Nutrición Hospitalaria

Nutr Hosp. 2015;32(5):2038-2045
ISSN 0212-1611 • CODEN NUHOEQ
S.V.R. 318

Original/*Obesidad*

Nutritional status, diet and non-alcoholic fatty liver disease in elders

Clarissa Lima de Melo Portela[1], Helena Alves de Carvalho Sampaio[2], Maria Luísa Pereira de Melo[3], Antônio Augusto Ferreira Carioca[4], Francisco José Maia Pinto[5] and Soraia Pinheiro Machado Arruda[6]

[1]Universidade de Fortaleza, Nutricionista, Mestre em Saúde Pública, docente da curso de Nutrição da Universidade de Fortaleza (UNIFOR). [2]Universidade Estadual do Ceará (UECE), Professora Emérita, Doutorado em Farmacologia. [3]Universidade Estadual do Ceará (UECE), Doutora em Farmacologia, docente do curso de Nutrição. [4]Universidade Estadual do Ceará, Nutricionista, Mestrando em Saúde Pública pela Universidade de São Paulo (USP). [5]Universidade Estadual do Ceará (UECE), Estatístico, docente do curso de Mestrado em Saúde Pública. [6]Universidade Estadual do Ceará (UECE), Doutora em Saúde Coletiva, docente do curso de Nutrição, Brazil.

Abstract

Objective: **evaluate the inter-relations between non-alcoholic fatty liver disease (NAFLD) and dietary factors in a population of hypertensive elders.**

Methods: **229 hypertensive elder patients were evaluated, from June to December 2009. All the patients that accepted to participate in the study signed a free consent term. An anthropometric evaluation was carried out and the body composition was evaluated. The diagnosis of NAFLD was determined by the American guidelines. The regular food intake was estimated through a 24 hour questionnaire.**

Results: **the weighted excess, by the body mass index and excess of abdominal fat, were associated with NAFLD ($p < 0.001$). An inverse profile was found with the diet variables.**

Conclusion: **the studied group presents a health risk situation, considering the nutritional status markers. The regular diet appeared to be inadequate, showing excess of sodium and low fiber and vegetables intake.**

(*Nutr Hosp*. 2015;32:2038-2045)

DOI:10.3305/nh.2015.32.5.9674

Key words: *Non-alcoholic fatty liver disease. Dietary patterns. Elderly. Nutrition.*

ESTADO NUTRICIONAL, DIETA Y ENFERMEDAD DEL HÍGADO GRASO NO ALCOHÓLICO EN ANCIANOS

Resumen

Objetivo: **evaluar las interrelaciones entre enfermedad grasa no alcohólica del hígado (HGNA) y factores dietéticos en una población de ancianos hipertensos.**

Métodos: **229 pacientes ancianos hipertensos fueron evaluados desde junio a diciembre del 2009. Todos los pacientes que aceptaron participar en el estudio firmaron un consentimiento libre e informado. Fueron realizadas evaluaciones antropométricas y de composición corporal. El diagnóstico de HGNA fue determinado por el American Guidelines. El consumo alimenticio regular fue estimado a través de una encuesta alimentaria de recordatorio de 24 horas.**

Resultados: **el exceso de peso, ponderado por el índice de masa corporal y el exceso de grasa abdominal, fueron asociados con HGNA ($p < 0,001$). Un perfil inverso fue encontrado con las variables dietéticas.**

Conclusión: **el grupo estudiado presentó una situación de riesgo para la salud, considerando los marcadores del estado nutricional. La dieta regular pareció ser inadecuada, mostrando exceso de sodio bajo consumo de fibras y vegetales.**

(*Nutr Hosp*. 2015;32:2038-2045)

DOI:10.3305/nh.2015.32.5.9674

Palabras clave: *Enfermedad del hígado graso no alcohólico. Hábitos alimentarios. Ancianos. Nutrición.*

Correspondence: Helena Alves de Carvalho Sampaio.
Av. Dr. Silas Munguba, 1700, Campus do Itaperi.
60.714.903 Fortaleza-CE Brasil.
E-mail: dr.hard2@gmail.com

Recibido: 23-VII-2015.
Aceptado: 17-VIII-2015.

Introduction

The nonalcoholic liver steatosis or nonalcoholic fatty liver disease (NAFLD) is characterized by the accumulation of fat in the hepatocytes in the absence of alcoholic intake. It includes the steatosis when there is only a fat infiltration, and the hepatic steatosis, which can be associated to fibrosis and evolve to liver cancer[1-7].

The NAFLD is commonly associated to obesity, hyperinsulinemia, peripheral insulin resistance, diabetes *mellitus*, dyslipidemies and high blood pressure. This liver disease is now considered the hepatic component of metabolic syndrome[1-6,8].

It is estimated that 20-30% of world's occidental population will have NAFLD[9-12]. It occurs in both sex patients, of all ethnic groups and ages, even in children. It is more prevalent in hispanics and less prevalent between nonhispanic blacks. Some studies have shown that its prevalence is more common in men because they often have more visceral fat[4,13].

Another aggravating factor of this situation is age. In elders, the gradual lowering of the organism efficiency characterized by aging permits the developing of illnesses associated to the increasing of insulin resistance[14]. This is a relevant issue, considering the increasing elder population all around the world. According to the World Health Organization (WHO), in 2002, the 60 year old population or more was of 400 millions of people. In 2025, this number would increase to approximately 840 millions, representing a 70% growing, and Brazil would be the sixth country in elder population in the world[15]. Data from the Brazilian National Research Home Sample (PNAD), from 2001 to 2008, made by the Brazilian Geography and Statistics Institute (IBGE) shows that the elder population, defined as 60 year old individuals and older, in Brazil is of 21.040 people[16].

Blood pressure also rises with age, being associated to high salt intake in diet, sedentary lifestyle, and obesity, strongly contributing to the increase of the number of elders with metabolic syndrome, specifically NAFLD[17].

The liver biopsy is the most precise exam for diagnosis, classification and staging of this disease, but sample mistakes may occur because the tissue diagnosis represents only one fraction of the hepatic parenchyma[1,3,4,13,18].

Clinically, NAFLD is a silent disease. The symptoms, when present, are hardly related with the seriousness of the condition and may suggest other affections. The most common clinic findings are fatigue, right chest pain, hepatomegaly, obesity, *acanthosis nigricans*, among others[4].

Some biochemical exams may be useful in the diagnosis, such as measuring out alanine-aminotransferase (ALT), aspartate-aminotransferase (AST), calculating the AST/ALT rate, also measuring out in blood gama-glutamil-transpeptidase (γ-GT), alkaline phosphatase, prothrombin time, albumin and bilirubin. Nevertheless, the advanced liver disease may show normal or altered hepatic enzyme levels from 1.5 to 3 times over the reference limits[1,4,19].

Image exams such as ultrasound, computerized tomography and magnetic resonance also contribute in NAFLD diagnosis, but are not capable of classifying steatosis (non progressive type) from hepatic steatosis (the most harmful type)[1,3,4,13,18].

Therefore, in the daily clinic practice, the NAFLD has been made without type distinction.

An inter-relation between NAFLD and diet factors has been found, but there aren't definitive conclusions yet. There seems to be an association with high calorie intake[20], simple carbohydrates[21], fat[22,23] and animal proteins[24], in addition to a low fiber intake[25].

From this background, the objective of the present study was to evaluate the inter-relations between the nonalcoholic fatty liver disease and diet factors in a population of hypertensive elders attended by the Unified Health System (SUS).

Methods

229 elder patients attended in the High Blood Pressure Outpatients Clinic from a reference center located in Fortaleza city, capital of Ceará state, were evaluated. The data was collected from June to December 2009. To participate in this study, the patients must be registered in the service, be 60 years old or older, capable to walk and haven't had liver disease diagnosed before. The research was aligned within Brazilian legal parameters (196/1996 Resolution) from the National Health Council[26]. This research was submitted to the Ethics Committee in Research and the data collection was begun after its approval. All the patients that accepted to participate in the study signed a free consent term.

An anthropometric evaluation was made, including weight and height measures as described in the Gouveia protocol[27]. The weight was obtained by using the Filizola anthropometric digital scale with 180kg capacity and a 100g sensibility. The height was measured using a stadiometer coupled to the scale, with 1.92 capacity and 0.5cm sensibility.

The body mass index (BMI) was determined using the weight and height values, and the elders who presented ranges between 22 to 27 kg/m^2 were classified as eutrophic, as proposed by the Health Ministry[28], which has the support of Lipschitz[29].

The body fat was determined by bioelectric impedance analysis (BIA), using a bipolar Omron^{Ò} equipment, which provides the body fat percentage by comparing sex, age, weight and height. The procedure to measure the body fat followed the producer manual. The fat body percentage presented by the BIA was compared with Lohman *et al.*[30], adopting as normal parameter a percentage ≤ 23% for men and ≤ 35% for women.

The waist circumference was measured to estimate the presence of abdominal fat, following the WHO protocol[31] and the protocol of the Cardiology Brazilian Society[32]. Abdominal fat was considered elevated for the elders who presented values over 102 cm and 88 cm, for men and women respectively.

The liver sonogram was made in the Image Center of the same service, using the En Visor C ultrasound from Philips.

The regular dietary consumption was determined through three 24 hour diet recalls, including two non-consecutive days and one weekend day[33].

For the diagnosis of NAFLD, the American guideline[34] was considered and an ultrasound evaluation pointing out hepatic steatosis in the absence of alcohol (abstinence or no ethanol consumption during ≤ 20-30g/day). In this document, it is not specified If there is any safe difference of alcohol consumption regarding sex, but considering that women have a lower limit than men, it was used 20g for women and 30g for men.

The hepatic steatosis was classified in three stages, defined as follows: low (mild and diffuse increase of the hepatic echogenicity, with normal view of diaphragm and the intra-hepatic vessel boards); moderated (moderated and diffuse increase of the hepatic echogenicity, with light difficulty of view of the diaphragm and the intra-hepatic vessels) and severe (hepatic echogenicity highly increased, low absorption in the back right lobe and difficulty or absence of view of the supra-hepatic and diaphragm vessels).

Results

Table I shows the prevalence of adiposity excess, based on the BMI, waist circumference and body fat indicators.

Considering the BMI, the prevalence of weighted excess was high in the studied group, without difference between sexes ($\chi^2 = 0.430$; $p = 0.512$). The accumulation of abdominal fat, estimated by an upper waist circumference, was high and more prevalent in female ($\chi^2 = 38.074$; $p < 0,001$). The average measure of men waist circumference was 99.1 (11.1) and in women 94.9 (10.3). Regarding to the body fat percentage, there was a high prevalence of elevated values, without difference for sexes (p de Fisher = 0.459). The average percentage of fat was 32.8 (4.6)% in men and 42.3 (4.6)% in women.

Regarding the patients diet, table II shows the patient distribution by average ingestion, with standard deviation of calories, carbohydrates, proteins, lipids, saturated fat, cholesterol, sucrose, sodium, fibers and fruits and vegetables.

The presence of hepatic steatosis was found in 103 (45,0%) patients, being 21 (36,2%) men and 82 (48,0%) women. Table III shows the distribution of patients having hepatic steatosis when compared to the disease staging and sex (p = 0,120).

The presence of NAFLD was evaluated according to nutritional status (weighted excess, body fat and abdominal fat), as shown in table IV. Considering the low number of men in the sample studied, the data is shown without considering sex.

The same procedure of analysis was made considering the absence or presence of NAFLD and the dietary pattern (Table V). It was observed that there is no association between diet factors and the presence of NAFLD.

Discussion

It was observed that most of the patients presented weighted excess, according to the BMI categorized by Lipschitz[29], with worst situation among women. Even though there are specific recommended normal anthropometric parameters for elders, the way of using these is not unanimous. The results of this research coincide with Arns *et al.*[36] study, where most of the elders presented overweight (40.8%) and women presented more prevalence of overweight/obesity. In the Lima-Costa *et al.*[37] study, the prevalence of overweight in elders, considering BMI as ≥ 25 kg/m^2 was of 54.7% and comparing hypertensive elders and elders with normal blood pressure, it was found prevalence of weighted excess of 62.0% and 45.0% respectively. In another Brazilian study of Cotrim *et al.*[38], it was also found more prevalence of weighted excess evaluated

Table I

Adiposity excess prevalence among studied patients according to anthropometric indicator and sex. Fortaleza, 2009

*Indicator**	*Male (n = 58)*		*Female (n = 171)*		*Total (n = 229)*	
	n	*%*	*n*	*%*	*n*	*%*
Body Mass Index[1]	29	50,0	94	55,0	123	53,7
Waist Circumference[2]	19	32,8	132	77,2	151	65,9
Body fat[3a]	56	98,2	157	94,6	213	95,5

[1]Categorized according to Lipschitz (1994); [2]Categorized according to the World Health Organization (1998); [3]Categorized according Lohman *et al*. (1997). [a]n= 223 (in 6 patients it was not possible to measure the body fat).

Table II
Daily average intake (standard deviation) of different dietary components by the studied patients according to sex. Fortaleza, 2009

Dietary component	*Average (standard deviation)*		
	Male	*Female*	*Total*
Total caloric value (kcal)	1608,8 (374,0)	1233,5 (328,5)	1328,6 (377,0)
Carbohydrates (%)[a]	49,8 (9,1)	50,7 (8,4)	50,4 (8,6)
Proteins (%)[a]	19,5 (4,3)	19,2 (4,7)	19,3 (4,6)
Lipids (%)[a]	28,7 (7,8)	29,3 (7,2)	29,2 (7,4)
Saturated fat (%)[a]	7,4 (4,4)	6,9 (2,6)	7,1 (3,2)
Cholesterol (mg)	191,3 (90,2)	148,6 (101,6)	159,4 (100,4)
Sucrose (%)[a]	4,1 (5,8)	4,2 (4,7)	4,2 (4,9)
Sodium (g)	4,4 (2,5)	4,1 (2,5)	4,2 (2,5)
Fibers (g)	20,3 (8,2)	15,6 (5,8)	16,8 (6,8)
Fruits and vegetables (g)	227,2 (236,5)	219,8 (234,0)	221,7 (234,2)

[a] Percentage according to the total caloric daily intake.

Table III
Distribution of the studied patients according to the staging of the hepatic steatosis and sex. Fortaleza, 2009

Hepatic steatosis staging *	*Male*		*Female*		*Total*	
	n	*%*	*n*	*%*	*n*	*%*
Low	16	76,2	63	76,8	79	76,7
Moderated	4	19,0	18	22,0	22	21,3
Severe	1	4,8	1	1,2	2	2,0
Total	21	100,0	82	100,0	103	100,0

*Categorized according to Wilson; Withers (2005); $c^2 = 2,415$; $p = 0,120$.

by BMI, carried out in the states of Rio Grande do Sul, Paraná, Pará, Paraíba, Pernambuco, Bahia, São Paulo, Rio de Janeiro, Minas Gerais and the Federal District, with 1280 patients with an average age of 49.7 (13.6), where 44.7% of the patients presented obesity and 44.4% were overweighed.

Another study which coincides with this study's results is Kirovski *et al*.[6], carried out in a university hospital in Germany, with 155 patients, with average age of 54.4 (17.7) and which compared the patients' BMI with and without NAFLD diagnosed by ultrasound. These authors observed a statistic difference ($p< 0.0001$) in the BMI averages, 28.7 (5.9) and 24.8 (3.6) in the patients with and without NAFLD respectively.

The Brazilian Families Budget Research – POF[39] established the profile of the nutritional status of Brazilian population during 2008 and 2009 and showed that the prevalence of overweight for people between 55 to 64 years, 65 to 74 years and from 75 years or more was of 60.7%, 56.2% and 48.6% respectively, thus, the population group described in this study coincides with the situation described for Brazilian elders.

Evaluating excess of abdominal fat, in the present study, the prevalence of high waist circumference values was increased, mainly in women 77.2%, and only 32.8% for men. In the SABE study (Health, Wellbeing and Aging), a population base research which has as objective the information collection about life and health conditions of different elder cohorts in seven countries of Latin America and the Caribbean, women also presented more accumulation of fat in abdominal region, but in less prevalence (50.0%) than the observed in this study [40].

An analysis of the percentage of body fat also showed high prevalence in men 98.2% and in women 94.6%, which could be explained by the reduction of lean body mass, bone tissue and total body water as age passes by[41-43]. In the Bueno *et al*.[44] study, lower results were found, where 37.8% of the population presented increased body fat. The Kriniski *et al*.[45] study evaluated the body fat percentage in hypertensive and sedentary elders before and after six months of exercise. The fat percentage before exercising was of 39.6% and at the end was of 37.3%, therefore lower

Table IV
Distribution of the studied group according to nutritional status and absence or presence of nonalcoholic fatty liver disease (NAFLD), with statistics analysis. Fortaleza, 2009

Nutritional status	*Without NAFLD (n = 126)*		*With NAFLD (n = 103)*		*Statistical analysis*
	n	*%*	*n*	*%*	
Weighted excess[2]					
Yes (n = 123)	49	39,8	74	60,2	$\chi^2 = 24,76$
No (n = 106)	77	72,6	29	27,4	$p < 0,001$
Body fat excess[3]					
Yes (n = 213)	117	54,9	96	45,1	p Fisher = 0,518
No (n = 10)	7	70,0	3	30,0	
Abdominal fat excess[a]					
Yes (n = 151)	65	43,0	86	57,0	$\chi^2 = 25,69$
No (n = 78)	61	78,2	17	21,8	$p < 0,001$

[a] Abdominal fat excess diagnosed according to high waist circumference (WHO, 1998); [1]According to WHO (1998); [2]According to Lipschitz (1994); [3]n= 223 (in 6 patients it was not possible to measure the body fat).

Table V
Distribution of the studied group according to dietary patterns and absence or presence of the nonalcoholic fatty liver disease (NAFLD), with statistical analysis. Fortaleza, 2009

Dietary pattern	*Without NAFLD (n = 126)*		*With NAFLD (n = 103)*		*Statistical Analysis*
	n	*%*	*n*	*%*	
Excessive ingestion					
Calories					
Yes (n = 17)	11	64,7	6	35,3	$\chi^2 = 0,70$
No (n = 212)	115	54,2	97	45,8	$p = 0,404$
Sucrose					
Yes (n = 27)	12	44,4	15	55,6	$\chi^2 = 1,38$
No (n = 202)	114	56,4	88	43,6	$p = 0,239$
Total fat					
Yes (n = 97)	47	48,5	50	51,5	$\chi^2 = 2,93$
No (n = 132)	79	59,8	53	40,2	$p = 0,087$
Saturated fat					
Yes (n = 101)	52	51,5	49	48,5	$\chi^2 = 0,91$
No (n = 128)	74	57,8	54	42,2	$p = 0,339$
Cholesterol					
Yes (n = 58)	29	50,0	29	50,0	$\chi^2 = 0,79$
No (n = 171)	97	56,7	74	43,3	$p = 0,374$
Sodium					
Yes (n = 175)	94	53,7	81	46,3	$\chi^2 = 0,51$
No (n = 54)	32	59,3	22	40,7	$p = 0,474$
Reduced ingestion					
Fibers				44,4	
Yes (n = 169)	94	55,6	75	46,7	$\chi^2 = 0,09$
No (n = 60)	32	53,3	28		$p = 0,759$
Fruits and vegetables					
Yes (n = 199)	111	55,8	88	44,2	$\chi^2 = 0,35$
No (n = 30)	15	50,0	15	50,0	$p = 0,553$

levels than the ones observed in this research. Bipolar bioelectric impedance analysis was used to measure body fat in the present study and in Bueno *et al*.[44], but in Kriniski *et al*.[45] skinfold test was used. It's important to remind that the methods of evaluating body fat suffer some variances, facilitating overestimation or underestimation[46].

The nutritional status findings concerns, because it shows a high weighted excess and body fat, with accumulation of abdominal fat, which are risk factors for a complicated aging, contributing to the emerging of CNCDs, such as dyslipidemies, heart diseases, type 2 diabetes *mellitus* and high blood pressure. Nevertheless, it is important to be careful when interpreting the data in elders, due to many types of studies associating risks are related to adults[37,40].

Regarding the dietary pattern found in the population studied, it was observed that a mild majority of elders presented an adequate average consumption of calories (50.2%). Considering the percentages of energetic contribution of carbohydrates, proteins and lipids that were 50.4%, 19.3% and 29.2% respectively and comparing such distribution with the dietary pattern of Brazilian population evidenced by POF 2008-2009[39], that presented 59.0%, 12.0% and 29.0% respectively for carbohydrates, proteins and lipids, it could be observed a similarity in the lipids percentage, but a difference for carbohydrates and proteins, characterizing the study patients' diet as high sucrose, high protein and normal lipids. The same classification is maintained when considering sex.

The average intakes of fiber, fruits and vegetables were low, (16.8g for fiber and 221.7g for fruits and vegetables), according to the Brazilian Dietary Guide[47] which is respectively 25g and 400g per day, which are equivalent to three portions of fruit and three portions of vegetables. In the Lopes *et al*.[48] study, in which they evaluated the dietary consumption in elders and adults, the average consumption of fibers was 9.3g per day.

Zelber-Sagi *et al*.[12] refer that the regular diet of NAFLD patients is associated with an unhealthy dietary pattern, similar to the occidental dietary pattern, which is characterized by the elevated consumption of fructose, sweet beverages, meat, saturated fat and cholesterol and low consumption of fibers, fish, Omega 3, poli unsaturated fat and some vitamins, which could indicate an undertake of vegetables. Some of these inadequacies were not found in the patients evaluated in this study, but some were as shown before.

It is important to point out the elevated sodium intake, with a daily average of 4.2g; higher than the patterns of the Brazilian Dietary Guide[47], which establishes 2.4g/day. This high sodium intake was also found in national studies carried out with this age range and also with other age ranges[37,49,50]. Nevertheless, this is an important finding in the age range evaluated, considering this is a hypertensive population, which could increase the risk of complications associated to this disease.

The prevalence of NAFLD in this study was high (45.0%), being lower in men, 36.2% than in women, 48.0%, comparing with the occidental prevalence, which is around 20-30% of the population[9,10]. Salgado Jr *et al*.[4] and Younossi[13] refer that NAFLD is more common in men, due to the higher quantity of visceral fat, opposite results to what was found in the present study. NAFLD prevalence data in elder studies are few, which reduces the possibilities of comparison of the study.

The weighted excess, such as abdominal fat in excess, defined by the waist circumference increased[31], was associated to NAFLD. This findings point out the importance of considering anthropometric markers to assume prevention procedures or to improve or controlling NAFLD.

The apparent higher prevalence of NAFLD among women could occur due to the fact of abdominal fat accumulation being higher in this sex, nevertheless, there wasn't statistical difference among men and women evaluated considering NAFLD.

The Karnikowski *et al*.[51] study, with 55 year old individuals and more, detected 35.2% NAFLD prevalence. The waist circumference was present in 38.1% of the patients, having also considered that the excess of abdominal fat is an underlying factor for NAFLD. In the Zelber-Sagi *et al*.[12] study, a positive association between BMI and NAFLD was found; the NAFLD patients had, in average, BMI of 30.2 kg/m^2, while in patients without NAFLD, the average BMI was 25.8 kg/m^2. The Jeong *et al*.[52] study showed a strong association between the increasing of visceral fat with NAFLD and metabolic syndrome.

Regarding the inter-relations between dietary pattern and NAFLD, an unexpected result was the apparent protector role of the excessive calories intake, but it didn't have statistic significance, which would be opposite to all the literature consulted. This fact could be explained due to having a short number of patients with excessive calories ingestion and, at the same time, a high prevalence of NAFLD, which generated a false association. The methodological limitations of the 24 hour dietary recall are also to be considered, which, even being the most adequate among the available, could allow underestimation of the real dietary consumption, because it is a method that depends of the memory of the interviewed and his/her ability to estimate the size of the portions and the interviewer capacity to establish communication channels[33].

There wasn't any dietary factor associated with NAFLD in the studied group, which aligns with the literature controversies, because, till now, it wasn't possible to establish a definitive association between any dietary component and the appearing of the disease.

It is also possible that the orientations received about some dietary components may have influenced in the dietary pattern, because there is an interdisciplinary health care in the service.

In the other hand, the detection of such a high prevalence of hepatic steatosis points out the importance

of including this evaluation in the routine care of these hypertensive and elder patients due to literature also demonstrating an important prevalence of NAFLD among them, and the study also confirms this reality. This becomes more relevant when considering that these patients already present risk factors, which's' association with the disease is pointed out in the literature and confirmed in this study with the weighted excess and abdominal adiposis.

Conclusion

The evaluated group presents a health risk situation considering the indicators of the nutritional status. The regular diet appeared to be inadequate, presenting sodium excess intake and low fiber, fruits and vegetables intake.

The prevalence of the nonalcoholic fatty liver disease was high and superior to other occidental data. This was associated to the weighted excess and abdominal fat, but not to the dietary patterns. It is recommended that the research of this disease could be included in the regular activities of health services for elder population.

References

1. Cruz T, Cotrim HP. Paraná R. Pereira JE. Mello V. O Fígado e a Síndrome Metabólica. In: Godoy-Matos AF de. Síndrome Metabólica. 1 ed. São Paulo: Atheneu. 2005: 259-276.
2. López-Diéguez Puerta M, Casal Esteban V, Barbado Hernández F, Gil Guerrero L, Rodríguez Molinero M, Larrauri J, *et al*., editors. Esteatohepatitis no alcohólica: el enigma de una mala evolucion. 2005: SciELO Espana.
3. Araya J, Rodrigo R, Videla LA, Thielemann L, Orellana M, Pettinelli P, *et al*. Increase in long-chain polyunsaturated fatty acid n-6/n-3 ratio in relation to hepatic steatosis in patients with non-alcoholic fatty liver disease. *Clinical Science*. 2004; 106(6): 635-43.
4. Salgado Jr W, Santos JS, Sankarankutty AK, Silva OC. Non-alcoholic fatty liver disease and obesity. *Acta Cirúrgica Brasileira*. 2006: 21(1).
5. Tan HH, Chang JPE. Non-alcoholic fatty liver disease. *Proceedings of Singapore Healthcare*, 2010: 19(1).
6. Kirovski G, Schacherer D, Wobser H, Huber H, Niessen C, Beer C, *et al*. Prevalence of ultrasound-diagnosed non-alcoholic fatty liver disease in a hospital cohort and its association with anthropometric, biochemical and sonographic characteristics. *International journal of clinical and experimental medicine*. 2010; 3(3): 202.
7. Vernon G, Baranova A, Younossi Z. Systematic review: the epidemiology and natural history of non-alcoholic fatty liver disease and non-alcoholic steatohepatitis in adults. *Alimentary pharmacology & therapeutics*. 2011; 34(3): 274-285.
8. Lê KA, Bortolotti M. Role of dietary carbohydrates and macronutrients in the pathogenesis of nonalcoholic fatty liver disease. *Current Opinion in Clinical Nutrition & Metabolic Care*. 2008; 11(4): 477.
9. Harrison SA, Day CP. Benefits of lifestyle modification in NAFLD. *Gut*. 2007; 56(12): 1760-9.
10. de Alwis NMW, Day CP. Non-alcoholic fatty liver disease: the mist gradually clears. *Journal of Hepatology*. 2008; 48: S104-S12.
11. Bellentani S, Scaglioni F, Marino M, Bedogni G. Epidemiology of non-alcoholic fatty liver disease. *Digestive Diseases*. 2010; 28(1): 155-61.
12. Zelber-Sagi S, Ratziu V, Oren R. Nutrition and physical activity in NAFLD: An overview of the epidemiological evidence. World journal of gastroenterology: *WJG*. 2011; 17(29): 3377.
13. Younossi Z. Review article: current management of non-alcoholic fatty liver disease and non-alcoholic steatohepatitis. *Alimentary pharmacology & therapeutics*. 2008; 28(1): 2-12.
14. Leite C, fernandes MG. Síndrome metabólica em idosos: explorando tendências atuais. Disponível em: <http://www.portaldoenvelhecimento.net/ artigos/artigo1710.htm>. Acesso em: 10 de outubro de 2006.
15. Who/Opas – World Health Organization. Organização Pan Americana da Saúde Envelhecimento ativo: uma política de saúde. Tradução: Suzana Gontijo. Brasília: Organização Pan Americana da Saúde, p. 1-62, 2005.
16. Brasil. Instituto Brasileiro de Geografia e Estatística (IBGE). Pesquisa Nacional por Amostra de Domicílios - PNAD 2001 – 2008; Brasil, 2008a. Disponível em: http://www.sidra.ibge.gov.br/pnad/default.asp/. Acesso em: 2. Fev. 2010.
17. Najas M, Pereira FAI, Nutrição. In: Freitas EV, Py L, Meri AL, Cançado FAX, Gorzoni ML, Rocha SM. Tratado de Geriatria e Gerontologia. 1 ed. Rio de Janeiro: Guanabara Koogan, p. 838-845, 2002.
18. Araya AV, Valera JM, Contreras B J, Csendes J A, Díaz JC, Burdiles P P, *et al*. Alteraciones de la tolerancia a la glucosa y frecuencia de síndrome metabólico en pacientes con enfermedad por hígado graso no alcohólico. *Revista médica de Chile*. 2006; 134(9): 1092-8.
19. Zamin I, Mattos AA, Perin C, Ramos GZ. A importância do índice AST/ALT no diagnóstico da esteatohepatite não-alcoólica. *Arq Gastroenterol*. 2002; 39(1): 22-6.
20. Capristo E, Miele L, Forgione A, Vero V, Farnetti S, Mingrone G, *et al*. Nutritional aspects in patients with non-alcoholic steatohepatitis (NASH). *European review for medical and pharmacological sciences*. 2005; 9(5): 265.
21. Le KA, Faeh D, Kreis R, Effect of a 6-day high fructose diet on insulin sensitivity and ectopic lipids in offspring of type 2 diabetic patients. *Diabetes and Vascular Disease Research*. 2007: 4.
22. Alessi MC, Bastelica D, Mavri A, Morange P, Berthet B, Grino M, *et al*. Plasma PAI-1 levels are more strongly related to liver steatosis than to adipose tissue accumulation. *Arteriosclerosis, thrombosis, and vascular biology*. 2003; 23(7): 1262-8.
23. Meugnier E, Bossu C, Oliel M, Jeanne S, Michaut A, Sothier M, *et al*. Changes in Gene Expression in Skeletal Muscle in Response to Fat Overfeeding in Lean Men* &ast. *Obesity*. 2007; 15(11): 2583-94.
24. Zelber-Sagi S, Nitzan-Kaluski D, Goldsmith R, Webb M, Blendis L, Halpern Z, *et al*. Long term nutritional intake and the risk for non-alcoholic fatty liver disease (NAFLD): a population based study. *Journal of Hepatology*. 2007; 47(5): 711-7.
25. Musso G, Gambino R, De Michieli F, Cassader M, Rizzetto M, Durazzo M, *et al*. Dietary habits and their relations to insulin resistance and postprandial lipemia in nonalcoholic steatohepatitis. *Hepatology*. 2003; 37(4): 909-16.
26. Brasil. Conselho Nacional de Saúde. Resolução CNS nº 196/96 – Diretrizes e Normas Regulamentadoras de Pesquisas Envolvendo Seres Humanos. Diário Oficial da União. 1996: 21082-5.
27. Gouveia ELC. Diagnóstico do estado nutricional da população. In: Chaves N. Nutrição básica e aplicada. Rio de Janeiro: *Guanabara Koogan*. 1978: 245-271.
28. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento De Atenção Básica. Envelhecimento e saúde da pessoa idosa. Brasília: Ministério da Saúde. 2006: 192.
29. Lipschitz DA. Screening for nutritional status in the elderly. *Primary care*. 1994; 21(1): 55.
30. Lobman TG, Houtkooper L, Going SB. Body fat measurement goes high-tech: not all are created equal. *ACSM's Health & Fitness Journal*. 1997; 1(1): 30.
31. WHO - World Health Organization. Obesity Preventing and Managing the Global Epidemic. Geneva, World Health Organization, 276 p., 1998.
32. Sociedade Brasileira de Cardiologia. I Diretriz Brasileira de Diagnóstico e Tratamento da Síndrome Metabólica. *Arquivos Brasileiros de Cardiologia*. 2005: 84(1): 1-27.

33. Fisberg RM, Martini LA, Slater B. Métodos de inquéritos alimentares. In: Fisberg RM, Slater B, Marchioni DML, Martini LA. Inquéritos Alimentares: métodos e bases científicos. 1 ed. São Paulo: Manole. 2005: 1-31.
34. American Gastroenterology Association, Medical Position Statement: Nonalcoholic fatty liver disease. *Gastroenterology*. 2002; 123: 1702-1704.
35. Wilson, SR. Withers, CE. O Fígado. In: Rumack CM, Wilson SR, Charboneau JW. Tratado de Ultrassonografia Diagnóstica. 3 ed. Rio de Janeiro: *Elsevier*. 2005: 79-145.
36. Arns BM, Moretti M, Moretti MP, Sakae TM, Bonatteli TH, Corrêa A, *et al*. Prevalência dos fatores de risco cardiovasculares nos pacientes atendidos no ambulatório de geriatria da UNESC. *Arquivos Catarinenses de Medicina*. 2009; 38(1).
37. Lima-Costa MFFL, Peixoto SV, César CC, Malta DC, Moura EC. Comportamentos em saúde entre idosos hipertensos, Brasil, 2006. *Revista de Saúde Pública*. 2009; 43(suppl 2): 18-26.
38. Cotrim HP, Parise ER, Oliveira C, Leite N, Martinelli A, Galizzi J, *et al*. Nonalcoholic fatty liver disease in Brazil. Clinical and histological profile. *Ann Hepatol*. 2011; 10(1): 33-7.
39. Brasil. Ministério da Saúde. Instituto Brasileiro de Geografia e Estatística (IBGE). Ministério do Planejamento, Orçamento e Gestão. Pesquisa de Orçamentos Familiares 2008-2009: antropometria e estado nutricional de crianças, adolescentes e adultos no Brasil. Rio de Janeiro, 2010.
40. Marucci MFN, Barbosa AR. Estado nutricional e capacidade física. In: Lebrão ML, Duarte YAO. SABE – Saúde, bem-estar e envelhecimento – O projeto SABE no município de São Paulo: uma abordagem inicial. 1 ed. Brasília: Organização Pan-Americana da Saúde, p. 93-117, 2003.
41. Anjos LA. Índice de massa corporal (massa corporal. estatura-2) como indicador do estado nutricional de adultos: revisão da literatura. *Rev Saúde Pública*. 1992; 26(6): 431-6.
42. Bedogni G, Pietrobelli A, Heymsfield SB, Borghi A, Manzieri AM, Morini P, *et al*. Is body mass index a measure of adiposity in elderly women? *Obesity*. 2001; 9(1): 17-20.
43. Cordeiro R, Moreira E. Avaliação nutricional subjetiva global do idoso hospitalizado. *Rev Bras Nutr Clin*. 2003; 18(3): 106-12.
44. Bueno JM, Martino HSD, Fernandes MFS, Costa LS, Silva RR. Avaliação nutricional e prevalência de doenças crônicas não transmissíveis em idosos pertencentes a um programa assistencial. *Ciênc Saúde Coletiva*. 2008; 13(4): 1237-46.
45. Krinski K, Elsangedy HM, Nardo Junior N, Soares IA. Efeito do exercício aeróbio e resistido no perfil antropométrico e respostas cardiovasculares de idosos portadores de hipertensão; Aerobic exercise and resistance effect on the anthropometric profile and cardiovascular responses in elderly people with high blood pressure. *Acta sci, Health sci*. 2006; 28(1).
46. Hammond KA. Avaliação dietética e clínica. In: Mahan LK, Escott-Stump S. Alimentos, nutrição e dietoterapia. 11°ed. São Paulo: *Rocca*. 2005: 391-481.
47. Brasil. Ministério da Saúde. Secretaria de Atenção Básica à Saúde. Departamento de Atenção Básica. Coordenação Geral da Política de Alimentação e Nutrição. Guia Alimentar para a população brasileira: promovendo a alimentação saudável. Brasília: Ministério da Saúde. 2006: 210.
48. Souza LAC, Teixeira CW, Rosely S, Aparecida MS, Fernanda LCM. Consumo de nutrientes em adultos e idosos em estudo de base populacional: Projeto Bambuí. *Cadernos de Saúde Pública*. 2005; 21.
49. Molina MCB, Cunha RS, Herkenhoff LF, Mill JG. Hipertensão arterial e consumo de sal em população urbana. *Rev Saúde Pública*. 2003; 37(6): 743-50.
50. Cotta RMM, Batista KCS, Reis RS, Souza GA, Dias G, Castro FAF, *et al*. Perfil sociossanitário e estilo de vida de hipertensos e/ou diabéticos, usuários do Programa de Saúde da Família no município de Teixeiras, MG. *Ciênc Saúde Coletiva*. 2009; 14(4): 1251-60.
51. Karnikowski M, Córdova C, Oliveira RJ, Karnikowski MGO, Nóbrega OT. Non-alcoholic fatty liver disease and metabolic syndrome in Brazilian middle-aged and older adults. *Sao Paulo Medical Journal*. 2007; 125(6): 333-7.
52. Jeong SK, Kim YK, Park JW, Shin YJ, Kim DS. Impact of visceral fat on the metabolic syndrome and nonalcoholic fatty liver disease. *Journal of Korean medical science*. 2008; 23(5): 789.