your answers to anyone. All information will be held in the strictest of confidence. Results from the research will be reported as aggregate data.

Right to withdraw: You are free to refuse to participate in the research and withdraw from this study at any time.Your decision to withdraw will result in no penalty to you.

Informed Consent: I, ---------- have read the description, including the purpose of the study, the procedures to be used, the potential risks and side effects, the confidentiality, as well as the option to withdraw from the study at any time. Each of these items have been explained to me by the investigator. The investigator has answered all my questions regarding the study, and I believe I understand what is involved. My signature below indicates

that I freely agree to participate in this study and that I have received a copy of this agreement by the investigator.

---------- ----------

Signature Date

Research Study Representative

---------- ----------

Signature Date

Appendix E

FacultyResearcher

HUMAN SUBJECTS PROTOCOL Approval Form

1 Title of Research: Calcium Nutrition and bone health among the elderly in Palestine

2. Principal Investigator: Razan Ata, MSc Student AAUP

3. Department: Health Science Dept. campus Ext: 0 2 2 9 4 1 9 9 9
Email: razan.ata94@gmail.com Mobile: 0592820904

4. Co-Investigators: Name and University (if applicable):
1. Laila A., BZU [X] Student [ ] Faculty
2. _____ [ ] Student [ ] Faculty

5. Recruitment/Data Collection Start Date: 1/7/2022 End Date: 29/07/2022

6. Check one [X] Unfunded [ ] Funded
Name of Funding Source:-N/A Submission Date: 1/8/2021

7. History of Protocol: [X] New [ ] Continuing (Previous Approval Date_____)

8. Existing Data: Will this study involve the use of existing data or specimens? YES [ ] NO [X]
If Yes, attach documentation indicating authorization to access the data

9. Subjects to be recruited (check all that apply): specify in Section 2.
a. [ ] Adults (18+ years)
b. [ ] Minors, specify age:
c. [ ] Cognitively or emotionally impaired
d. [ ] UNI students
e. [/] Other, specify: elderly 51-99 years
f. [ ] Existing data

10. Data will include (check all that apply): specify all checked items in the Project Information Form.
a. [ ] Names of people
b. [ ] Email address
c. [ ] Street address
d. [ ] Phone numbers
e. [/] Age
f. [/] Gender
g. [ ] Ethnicity
h. [ ] Marital status
i. [ ] Income
j. [ ] Social security
k. [ ] Job title
l. [ ] Names/types of employers
m. [ ] Physical health report
n. [ ] Other, specify: height, weight

11. Will subjects be identified by a coding system (i.e., other than by name)? [ ] YES [X] NO

12. Is compensation offered? [ ] YES [X] NO
If yes, describe (e.g., gift cert., cash, research credit): _____

13. Projected number of subjects: 100

14. Method of recruiting subjects . Word of mouth

15. Will there be any deception (not telling subjects what is being tested)? [ ] YES [X] NO

16. Potential Risk Exposure: [ ] Physical [ ] Psychological [ ] Economic [ ] Legal [ ] Social
[X] No anticipated risks

17. Data Collection Instruments (check all that apply)
    - a. [ ] Standardized tests
    - b [/] Questionnaire
    - c. [ ] Interview
    - d. [ ] Existing data
    - e. [ ] Other, specify: Motion analysis

18. Recorded by (check all that apply)
    - a. [ ] Written notes
    - b. [ ] Audio tape
    - c. [ ] Video tape/film
    - d. [ ] Photography
    - e. [ ] Observation
    - f. [ ] Existing data

19. Administered by (check all that apply)
    - a. [/] In person
    - b. [ ] (group/individual)
    - c. [ ] Telephone
    - d. Text
    - e. [ ] message
    - f. [ ] Email/websit
    - g. [ ] eMail

    Existing data

    Other, specify: _____

20. Findings used for (check all that apply)
    - a. [ ] Publication/presentation
    - b. [ ] Evaluation
    - c. [ ] Needs assessment
    - d. [ ] Thesis/dissertation
    - e. [ ] Other, specify: _____

21. Are drugs or radioactive materials used in this study? [ ] YES [X] NO
    If yes, list the drugs or radioactive materials and provide a detailed description of each, with justification for its use.

22. Are any medical devices or other equipment to be used in this study? [ ] YES [X] No
    If yes, describe in detail the medical devices or equipment to be used in Section 2.

23. Did you attach a copy of any questionnaire(s), survey instrument(s) and/or interview schedule(s) referred to in this protocol? [X] YES [ ] NO

24. Is a letter of permission for subject recruitment attached?
    [X] Yes [ ] No

25. Does your research require international travel? [ ] YES [X] NO
    If yes, your travel must be approved by the Office of Insurance and Risk Management.

26. SIGNATURE:
    Your signature on this Protocol Approval Form indicates that *You are familiar with the regulations for human subject research as defined by Standing Advisory Committee for Protection of Human Subjects (SACPHS) and you intend to follow those regulations when conducting this study.*

Ramon Ata 1/7/2022

_____

Signature of Faculty Researcher Date

Appendix F

SPSS as an efficient tool for data analysis

SPSS (Statistical Package for the Social Sciences), usually referred to as IBM SPSS Statistics, is a statistical data analysis software package.SPSS is commonly used in healthcare, marketing and education research.

For data entry in SPSS, the user should be aware of data types.

There are two basic data types, each with two sub-types (Field, A. , 2013)

– Numerical: expressed by numbers

■ Discrete: numbers take on integer values only (number of children, number of siblings)

■ Continuous: numbers can take on decimal values (height, weight) – Categorical: expressed by categories (also known as factors/groups)

■ Nominal: no meaningful order between categories (gender, occupation)

■ Ordinal: categories can be put in meaningful order (agreement, level of pain, etc.)

■ If data is not used for analysis, it can be labeled as a nuisance or bookkeeping variable

We utilize two sorts of variables in statistical tests:

-**Independent Variable** — variation that is unrelated to another variable. X is usually used to symbolize what the researcher has set up (treatment, group, etc.)

- **Dependent Variable** – a variable whose value is determined by another variable (the independent one) Y is the variable that the researcher is interested in as an output or outcome.

Almost all statistical tests provide three key pieces of information ;Statistical test Degrees of Freedom is a variable generated from sample data and used in hypothesis testing to determine if a test was significant or not. The maximum number of different values of a quantity that can be assigned to a statistical distribution.P-value should be reported with test findings The cutoff for 0.05 is usually used as a measure of significance for the test statistic.

There are two ways to enter data into SPSS

– Manually (entering the data by hand)

– Loading in a file (data is saved in some form and can be opened in SPSS)

The data can be seen in two ways

– Variable View

– Data View

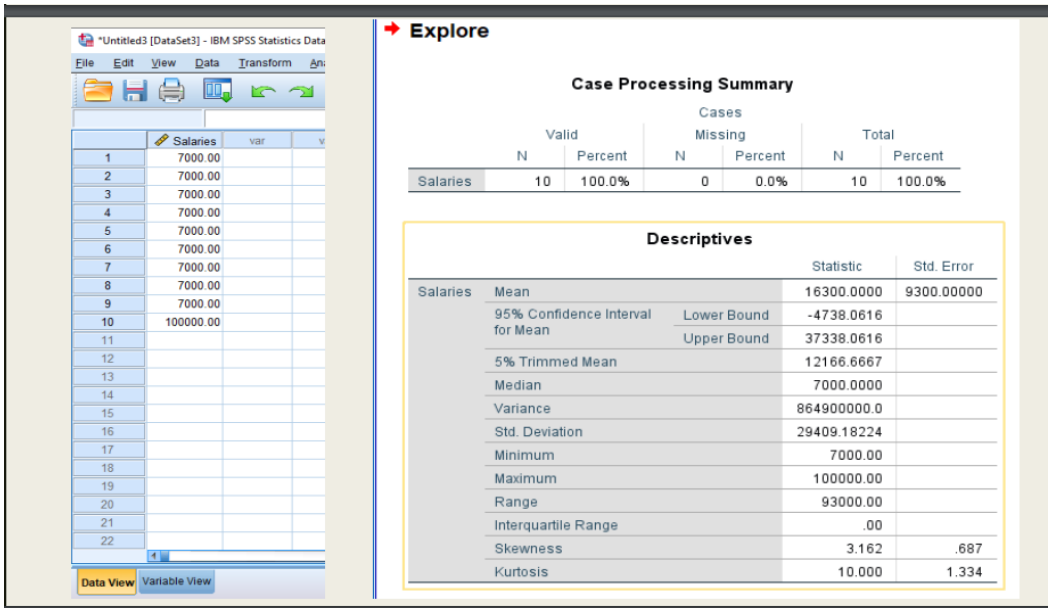
Using descriptive statistics [Williamson. 20..]

■ It is hard to read out the various descriptive statistics from graphs

■ Instead, we can calculate them and spit out numbers in tables: such as medium, mean, interquartile range, and, standard deviation

■ Measures of central tendency, or 'average: – Mean: all values are summed and divided by the number of values – Median: middle value – Mode: the most common value

■ Measures of spread: – Interquartile range – Standard Deviation

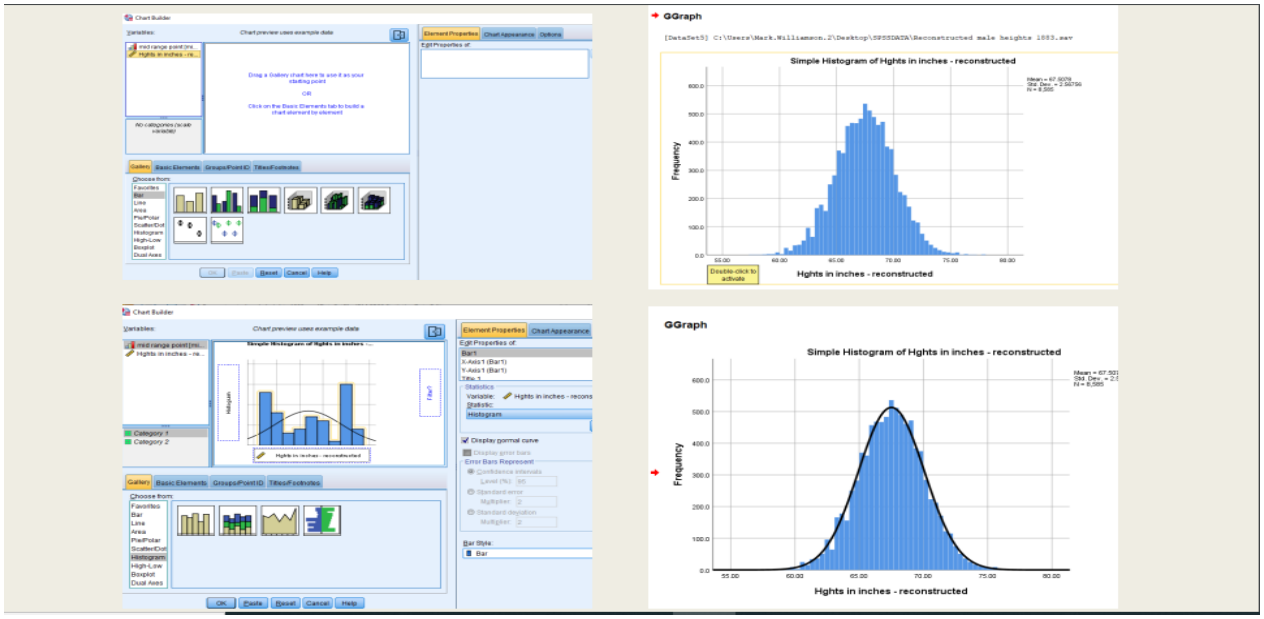


Types of Graphs used in SPSS

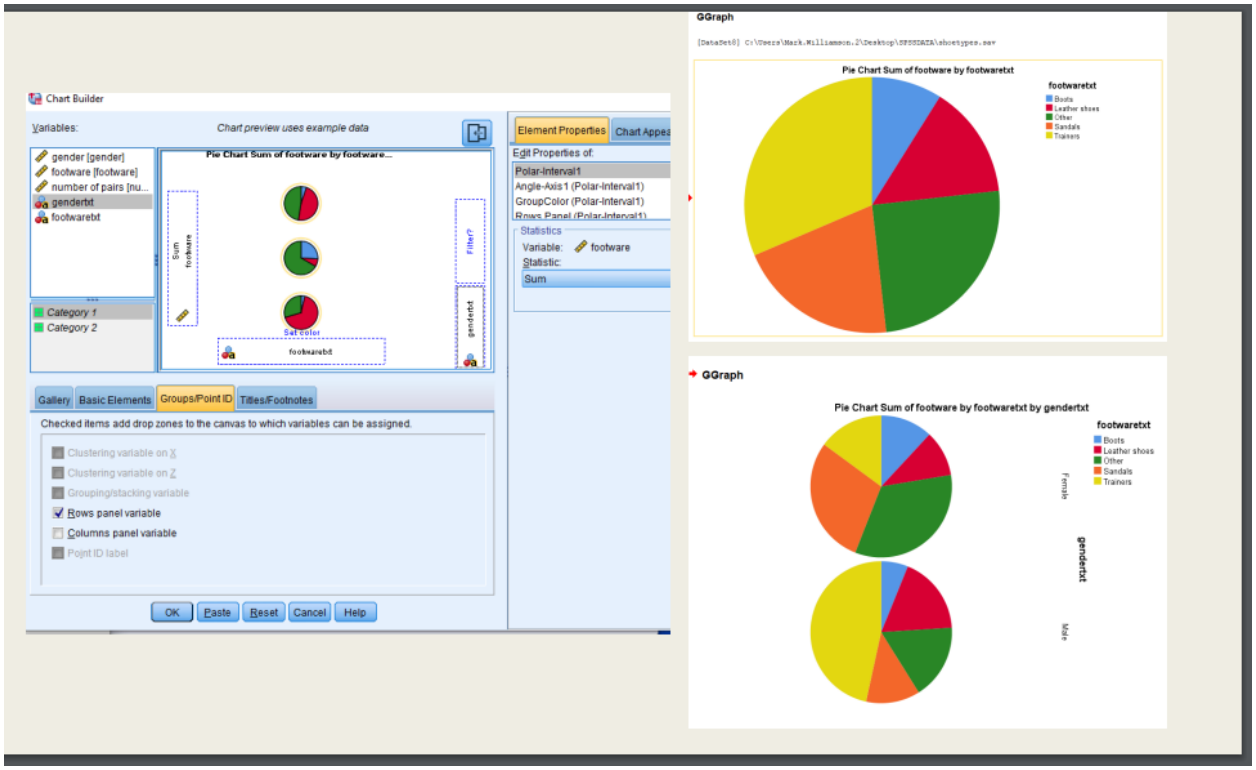
Types of Graphs to be covered

Type of Graph	Data Type	Usage	Basic Example	Another Example
Histogram	Single numerical variable	Data exploration (determining normality)	*Heights of freshman students*	*Tooth number of apex-predator dinosaurs*
Boxplot	Single numerical variable; single numerical variable + categorical variable	Data exploration, presenting non-parametric t-tests/ANOVA	*Heights of freshman students; Heights of students by grade*	*Weights of apex-predator dinosaurs; Weight of apex-predator dinosaurs by geological period*
Bar Chart	Single numerical variable + categorical variable	Presenting Parametric T-test/ANOVA results	*Heights of students by grade*	*Tooth number of sharks by species*
Scatterplot	Two numerical variables	Data exploration, presenting correlation results	*Heights and weights of students*	*Weights and top swimming speed of sharks*
Line Charts	Two numerical variables (one usually time)	Data exploration	*Heart rate over time*	*Ounces of coffee drank by students over time*
Multiple Line Charts	Three or more numerical variable (one usually time, rest on same scale)	Data exploration	*Various concentrations of nutrients in bloodstream over time*	*Ounces of various caffeinated beverage drank by students over time*
Pie graph	Single numerical variable (proportions) + categorical variable	Data exploration	*Percentage of students across grades*	*Percentage of different caffeinated beverages drank in a month*

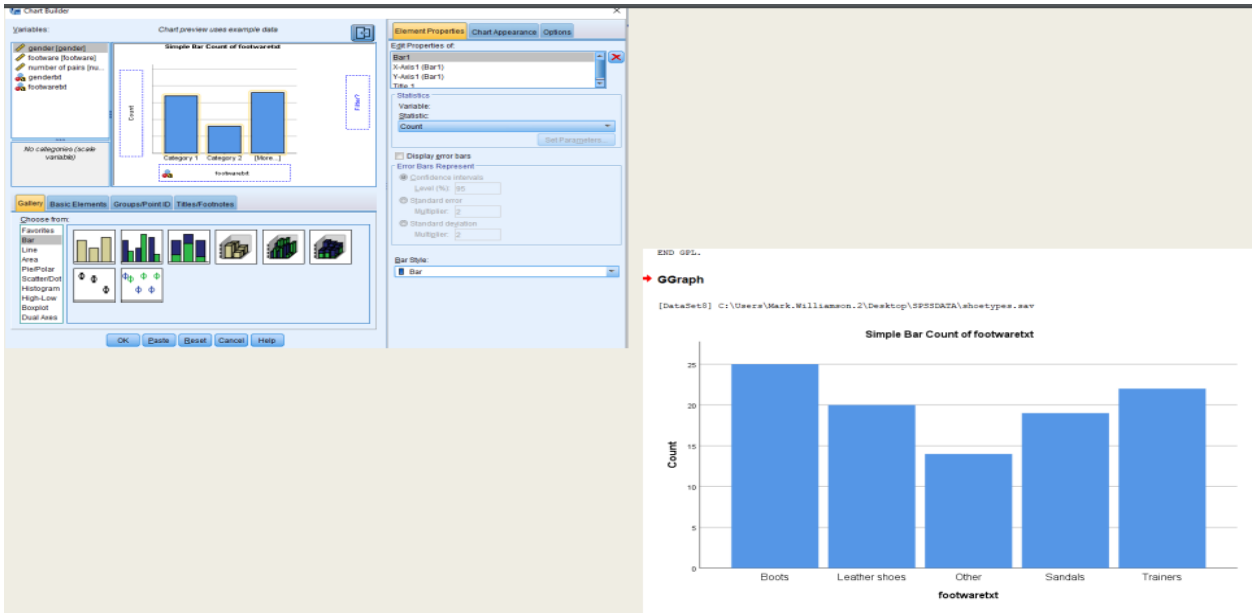
How to apply graphic on SPSS



Pie charts are ideal for showing proportions and summarizing data , they can be made using raw data or pre-aggregated data



Bar charts are for non-continuous data e.g. the number of people from each of five towns, the bars do not touch. Bar charts should be labeled clearly and the units of measure displayed. Bar charts and Histograms look similar, however the type of data they should be used on is different.



ملخص

يتناول العمل البحثي التغذية بالكالسيوم وصحة العظام لدى كبار السن (الأعمار 51-99) في فلسطين، وتحديداً أولئك الذين يعيشون في دور المسنين والذين يترددون على نوادي المسنين الموجودة في رام الله وبيت لحم. يعتبر كبار السن جزءًا مهمًا من المجتمع، ومن المهم حقًا التركيز على هذه الفئة من المجتمع لأنهم أكثر عرضة للأمراض المزمنة بما في ذلك الأمراض المرتبطة بالكالسيوم مثل هشاشة العظام وكسور العظام ونقص فيتامين "د" وعدم تحمل اللاكتوز. إن كبار السن معرضون لخطر الإصابة بنقص الكالسيوم لأسباب عديدة مثل انخفاض تناول الكالسيوم مع التقدم في السن، والتفاعلات الدوائية التي قد تقلل من امتصاص الكالسيوم الغذائي والأمراض المزمنة لهشاشة العظام والتي تتعارض مع قوة العظام وتكوينها. تعتمد الدراسة البحثية على عينة من كبار السن ذات طبيعة طبقية وعشوائية. تم أخذ العينات الطبقية على أساس المنطقة والجنس، وعدا ذلك فهي عشوائية بطبيعتها. يتاح نتيجة ذلك إجراء مقارنة عادلة في المنطقة والجنس لكبار السن في رام الله وبيت لحم ، وكذلك بين الذكور والإناث. سيتم تقدير حالة الكالسيوم من خلال كمية الكالسيوم التي تحتوي على الأطعمة التي يستهلكها كبار السن، والتي توجد بشكل أساسي في منتجات الألبان مثل الحليب واللبن وغيرها من الأطعمة مثل اللوز والبروكلي والسردين . أما مخصصات الحمية الموصى بها (RDA)فهي 1200مغم / اليوم للإناث المسنات و 1000 مغم / اليوم للذكور المسنين الذين تتراوح أعمارهم بين 50-71 عامًا. أما فوق تلك الفئة العمرية ، فتبلغ 1200 مغم / اليوم لكلا الجنسين. ستركز الدراسة أيضًا على الحواجز التي يواجهها كبار السن والتي تمنعهم من تناول الكالسيوم الكافي.

أمانتيجة الدراسة فتظهر مدى كفاية تناول الكالسيوم بين كبار السن، بشكل أساسي من الغذاء، و مقارنة النتائج مع الدراسات الأخرى التي أجريت على تناول الكالسيوم وفئات المسنين الأخرى في الأجزاء الإقليمية والعالمية من العالم. من المأمول أن يرتفع الوعي بين كبار السن لمنع عواقب الأعراض غير المعالجة لنقص كالسيوم الدم مثل التنميل في الأصابع ، وتشنجات العضلات ، وضعف الشهية ، وإيقاعات القلب غير الطبيعية والتي إذا تركت دون علاج فقد تكون قاتلة.

تم تطوير تطبيق على الهاتف المحمول لحساب كمية الكالسيوم التي يتم تناولها ، وهو نهج أسرع سيساعد أخصائيي التغذية على تقييم الكالسيوم بين مختلف فئات المجتمع وخاصة كبار السن.