

Consumption of Nutritional Supplements in Older Adults Sabaneta, Antioquia, 2021

Deossa-R GC^{1*}, Duque S², Mejía Y², Ortiz L² and Portillo M²

¹Dietitian Nutritionist, Specialist and Master in Human Nutrition, Professor at the School of Nutrition and Dietetics, University of Antioquia, Antioquia

²Undergraduate Students, School of Nutrition and Dietetics, University of Antioquia, Antioquia

***Corresponding Author:** Deossa-R GC, Dietitian Nutritionist, Specialist and Master in Human Nutrition, Professor at the School of Nutrition and Dietetics, University of Antioquia, Antioquia.

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Abstract

Objective: to characterize the use of nutritional supplements, according to qualitative and quantitative consumption of food groups in older adults of the "Club del Adulto Mayor" of the municipality of Sabaneta, Antioquia.

Materials and Methods: A structured survey was applied, which investigated sociodemographic, socioeconomic, health and morbidity variables, consumption of nutritional supplements and food, through a questionnaire of frequency of consumption, based on food-based dietary guidelines for the Colombian population; nutritional status was evaluated by means of mini nutritional assessment (MNA). The information was analyzed by means of graphs generated by the "google forms" tool and was stored and processed in the Microsoft Excel 2016 program.

Results: Participated 17 elderly; 47.1% presented a risk of malnutrition and 52.9% a normal nutritional status due to MNA 82.4% of older adults consumed nutritional supplements, which were recommended by relatives in 46.6%; however, in terms of food consumption, none of the participants managed to comply with the consumption recommendation for the 7 food groups analyzed.

Conclusion: No participant managed to meet 90% of the daily recommendations for consumption of food groups, however most of the participants reported nutritional supplements. Therefore, it is necessary to propose immediate actions with educational processes aimed at the selection of the different food groups, as well as motivating adults and their families to know the benefits of a healthy diet during the human life process and to moderate the use of nutritional supplements.

Keywords: Older Adults; Nutrition; Malnutrition; Nutritional Supplements; Mini Nutritional Assessment

Introduction

In Colombia, as well as in Latin America, there has been a fairly notable increase in the group of older people; the population pyramids based on the latest censuses and synthesize the process of demographic transition that has occurred in the country in recent decades and its impact on the structure of the population, where the reduction of the child and adolescent population is clearly observed and a noticeable increase in the proportion of people over

60 years of age is observed [1]. In all the departments of Colombia, an increase in the Older adults (OA) is reflected, presenting in some of these departments greater figures of aging than in others, possibly due to genetic, environmental, lifestyle conditions, coverage in health services and social protection, among others. According to the population pyramid of the municipality of Sabaneta, it denotes the increase in the OA population that corresponds to 18.58% of its

inhabitants, projecting that in five years there will be a significantly aging population, which implies the need to implement policies, plans, programs and projects aimed at the care and well-being of this population group [2].

These figures reflect that the population lives longer and longer and this fact is closely related to nutrition. The OA, like all the others, need a healthy diet, but this population has peculiar characteristics that determine their nutritional status and makes them a group with a special risk of malnutrition, so it requires attention due to the physiological changes of the aging process, their socio-economic and family status, the various diseases and therefore polymedication, which finally guarantees an adequate diet and an optimal nutritional status [3].

Given that it is considered one of the most vulnerable groups to present nutritional problems, it is imperative to design health interventions that guarantee a good state of health, for which it sometimes merits resorting to the consumption of nutritional supplements, which, without adequate supervision, they can be harmful, since it is often not possible to guarantee that such consumption will be beneficial, without leading to nutritional imbalances, either due to excess or deficit of nutrients [3].

In Latin America since 2010 the market for these products increased from 9% to 30% in registered sales, leaving Chile as the country that led consumption and Colombia in fourth place, with an increase of 7.7%, which has a variation close to 30% with respect to what was reported for 2019, showing considerable growth [4], this was complemented by data from the National Survey of the Nutritional Situation of Colombia, ENSIN 2010, where it was reported that 24.5% of adults in Colombia consumed nutritional supplements with a daily consumption frequency of 13.7% [5].

According to the above, there is an interest in studying the consumption of nutritional supplements on free demand in the OAs that attend the elderly club in the municipality of Sabaneta (Antioquia), since it is a population prone to consumption, as they are vulnerable to suffer nutritional imbalances both in the intake of macro and micronutrients, for different reasons and to resort to self-medication; it is for this reason that through this research it was sought to analyze the frequency in the use of nutritional supplements, the knowledge of these and their relationship with the qualitative and

quantitative consumption of the different food groups in OA of the municipality of Sabaneta (Antioquia).

Materials and Methods

The research was carried out between the months of February and March 2021, with a sample at convenience, where 17 OA, 60 or more years of both sexes, belonging to the Life Center "Club del Adulto Mayor", a program of the Ministry of Health of the Municipality of Sabaneta located south of the Aburrá Valley in the department of Antioquia (Colombia), participated voluntarily. Endorsement was obtained from the ethics committee of Faculty of Medicine of the University of Antioquia, in April 2020 in this place, nutritional care days were held at the outpatient OA, in which a structured survey was applied, which included open and closed questions, which inquired about different variables: sociodemographic, health, consumption of nutritional supplements and food, using a questionnaire of frequency of semi qualitative consumption or, according to the food-based dietary guidelines (GABAS), for the Colombian population [6].

The evaluation of nutritional status was carried out through the MNA tool [7], an accepted method to assess the EN of outpatient OAs, validated in different countries, which is used both in hospitalized patients and in those who require care at home or in outpatients; constant of eighteen items, which assess the general condition (morbidity, lifestyles, medication), anthropometric (weight, height, arm circumference, calf circumference), dietary (frequency of consumption of some food groups) and subjective (self-perception of health and nutrition).

The semi-quantitative consumption frequency questionnaire (CFCS) was adapted from the research conducted by Monsalve J., *et al.* [8], in which 127 foods distributed in 7 groups were included, which were established according to the dietary pattern suggested by GABAS [9]. The foods commonly consumed by the Antioquia population were chosen, including the first 50 foods established as the ones with the highest frequency of consumption reported in the Food and Nutritional Profile of Antioquia (PANA) [10]. The serving size for each food was established according to the portions of the Food Atlas of the Industrial University of Santander [11], in order to have a visual aid at the time of performing the CFCS; for foods that were not reported in said atlas, the portions suggested in the food exchange list of the University of Antioquia [12] were taken

as a reference.

The present study was descriptive and cross-sectional. The following inclusion criteria were established: without the presence of serious diseases, or some type of neurological disorder, that could mobilize themselves, that did not present any difficulty in taking anthropometric measurements and that were able to answer the questions formulated in the survey.

The information was collected by eighth-semester students of the Nutrition and Dietetics program offered by the University of Antioquia (Medellín headquarters), trained in taking anthropometric measurements and collecting food and nutrition data. The adults were selected through an open call, where participation was free and voluntary (at convenience), greatly reduced by the conditions of social and work isolation, caused by the COVID-19 pandemic and by the situation of vulnerability, since they belong to a risk group, because they are OA. To carry out the data collection, which was face-to-face, the guidelines of the Biosafety Protocol defined for the OA program in Sabaneta and by the University of Antioquia were applied for the realization of group activities, within the framework of the health, economic and social emergency due to COVID-19 [13].

Anthropometric measurements (weight and height) were obtained using the Lohman technique [14], with which the body mass index (BMI) was found; in addition to the perimeters of the arm, waist and calf and the fold of tricipital fat; the body weight was obtained in kg and for its measurement a digital scale brand Seca 813 was used, with a capacity of 150 kg and 0.1 kg of sensitivity; the weight was taken with light clothing, without shoes and with the minimum amount of accessories. The height was measured in cm with a portable dry meter with metal tape measure, body paste, fixed piece and mobile square, with a length of 220 cm and a sensitivity of 0.1cm. Both the arm perimeters and waist and calf were taken by means of a metal tape measure brand Lufkin w606PD, with a length of 200 cm and a sensitivity of 0.1cm and the fold of fat was measured with the plastic adipometer (Slim Guide model) with an aperture of 80 mm and a sensitivity of 1 mm. BMI was obtained by dividing weight in kg over height in cubic meters; for its classification, the cut-off points of the National Health and Nutrition Examination Survey of the United States (NHANES III), suggested for people over 60 years of age [15], were used.

The analysis of the information was carried out by means of graphs generated by the "google forms" tool, used to make the collection of the data easily and efficiently. As for food consumption, the information collected from each food was converted to grams or cubic centimeters (gr or cc) per day; this was done taking into

account the grams or cc that the portion reported by the participant had and the frequency with which he consumed it. After this, the grams of the foods reported in the GABAS were averaged by food group, that is, the foods that were mentioned in the "list of foods that represent an exchange by food group" tables; this average was multiplied by the number of exchanges recommended for the OA group, in order to obtain an average of total grams per food group per day and according to this average, a percentage of compliance was established with respect to the grams-cc/day consumed by each participant; assigning a classification according to the percentage of compliance, like this: <90% - lower than recommended, between 90 and 110% - recommended and >110% - higher than recommended. The above information was stored and processed in the Microsoft Excel 2016 program.

Results

A total of 17 people participated; 14 were women, most of them between 66 and 70 years of age and 7 reported being married at the time of the research. 88.2% of the population belonged to stratum 3 and the percentage distribution of educational level was equal for secondary, middle and technical with 23.5% for each category. With regard to income, 76.5% of the OA receive between 1 and 2 SMLV and 58.8% of these people, do not allocate their income for something specific, because the money becomes part of the total household expenses. The majority (76.5%) reported being affiliated to the contributory health system, as well as the type of affiliation as a contributor in 64.7%; this same percentage of the participants, were pensioned or retired and dedicated most of the time to household trades or to perform crafts.

Regarding the consumption of supplements in the surveyed population, which was the main objective of the study, a high consumption of these was found, taking into account that 82.4% of the MAs who participated, made use of them, which were recommended mostly by relatives (46.6%), followed by a friend, pharmacist or doctor, each of these in equal proportion (13.3%); self-medication was reported by 6.6%; it is noteworthy that none was advised by a professional in nutrition and dietetics, to start the consumption of these products.

The most consumed supplements were: collagen with a proportion of 46% of the population, followed by vitamins and minerals (61.5%), mainly vitamin C, E and Thiamine; as for minerals the only consumption reported was for calcium, being consumed by 23% of the participants; In addition, 7.7% of the participants indicated on not knowing what supplements he was taking, despite having claimed to be using them at the time of the research.

Regarding the time they have been consuming the supplement, a report was found between 1 and 3 months prior to the completion of the survey in 41.2%; followed by a consumption between 4 to 8 months prior to 29.4%; consuming them with a daily frequency in 70.6% of cases and spending less than \$ 100,000 pesos per month (23 dollars) in 64.7% of the participants. The main motivation for making use of these products was health, followed by trying to solve bone problems and to obtain energy.

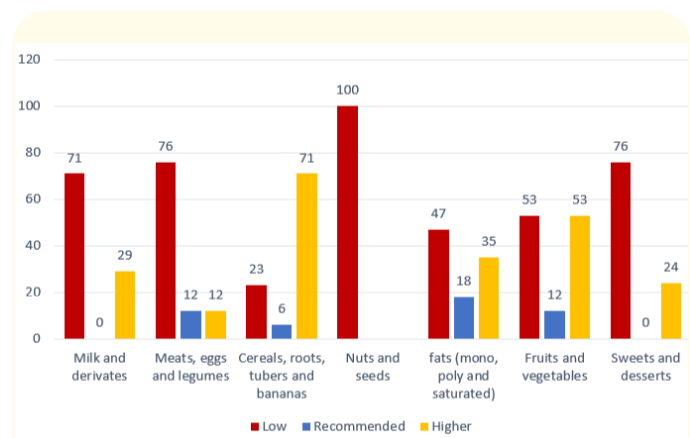
When inquiring about some aspects related to lifestyle and health conditions, it was found that 23.5% of the participants had limitations in walking or moving and that the majority (64.7%) performed physical activity at least three times a week. Regarding the presence of comorbidities, 52.9% of respondents said they had been diagnosed with a disease in the last year, with cardiovascular disease being the most common. With regard to the consumption of medicines, 88.2% of the OA reported consuming them in the last year, being heart problems, the main reason for making use of these, in addition 47.1% of the OA consumed more than three medications a day, a situation considered as polymedication.

When applying the nutritional screening test (MNA), it was found that 47.1% of the OA presented a risk of malnutrition (points: 17 to 23.5 in the application of screening) and 52.9% presented normal nutritional status (24 to 30 points in the application of screening). When analyzing the data of the anthropometric evaluation, it was evidenced that 70% of the respondents presented an adequate BMI, 18% were overweight and 12% had obesity grade I. Regarding the perimeter of the arm, 69% presented the arm circumference adequate, 6% moderate depletion and the remaining 25% presented mild depletion. According to waist circumference, 47% of participants presented cardiovascular risk; while, when assessing the calf perimeter, only 6% presented a possible risk of sarcopenia.

Regarding the intake of the different food groups, it was found in a general way that none of the participants managed to meet at least 90% of the recommendation for the 7 food groups analyzed, taking into account that the highest value reached in terms of daily consumption recommendations was 86% and was only met in 6% of the participants; in addition, only 5 participants (29%) covered the recommendation in only 1 of the 7 food groups, which is equivalent to 14% of the daily recommendation (Graph 1) with fats (2 OA), cereals (2 OA) and milks (1 OA) being the groups in which they partially met the consumption recommendation.

Graph 1: Compliance with the recommendation by food groups (%).

On the other hand, when investigating more specifically by the daily consumption of food, in the groups such as: nuts and seeds, dairy, meats-eggs-legumes, fruits and vegetables, an intake was found that was classified as “lower than recommended” for this population group; Where nuts had the highest representation with a percentage of 100% non-compliance, followed by dairy, which was 71%, as well as for the meat group, since only 24% claimed to eat it every day; finally, for the Group of fruits and vegetables, only



Graph 2: Compliance with what is recommended according to the food group (%).

47% of the population managed to comply with the recommended . In contrast, only the group of cereals, roots, bananas and tubers presented a consumption equal to or greater than recommended (76%), see graph 2.

Discussion

In various studies such as that of LM Ruilope., *et al.* it has been determined that in Latin American countries, overweight and obesity in the OA, has suffered a dramatic increase in recent decades, mainly in women [16]; in this research, the results are consistent with the above, since 30% of the participants presented excess weight (overweight and obesity), associated with a high percentage that presented cardiovascular risk, according to the waist circumference, which was observed both in people with high BMI and within the range of normality, an aspect of relevance due to the risk of mortality represented by cardiovascular diseases in the world.

A review carried out by Arden R Barry., *et al.* on primary prevention of cardiovascular diseases in OA, showed that cardiovascular disease is the main cause of death in this group and that, in primary prevention, lifestyle changes are very important, focused on the regular practice of physical activity and on achieving a healthy diet, that meets all energy and nutrient needs [17].

Nutritional assessment using the MNA showed that 47% of individuals were classified as at risk of malnutrition. Although the population of this study was outpatient, similar results were found to the study of Santos de Oliveira., *et al.* who evaluated the influence of physical status, nutritional status and general health on the quality of life of institutionalized MAs in two Brazilian cities., where the participants were mostly women, finding in the assessment of nutritional status by MNA that 43.6% of the participants were at risk of malnutrition; It should be noted that the majority of the participants in this study presented an adequate BMI classification, as did the population evaluated in the present study [18].

The risk of malnutrition found in the OA may be associated with inadequate eating habits, finding nutritional imbalances in most participants, which could imply a risk of deficit or excess in the consumption of calories and nutrients. It should be noted that a healthy diet is one that allows to achieve and maintain an optimal functioning of the organism, preserve or restore health and reduce the risk

of suffering from diseases. It must be satisfactory, sufficient, complete, balanced, harmonious, safe, adapted, sustainable and affordable. For this population group, due to the changes involved in the aging process, food is a primary factor that contributes to achieving an adequate nutritional status and therefore a better quality of life; so a healthy diet must cover the needs of energy and nutrients from the balanced consumption of a varied range of fresh foods and of mainly vegetable origin; with little or no presence of foods containing low nutritional quality [19].

In addition to the above, this study identified a higher than recommended consumption for the group of cereals, roots, bananas and tubers in the daily intake of food, this being a characteristic that reinforces aspects of the country's food culture and that also coincides with other research, where this population group was evaluated [20,21].

There was evidence of higher intake of carbohydrates than lipids and proteins, highlighting that protein intake was lower than recommended in more than 70% of the participants. It is relevant to note that, the low consumption of dairy found in this study as well as other similar ones, generates concern, since the OA present greater risk of osteoporosis associated with the low consumption of calcium; In addition, the consumption of fruits and vegetables, as expected, was found to be below what was recommended in more than 50% of the participants, which does not differ from the results found in other studies, where the pattern of consumption of these foods was significantly lower than suggested [22,23].

Despite the fact that most OA consume three or more meals a day, their diet is little varied, because it includes little diversity of foods, also insufficient, since it was observed that it did not cover the needs of nutrients and possibly not those of calories depending on the recommendations for their stage of life, and it is not balanced in the consumption of food since the recommended proportions were not given, aspects that can be identified as factors that deteriorate the state of health; with respect to this, other studies that analyzed the consumption of food, based on recommendations from different countries, conclude that a very low fraction of the population complies with the dietary recommendations and does not have a healthy diet, therefore, they suggest interventions that generate changes in diet [22].

Taking into account that the main objective of this study was to characterize the use of nutritional supplements, according to qualitative and quantitative consumption of food groups in older adults of the Club of the Elderly of the municipality of Sabaneta, Antioquia, it was found in a general way that from the diet it is possible to cover the energy needs, given by the high consumption of cereals, bananas and tubers in most participants; whereas, the intake of foods that provide nutrients such as vitamins and minerals having been significantly lower, could be alluded to a consequent relationship in context with the most used supplements, since the respect of supplements was found mostly that of vitamins and minerals; however, this fact does not determine that the use of these products is relevant or appropriate, because as in other studies, it was also found that this behavior is practiced mostly without adequate professional advice, therefore, the population even without having knowledge about the bases of an adequate diet, skips this step and goes to the consumption of supplementary products, predominantly for health reasons and suggested by a family member or friend, who in most cases have not been advised by a professional, which can put their health at risk [24,25].

Considering the lack of knowledge about supplementation, from the point of view of the comorbidities and food intake of the participants, in some cases it could be suggested in some way that "if it is pertinent" the consumption of certain products for this population group; for example in the case of vitamin C, which due to its antioxidant and protective effect against cardiovascular risk and taking into account on the one hand, the high percentage of participants who present Aron RCV and those who already suffer from this pathology; the above in complement with the food intake, which was not varied in most of the participants, being very low the consumption of fruits (especially citrus fruits), fresh vegetables and vegetables, all sources of this nutrient, may merit the supplementation of this micronutrient [26].

Another nutrient that gained relevance in terms of supplementation was vitamin E and although its deficit is uncommon, the main source of it are fats and oils, especially sunflower, olive and cotton oils; as well as nuts, cereal germ and beef liver that, compared to what was reported in the frequency of food consumption, an intake below what was recommended was found. It should be noted that the deficiency of this vitamin mainly produces neurological alterations, which occur frequently in this age group, and it is for this rea-

son that emphasis could be placed on requiring supplementation [26,27].

Now, although calcium is another of the nutrients with a considerable consumption in supplementation by the OA (23%) and in contrast to the contribution of this by the intake of dairy products, it was found that 71% of the participants reported a lower consumption than recommended, and its supplementation becomes relevant, since this is an essential element, it performs a wide variety of important functions in the organism. During the aging stage, it is essential to slow its loss, since, in postmenopausal and older women, calcium needs are higher due to the physiological changes that aging entails (hypochlorhydria, intestinal resistance to the absorption of vitamin D and estrogen deficiency in postmenopausal women, among others) that can modify the intestinal absorption of calcium [28].

On the other hand, from the perspective indicated in this study, where the use of supplements in the OA population could "not be relevant", there are several reasons that support this perspective, among which it is worth mentioning: there is no professional advice that adequately accompanies this behavior, because there is no permanent advice of a professional who adequately accompanies the supplementation, which is considered an important issue when making use of it, since although some of the nutrients consumed may have relevance, this occurred essentially because most of the participants do not carry out a varied diet and from there, that the unresolved deficiencies from the diet are so high that in the same way it would be difficult to attend to them from the supplementation, in addition to the fact that it could be incurring in the intake of supplements in an inadequate way in which the purpose of its use is not fulfilled [29].

Another reason that supports the "non-relevance" in the use of supplements, is that as suggested by the "ESPEN" (European Society for Clinical Nutrition and Metabolism), the use of oral supplements in the geriatric patient is recommended in those who suffer from malnutrition or who are at risk of it, either due to lack of appetite, problems of TGI and diseases that limit the diet from the primary source, this in order to increase the supply of energy, macro and micronutrients to improve nutritional status. Now taking into account the above, in this study despite the fact that it is very possible that most of the participants present malnutrition due to

their eating habits, according to the BMI indicator, none presented malnutrition, in addition to the fact that a representative part of the population did not report problems in the gastrointestinal tract or diseases that limited the eating act, so the first option to obtain nutrients is healthy nutrition provided by food. On the other hand, supplements are often expensive compared to food and suggesting their use might not be relevant, especially considering that most of the participants were from low socioeconomic strata (stratum 2 and 3), with incomes below 2 minimum wages; in addition, the income was destined for household expenses in general [29].

Some of the nutrients of great importance for health in this population, such as proteins of both high and low biological value, were found deficient (76% lower than recommended) and had no representation since supplementation, which also reflects the absence of the accompaniment of a professional. Although the nutritional needs of the OA are not covered from the diet, since 6 of the 7 food groups do not comply with the recommended, especially the group of nuts and those that include contribution of essential fatty acids, of which the use of supplements such as omega 3 and 6 was not reported either, since the consumption of fish, nuts, seeds and olive oil were much lower than suggested by GABAS and these are relevant for this population group, since long-chain polyunsaturated fatty acids omega-6; arachidonic acid, and omega-3; docosahexaenoic acid, are fundamental in the formation of the structure and functionality of the nervous and visual system; In addition, they have demonstrated physiological benefits in blood pressure, heartbeat, decreased triglyceride levels, endothelial function, and cardiac diastolic function. Other benefits have also been found in musculature, having a direct effect on muscle protein synthesis by improving walking speed, muscle strength and functional capacity [30,31].

Vitamin D was another of the nutrients that it is advisable to supplement, if a calcium deficit is suspected as evidenced from the food intake in this study, also in OA it is one of the vitamins that merits supplementation, since the activation of this through the skin, is decreased; supplementation is indicated in especially elderly women, with osteoporosis or who have suffered a fracture. There are studies that show that 60-70% of healthy older people have vitamin D intakes less than two thirds of what is recommended, with a high prevalence of insufficiency in Hispanics, so it is important to consider the relevance that various health professionals

have found compared to the supplementation of this vitamin in the OA population, based on experiments suggesting that it could play an essential role in modulating a large number of diseases, and its deficiency is associated with structural brain abnormalities, cognitive impairment and dementia. In OA it can precipitate or accelerate osteopenia and osteoporosis, cause osteomalacia and muscle weakness, increasing the risk of hip fracture in OA [32].”

OAs are at risk of vitamin D deficiencies, limited exposure to sunlight and a reduction in the skin's ability to produce vitamin D, therefore supplements of this vitamin are for some OA the best source to obtain this vitamin, since many of the source foods such as salmon, Fresh seafood, sardines or tuna in olive oil, cod liver oil and eggs, are not part of the diet in this population, as was evidenced in the intake of the participants of this research and despite this, none reported consuming this supplement [33].

Finally, thiamine is one of the vitamins reported as a supplement, in which great participation was found; however, this nutrient could be unnecessary in supplement form, since it is found in foods such as bread, yeasts, legumes, peas, potatoes, tomatoes, cereals and eggs, etc. These being the foods that the participants of this study consumed the most, in addition, that the deficiency in the elderly appears before very low socioeconomic level and in alcoholics, features that were not reported in this study [26].

Conclusion

In general, it was found that from the diet it is possible to cover the energy and nutritional needs, given by the high consumption of cereals, bananas and tubers in most of the participants; while, the intake of foods that provide nutrients such as vitamins and minerals having been significantly lower, could be alluded to a consequent relationship in context with nutritional supplements; however, this fact does not determine whether the use of these products is relevant or appropriate. It is necessary to deepen the study of sociodemographic factors related to access to healthy foods for the design of strategies and policies that increase their consumption.

The results indicate the need for immediate actions in this population group, which translates into the requirement of contextualized educational processes aimed at the selection of foods and nutritional supplements that report the greatest benefit to this group,

which motivate older adults and their families to know the benefits of a healthy diet in the vital process and how it contributes to well-being and to the quality of individual and collective life.

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Conflict Interests

None.

Bibliography

- Colombia. "Ministerio de Salud y Protección Social". Envejecimiento demográfico Colombia 1951-2020, Dinámica demográfica y estructuras poblacionales. Bogotá DC (2013).
- Colombia Antioquia. "Alcaldía de Sabaneta". Plan decenal de Salud Pública 2012-2021, metodología PASE a la equidad en salud (2021).
- Tafur J., *et al.* "Factors that affect the nutritional status of the elderly". *Latin American Journal of Hypertension* 13.5 (2018).
- Rojas S., *et al.* "Consumption of nutraceuticals, an alternative in the prevention of chronic non-communicable diseases". *Bio-salud Magazine* 14.2 (2015): 91-103.
- Colombia. "Ministerio de Salud y Protección Social. Recomendaciones de ingesta de energía y nutrientes RIEN para la población Colombiana". Bogotá DC abril (2016).
- Instituto Colombiano de Bienestar Familiar - ICBF, Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). "Guías Alimentarias Basadas en Alimentos para la población colombiana mayor de dos años" (2015).
- Cereda E. "Mini nutritional assessment". *Current Opinion in Clinical Nutrition and Metabolic Care* 15.1 (2012): 29-41.
- Monsalvo J and González L. "Design of a frequency questionnaire to evaluate food intake at the University of Antioquia, Colombia". *Nutricion Hospitalaria* 26.6 (2011): 1333-1344.
- Colombia. Instituto Colombiano de Bienestar Familiar. "Guías alimentarias basadas en alimentos para la población colombiana mayor de 2 años" (2021).
- Gobernación de Antioquia. "Perfil Alimentario y Nutricional de Antioquia" (2019).
- Prada G., *et al.* "Atlas fotográfico de porciones para cuantificar el consumo de alimentos y nutrientes en Santander, Colombia". Santander: Universidad Industrial de Santander (2011).
- Grupo académico Consumo de alimentos. "Reimpreso Lista de intercambios. Escuela de Nutrición y Dietética. 5th edition". Medellín: Universidad de Antioquia (2018).
- Universidad de Antioquia. "Curso UdeA Biosegura: en la U y en casa nos cuidamos [internet]". Udearropa (2021).
- Restrepo M., *et al.* "Técnica para la toma de medidas antropométricas. 3rd edition". Medellín: Centro de atención nutricional (2006).
- Third National Health and Nutrition Examination Survey (NHANES III), National Center for Health Statistics, Center for Disease Control and Prevention, USA (2021).
- Ruilope L., *et al.* "Obesity and hypertension in Latin America: Current perspectives". *Hipertensión y Riesgo Vascular* 35.2 (2018): 70-76.
- Barry A., *et al.* "Primary Prevention of Cardiovascular Disease in Older Adults". *Canadian Journal of Cardiology* 32.9 (2016): 1074-1081.
- Santos de Oliveira L., *et al.* "Health-related quality of life of institutionalized older adults: Influence of physical, nutritional and self-perceived health status". *Archives of Gerontology and Geriatrics* 92 (2021): 104278.
- Basulto J., *et al.* "Definition and characteristics of a healthy diet" (2013).
- Closs VE., *et al.* "Description and association with energy, macronutrients and micronutrients intake" (2014).
- Arriaga G. "Food insecurity and diet quality in older adults in four rural communities in the state of Morelos" (2014).
- Gómez G., *et al.* "Diet quality and diversity in eight Latin American countries: Results of the Latin American Study of Nutrition and Health (ELANS)". *Nutrients* (2019).

23. Sousa AG and Da Costa THM. "Assessment of Nutrient and Food Group Intakes across Sex, Physical Activity, and Body Mass Index in an Urban Brazilian Population". *Nutrients* 10.11 (2018): 1714.
24. Kantor ED., *et al.* "Trends in Dietary Supplement Use Among US Adults From 1999-2012". *JAMA* 316.14 (2016): 1464-1474.
25. Gahche JJ., *et al.* "Dietary Supplement Use Was Very High among Older Adults in the United States in 2011-2014". *The Journal of Nutrition* (2017).
26. Spanish Society of Geriatrics and Gerontology. "Nutrition in the elderly- Guide to good clinical practice in geriatrics" (2013).
27. González N., *et al.* "Caracterización de la ingesta de alimentos y nutrientes en adultos mayores chilenos". *Revista Chilena de Nutricion* (2016).
28. Rosaura F. "Milk and dairy products: dietary sources of calcium" (2015).
29. Luna R. "Standard and polymeric versus standard diet in the nutritional status of the geriatric patient with frailty". *Revista Medicina Instituto Mexicano Seguro Social* (2016).
30. Gil S., *et al.* "Suplementos nutricionales en el deterioro cognitivo y la enfermedad de Alzheimer: revisión de la literatura". *Acta Neurológica Colombiana* (2017).
31. Rendon Ry and Osuna I. "El papel de la nutrición en la prevención y manejo de la sarcopenia en el adulto mayor". *Nutrición Clínica en Medicina* (2018).
32. Escaffi M., *et al.* "Dieta Mediterránea y vitamina D como potenciales factores preventivos del deterioro cognitivo". *Revista Médica Clínica Las Condes* (2016).
33. Alvarado-García A., *et al.* "La nutrición en el adulto mayor: una oportunidad para el cuidado de enfermería". *Enfermería Universitaria* (2017).