ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Impact of physical activity on the risk of developing non-communicable diseases – A study of 912 individuals from Laconia, Greece

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Manuscript Info

Manuscript History:

Received: 15 August 2015
Final Accepted: 22 September 2015
Published Online: October 2015

Key words:

Physical activity, non-communicable diseases, Laconia, Greece

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Abstract

The aim of the present study was to investigate the association between the physical activity levels and the risk for development of non-communicable diseases (NCDs) in the residents (35-65 years) of the Municipality of Laconia, Greece. A random sample of 912 individuals was selected from the population of Laconia, Greece. A quantitative questionnaire was employed for the collection of: demographic characteristics (age, height, weight, family status, education level, vocation, location), physical activity levels (during work, home and leisure time), and NCD risk-levels in 16 systems of the organism. T-test and ANOVA was carried out to determine differences between individuals based on demographic characteristics and multiple regression analysis to determine association between physical activity levels and risk for development of non-communicable diseases. Results showed that there are significant differences in physical activity between individuals with respect to the demographic characteristics studied. The leisure time physical activity levels were found to be significant determinants for the risk of development of NCDs. There is an inverse association, and the higher the physical activity levels of the individuals the lower is the risk for the development of NCDs. It is concluded that the increased levels of physical activity levels during leisure time lower the risk for the development of NCDs in the residents of the Municipality of Laconia, Greece aged 35-65 years. Health care professionals should strongly recommend individuals to adopt a more active lifestyle during leisure time and to exercise regularly in order to lower the risk for developing NCDs like obesity, diabetes type II, cardiovascular diseases and some types of cancer.

INTRODUCTION

Over the last century, the processes of industrialisation, urbanisation, economic and social development, and more recently globalisation have lead to rapid changes in the lifestyle of the people around the globe. As a result these phenomena led to millions of people suffering from health problems due to improper or poor nutrition, lack of physical activity and exercise, and other lifestyle behaviours like smoking and excessive alcohol consumption, which are well known to be harmful.

Scientific evidence has shown that lack of physical activity, inactivity and a sedentary lifestyle are independent risk factors for non-communicable diseases (Dunstan et al., 2012). Lack of physical activity is one of the major human-induced factors of unhealthy behaviour and has been associated with over 35 different diseases or anomalies, like cardiovascular diseases, type 2 diabetes mellitus, some types of cancer, hypertension, etc (Booth et al., 2002). In contrast, regular exercise is crucial and has many beneficial effects on a person's health as it improves balance, flexibility, mental health, and the quality of life in general, by helping in the prevention of non-communicable diseases. People who do not exercise regularly are twice as likely to develop cardiovascular and other diseases compared with those who exercise (Stocks et al., 2007).

Physical activity and regular exercise have been known to: (a) prevent or delay the onset of high blood pressure and decrease it in individuals that already suffer from hypertension (Whelton, 2002); (b) prevent or delay the development of type 2 diabetes (Yates et al., 2007) and reduce blood sugar levels in diabetic individuals (Boule, 2001); (c) improve balance and muscle strength and help prevent osteoporosis, thus reducing, inter alia, the number of accidents from falling and fractures of the bone (Warburtonet et al., 2006); (d) enhance the immune response of the body and help prevent depression (Warburtonet et al., 2006); (e) decrease the risk of developing cancer, including colon cancer and breast cancer (Martin-Moreno, & Soerjomataram Magnusson, 2008); and, (f) slow the aging process that is genetically programmed by the chromosomes of an individual and maintain their structure ten years younger (Cherkas et al., 2002).

Statistical data show that approximately 15% of the 1.6 million annually newly diagnosed non-communicable diseases are due to a sedentary lifestyle (Martin et al., 2009). Cardiovascular diseases are the leading cause of death and disability in Europe, as they cause over 4.3 million deaths each year (European Heart Network, 2008). Cardiovascular diseases account for almost half (49%) of the total deaths in Europe, including 30% of premature deaths (before age 65) (European Heart Network, 2008). Cancer is the second biggest cause of death in Europe, with 3 million new cases and 1.7 million deaths annually (Coleman et al., 2008). In 2002, 20% of all deaths in the European region were caused by cancer, which contributes by 11% to overall morbidity levels. The increasing prevalence of type 2 diabetes in Europe was recorded by WHO in 2003 to be 7.8%, with over 48 million adults aged 20 to 79 years of age suffering from diabetes (23 million in the EU), while in Central and Eastern Europe its incidence is higher (European Heart Network, 2008). Obesity and overweight are considered simultaneously non-communicable diseases and risk factors for them. Obesity increases the risk of developing diabetes, cancer and cardiovascular diseases and is responsible for over 1 million deaths annually (10-13% of deaths) and 12 million years of living with ill health each year in the European region, while the increased weight is responsible for a significant portion of the total disease burden in Europe (James, 2004).

In the last decades in Greece, the lack of physical activity and exercise and the adoption of a sedentary lifestyle along with bad eating habits, and the moving away from the Mediterranean diet has changed the disease profile of the Greek population by increasing the incidence of non-communicable diseases. In terms of life expectancy, Greece is in a relatively good position in the world rankings. According to the statistics presented by WHO (2010), Greece has an average life expectancy at birth of 79.5 years (76 for men and 82 for women). This ranks Greece in the 21st position globally and 11th in the European Union. The main causes of death in the Greek population in 2009, in descending order, were cardiovascular diseases, malignant neoplasms and cancer, the diseases of the respiratory system and external causes that are responsible for injuries and poisonings. In 2009, 43.3% of deaths in Greece were due to diseases of the circulatory system, while the malignant neoplasms and cancer accounted for 25.2% of deaths, respiratory diseases were responsible for 6.2%, with the remaining reasons to follow with much smaller percentages of the population (Terzopoulos & Sarafis, 2013).

There is an urgent need for the recording, study, evaluation and monitoring of dietary habits, physical activity levels and lifestyle of individual populations throughout Greece, as is done in other countries around the world. In this respect, the purpose of the current study was to explore relationships between the levels of physical activity at work, at home and during leisure time by the residents of the Municipality of Laconia that are middle-aged (35-65) and the dangers and the risks of developing non-communicable diseases.

Today, health systems and research centres spend the bulk of their resources to find ways for the treatment of illnesses. The great challenge for developed and developing countries, is to reverse this situation, and shift from a defensive policy of combating the disease to an aggressive and proactive approach to health promotion. The research provides information to scientists and the academic community, the medical and nursing staff, nutritionists, fitness instructors, local communities and the State authorities on the importance of physical exercise, particularly during leisure time. Similar research is rare in Greece and the health problems faced by the Greek population urgently need attention, and research studies need to be undertake in order to identify the points on which the Government and the scientific community needs to focus in order to address them effectively. Disease prevention helps a population to

improve levels of health and quality of life of its members and at the same time prevents the development of diseases that burden the healthcare system and the budget allocated to it by the State.

MATERIALS AND METHODS

Study design

The study uses the quantitative research paradigm and is based on primary information gathered with the help of a questionnaire. The objective of quantitative research is to find relations between various factors, in this case between the intensity of physical activity and risk for developing non-communicable diseases in 16 systems of the human organism.

Sample

This research is based on purposive sampling, as the selection of individuals was based on three criteria: participants had to be residents of the Municipality of Laconia, Greek citizens, in the 35 to 65 years age range. However, subsequently random sampling was applied, as each individual with these characteristics had the same probability of selection in the sample. The age range was chosen because these individuals are more prone to lifestyle related diseases, while the development of co-morbidity at older ages can create problems of reliability and validity in small samples. Individuals that are younger than 35 years on the other hand, show smaller frequencies of lifestyle related diseases, which in small samples may go undetected.

For validity and reliability purposes, the intention was to base the sample size at 2% of the permanent residents of the Municipality of Laconia that were middle aged (35-65), according to the latest census of the Greek population in 2011. The total population of the Municipality of Laconia in 2011 was 89,138 (±2.46%) permanent residents. In the general population of Greece, the proportion of people aged 35-65 was 38.11% (ELSTAT, 2012). Assuming that this applies to the Municipality of Laconia (although the mountainous or rural areas are characterised by older ages), the population of individuals aged 35-65 was 33,924 inhabitants. Thus, 2% corresponds to 1,020 permanent residents (± 2.46%). A total of 1,020 questionnaires were distributed to the residents of the Municipality of Laconia, but only 912 (89.41%) were returned to the researcher. The levels of non-response for various reasons amounted to 10.59%.

Measurements

All the necessary information was collected using a questionnaire that had three parts: (a) demographic characteristics (e.g., age, height, weight, family status, education level, vocation, and residential zone); (b) Physical Activity Levels Questionnaire for assessing physical activity at work, home and during leisure time; and, (c) the Nutritional Assessment Questionnaire for the determination of non-communicable disease risk-levels in 16 systems of the organism.

Physical activity was assessed by the use of a Physical Activity Questionnaire, which has been developed and evaluated for its reliability by the Department of Clinical Dietetics and Nutrition of the Harokopio University in Athens, Greece (Papakonstantinou, 2010). The questionnaire allows the determination of the levels of physical activity and energy consumption. The participants answer questions in three categories. The first category of questions records the physical activity levels at work, the second one relates to activities at home and the third to physical activity during leisure time (e.g., walking, cardio exercise, weight lifting, various sports etc.). The questionnaire has 20 questions with subcategories. Based on the responses participants were placed in three categories of physical activity: low, medium and high intensity.

The Nutritional Assessment Questionnaire was developed by Dicken Weatherby (2004), and has been used widely by the medical community for the assessment of risk associated with different systems of the human organism. This part of the questionnaire had a total of 270 questions. The scoring of the risk levels for each of the systems of the organism studied was determined based on the assessment instructions provided by Weatherby (2004).

Study Approval

The study was approved by the Bioethics Committee of the University of Peloponnese. Written informed consent was obtained from all individuals that agreed to participate in the study. For confidentiality purposes no personal details of the participants were recorded.

Statistical analysis

Continuous variables are presented as mean and standard deviation with maximum and minimum range, while categorical variables are presented as absolute and relative frequencies. Histograms and P-P plots were applied to evaluate the normality of the distribution of the continuous variables. BMI categories were calculated according to the proposed cut off points suggested by International Obesity Task Force (IOTF). Correlations between continuous variables were examined with the Pearson's product-moment correlation coefficient, after checking for the assumptions (e.g., linear relationship between the correlated variables, independency, homoscedacity and normality) with the use of scatterplots.

T-test and ANOVA was employed to assess the differences in the physical activity levels between the various groups based on the demographic characteristics. Comparisons were made based on sex, age groups, marital status, BMI, educational level, vocation and residential zone.

Multivariate linear regression analysis with the risk for non-communicable diseases in a particular system as the dependent outcome was carried out with the following determinants (independent variables): sex, age, BMI and three separate entries for physical activity at work, home and leisure time. In total, 16 multivariate linear regression analyses were performed that corresponded to the risk associated with the 16 different systems of the human organism studied. Normality of the residuals derived from the linear regression was tested using Kolmogorov-test and P-P plots, homoscedacity was evaluated by fitting scatterplots of standardised residuals against predicted values, the Variance Inflation Factor (VIF) was calculated to test for colinearity of the independent variables and the Durbin-Watson criterion was applied to evaluate serial dependency of BMI. Hosmer and Lemeshow's goodness of fit test was calculated in order to evaluate the model's goodness-of-fit and residual analysis was implicated using the dbeta, the leverage, and Cook's distance D statistics in order to identify outliers and influential observations.

All analyses were performed using the SPSS version 18.0 software for Windows (SPSS Inc., Chicago, Il, USA). Statistical significance level from two-sided hypotheses was accepted at the 5% level ($p \leq 0.05$).

RESULTS

Baseline characteristics of individuals

The demographic characteristics of the participants are presented in Table 1. From the 912 participants in the research 448 (49.1%) were men and 464 (50.9%) were women. The mean age of the participants was 49.71 ± 9.27 years (35, 65), the mean weight was 79.02 ± 16.43 kg (30, 151), the mean height was 171.48 ± 9.00 cm (150, 199), and the mean BMI was 26.75 ± 4.53 kg/m^2 (11, 47). The mean age of men was 52.19 ± 9.93 years (35, 65) and of women was 47.31 ± 7.90 (35, 65), the mean weight of men was 87.58 ± 13.50 kg (60, 141) the mean weight of women was 70.75 ± 14.70 kg (30, 151), the mean height of men was 177.56 ± 7.54 cm (155, 199) and of women was 165.60 ± 5.83 cm (150, 181), and mean BMI of men was 27.78 ± 3.73 kg/m^2 (21, 41) and of women was 25.78 ± 5.02 kg/m^2 (11, 47).

As far age groups are concerned 303 participants were 35-44 years (33.2%), 302 were 45-54 years (33.1%), and 307 were 55-65 years (33.7%). As far as marital status is concerned the majority of the participants 714 (78.3%) were married/partnered, while the rest 198 (21.7%) were single/divorced. As far as residential zone is concerned the participants in their majority lived in urban areas 416 (45.6%), while 332 (36.4%) lived in rural and 164 (18.0%) lived in semi-urban areas. As far as education level is concerned 518 (56.8%) of the participants had attained a maximum of high school education, while 322 (35.3%) had undergraduate, and 72 (7.9%) had postgraduate qualifications.

Table 1: Demographic characteristics

Continuous Variables		Mean ± SD
Age (y)		49.71 ± 9.27
Height (cm)		171.48 ± 9.00
Weight (kg)		79.02 ± 16.43
BMI (kg/m2)		26.75 ± 4.53
Age	Men	52.19 ± 9.93
	Women	47.31 ± 7.90
Height (cm)	Men	177.56 ± 7.54
	Women	165.60 ± 5.83

Weight (kg)	Men	87.58 ± 13.50
	Women	70.75 ± 14.70
BMI ((kg/m2)	Men	27.78 ± 3.73
	Women	25.78 ± 5.02
Categorical Variables		N (%)
Sex	Men	448 (49.1%)
	Women	464 (50.9%)
Age Group	35-44	303 (33.2%)
	45-54	302 (33.1%)
	55-65	307(33.7%)
Marital Status	Single/Divorced	198 (21.7%)
	Married/Partnered	714 (78.3%)
Residential Zone	Urban	416 (45.6%)
	Semi-Urban	164 (18.0%)
	Rural	332 (36.4%)
Educational Level	≤12	518 (56.8%)
	Undergraduate	322 (35.3%)
	Postgraduate	72 (7.9%)
Vocation	Farmer	188 (20.6%)
	Self-Employed	286 (31.4%)
	Civil Servant	140 (15.4%)
	Private Sector Employee	140 (15.4%)
	Other	158 (17.3%)
	Unemployed	168 (18.4%)
BMI Category	Underweight <20)	6 (0.7%)
	Normal (20-25)	373 (40.91%)
	Overweight (26-30)	343 (37.6%)
	Obese (31-40)	178 (19.5%)
	Strongly Obese (>40)	12 (1.3%)

As far as the their employment is concerned 286 (31.4%) were self-employed, 188 (20.6%) were famers, 140 (15.4%) were civil servants, 140 (15.4%) were employees of the private sector, 158 (17.2%) had other form of employments, and 168 (18.4%) were unemployed. As far as BMI category is concerned, the majority, 373 (40.9%) were of normal weight, (20-25), 343 (37.6%) were overweight, 178 (19.5%) were obese (31-40), 12 (1.3%) were severely obese (>40). Only 2 out 5 had normal weight.

The physical activity levels of the participants are presented in Table 2. Of the 912 participants the majority, 696 (76.3%) participants stated that they had moderate intensity physical activity during work, 197 (21.6%) participants had low intensity, while just 19 (2.1%) participants had high intensity (e.g., heavy occupations). As far as the levels of physical activity at home are concerned, the majority-612 (67.1%) had low and 300 (32.9%) moderate intensity. Finally, as far as physical activity during leisure time is concerned, the majority of participants, 602 (66.0%) participants had low intensity, which means that they were not doing any form of exercise, 228 (25.0%) participants had moderate, which means they undertook some form of exercise such as walking or swimming, while only 82 (9.0%) participants exercised regularly in gyms or participated in any athletic activities (e.g., soccer, basketball, yoga, jogging, etc.). Overall, the middle-aged residents of the Municipality of Laconia exhibit moderate to low levels of physical activity in their lives, while very few exercise, with what this entails for their physical condition and the chances of developing non-communicable diseases and anomalies.

Table 2:Physical activity levels

Physical Activity Levels	Intensity	N (%)
Work	*Low*	197 (21.6%)
	Medium	696 (76.3%)
	High	19 (2.1%)
Home	*Low*	612 (67.1%)
	Medium	300 (32.9%)
	High	-
Leisure Time	*Low*	602 (66.0%)
	Medium	228 (25.0%)
	High	82 (9.0%)

The risk levels for developing non-communicable diseases are presented in Table 3. From the primary data collected it becomes evident that a large part of the population of the Municipality of Laconia faces problems related to all the systems of the organism studied. More specifically, the number of individuals that have a high risk for developing non-communicable diseases and anomalies include: 148 (16.2%) have problems related to the upper gastrointestinal system, 56 (6.1%) have problems related to the liver and gallbladder, 78 (8.6%) have problems related to the small intestines, 36 (3.9%) have problems related to the large intestines, 26 (2.9%) have problems related to the lack of minerals, 378 (41.4%) have problems related to the lack of essential amino acids, 338 (37.1%) have problems related to the carbohydrate metabolism, 138 (15.1%) have problems related to the lack of vitamins, 220 (24.1%) have problems related to the adrenal glands, 142 (15.6%) have problems related to the hypophysis, 190 (20.8%) have problems related to the thyroid, 24 (5.4%) men have andrologic problems, 110 (23.7%) women have gynaecologic problems, 188 (20.6%) have problems related to the cardiovascular system, 152 (16.7%) have problems related to the kidneys and bladder, και 72 (7.9%) have problems related to the immune system.

The number of individuals that have a moderate risk for development of diseases and anomalies include: 196 (21.5%) have problems related to the upper gastrointestinal system, 138 (15.1%) have problems related to the liver and gallbladder, 144 (15.8%) have problems related to the small intestines, 126 (13.8%) have problems related to the large intestines, 80 (8.8%) have problems related to the lack of minerals, 224 (24.6%) have problems related to the lack of essential amino acids, 200 (21.9%) have problems related to the carbohydrate metabolism, 192 (21.1%) have problems related to the lack of vitamins, 186 (20.4%) have problems related to the adrenal glands, 318 (34.9%) have problems related to the hypophysis, 166 (18.2%) have problems related to the thyroid, 26 (5.8%) men have andrologic problems, 124 (26.7%) women have gynaecologic problems, 186 (20.4%) have problems related to the cardiovascular system, 122 (13.4%) have problems related to the kidneys and bladder, και 286 (31.4%) have problems related to the immune system. Possibly the low level of andrologic problems reported does not reflect reality, as many Greek men tend to hide problems related to their genitals because they are ashamed, and generally they are reluctant to speak about problems related to them.

Table 3: Risk levels for developing non-communicable diseases

SYSTEMS	Low Risk	Medium Risk	High Risk
Upper Gastrointestinal System	568 (62.3%)	196 (21.5%)	148 (16.2%)
Liver and Gallbladder	718 (78.7%)	138 (15.1%)	56 (6.1%)
Small Intestines	690 (75.7%)	144 (15.8%)	78 (8.6%)
Large IntestinesP	750 (82.2%)	126 (13.8%)	36 (3.9%)
Mineral Needs	806 (88.4%)	80 (8.8%)	26 (2.9%)
Necessary Amino Acids	310 (34.0%)	224 (24.6%)	378 (41.4%)
Carbohydrate Metabolism	374 (41.0%)	200 (21.9%)	338 (37.1%)
Vitamin Needs	582 (63.8%)	192 (21.1%)	138(15.1%)
Adrenal	506 (55.5%)	186 (20.4%)	220 (24.1%)
Hypophysis	452 (49.6%)	318 (34.9%)	142 (15.6%)
Thyroid	556 (61.0%)	166 (18.2%)	190 (20.8%)
Andrologic	398 (88.8%)	26 (5.8%)	24 (5.4%)
Gynaecologic	230 (49.6%)	124 (26.7%)	110 (23.7%)
Cardiovascular System	538 (59.0%)	186 (20.4%)	188 (20.6%)

Kidneys and Bladder	638 (70.0%)	122 (13.4%)	152 (16.7%)
Immune System	554 (60.7%)	286 (31.4%)	72 (7.9%)

Comparisons between groups

There were statistically significant differences among the different parameters studied with respect to physical activity at work: (a) between men (1.88±0.40) and women [1.73±0.476, t(910)=5.046, p=0.0005). The difference was however small (eta2=0.03). Men are involved in vocations that need greater physical activity and strength to a greater extent than women. (b) Among the three age groups [F(2, 910)=16.678, p=0.0005]. The difference was however small (eta2=0.03). The mean value of the age group 35-44 (1.86±0.42) was statistically greater than that for the age group 45-54 (1.86±0.40) and the age group 55-65 (1.69±0.50). The data shows that physical activity at work becomes less at the ages 55-65. (c) Among different BMI groups [F(2, 910)=6.938, p=0.0005]. The difference was however small (eta2=0.02). The mean value for normal individuals (1.73±0.48) was statistically different from that for the overweight (1.88±0.41). Overweight individuals are more active at work than normal individuals. (d) Among the three educational levels [F(2, 910)=11.652, p=0.,0005]. The difference was however small (eta2=0.02). The mean value for high school graduates (1.77±0.48) was statistically different compared to the one for undergraduates (1.80±0.42) and postgraduates (2.04±0.20). Physical activity at work increases as educational level increases. (e) Among different vocations [F(2, 910)=43.325, p=0.0005]. The difference was quite large (eta2=0,16). The mean value for the farmers (1.77±0.51) was statistically different from the one for the private sector employees (1.99±0.27), and the self-employed individuals (1.91±0.34). Farmers have lower levels of physical activity at work than self-employed individuals and private sector employees, which is very worrying.

There were statistically significant differences among the different parameters studied with respect to physical activity at home: (a) Among men (1.10±0.30) and women [1.55±0.50, t(910)=-16.527, p=0.0005]. The difference was very large (eta2=0.23). Women, as is traditionally held in Greece, undertake the responsibilities of the house to a greater extent than men. (b) Among single/divorced (1.59±0.75) and married/partnered individuals [1.39±0.62, t(910)=3.833, p=0.0005]. The difference was however small (eta2=0.01). Single individuals, possibly because of fewer responsibilities have more time to undertake physical activities like exercise during leisure time. (c) Among BMI groups [F(2, 910)=10.306, p=0.0005]. The difference was however small (eta2=0.03). The mean value of the obese individuals (1.22±0.42) is statically different to the one for normal weight individuals (1.1±0.50) and overweight individuals (1.37±0.48). Obese individuals have lower physical activity levels at home than normal weight and overweight individuals. (d) Among vocations F(2, 910)=8.399, p=0.0005]. The difference was however small (eta2=0.03). The mean value for civil servants (1.41±0.49) is statistically different from the one of the self-employed individuals (1.25±0.44), and private sector employees (1.26±0.44). Civil servants have higher physical activity levels at home compared to self-employed individuals and private sector employees.

There were statistically significant differences among the different parameters studied with respect to physical activity during leisure time: (a) Among age groups[F(2, 910)=3.914, p=0.020]. The difference was however small (eta2=0.01). The mean value of the age group 35-44 (1.47±0.68) is statistically different from the one for the age group 45-54 (1.47±0.70), and age group 55-65 (1.35±0.58). Physical activity during leisure time decreases at the ages of 55-65. (b) Among BMI groups [F(2, 910)=5.358, p=0.001]. The difference was however small (eta2=0.03). The mean value of normal weight individuals (1.51±0.70) is staticially different from the one for obese individuals (1.30±0.55). Normal weight individuals have higher levels of physical activity during leisure time than obese individuals. (c) Among education levels [F(2, 910)=15.993, p=0.0005]. The difference was however small (eta2=0.03). The mean value of high school graduates (1.34±0.58) is statistically different from the one for undergraduates (1.51±0.70), and postgraduates (1.74±0.81). Physical activity during leisure time increases as educational level increases. (d) Among vocations [F(2, 910)=7.002, p=0.0005]. The difference was however small (eta2=0.03). The mean value for private sector employees (1.56±0.72) is statistically different from the one for the self-employed individuals (1.25±0.44), and civil servants (1.41±0.49). Private sector employees have greater physical activity levels during leisure time than self-employed individuals and civil servants. (e) Among residential zones [F(2, 910)=24.517, p=0.0005]. The difference was however small (eta2=0.05). The mean value for the urban zones (1.56±0.70) was statically different from the one for the semi-urban (1.49±0.70) and the rural zones (1.24±0.51). Physical during leisure time decreases as we pass from urban, to semi-urban and rural zones of residence.

Multiple Regression Analysis – Determinants of Risk Levels for Development of non-Communicable Diseases

A multiple regression equation was identified for each of the 16 systems studied. The r-squared and standardised beta values are presented in Table 4. From the analysis it becomes evident that sex is a contributing factor for all systems studied, and women face greater risks than men. BMI is also a major determinant and affects risk in all systems studied except the liver/ gallbladder and kidney/bladder, and the greater the BMI the greater is the risk. Age is also a determinant for seven of the systems studied and as age increases risk in these systems is lowered. This is a paradox as problems usually increase as individuals grow older and can only be explained on the basis that the risks for developing non-communicable diseases by the residents of the Municipality of Laconia have started to develop at earlier ages. Physical activity at work increases risk for carbohydrate regulation and kidneys/bladder, while physical activity at home increases the risk for the upper gastrointestinal system and the large intestines. Finally, physical activity during leisure time lowers the risk for developing non-communicable diseases in all of the 16 systems studied.

Table 4: Multiple Regression Analysis of Physical Activity vs. Risk Levels for Each System

	F(6. 905)	R^2(p=0.0005)	SEX	BMI	AGE	PHYSICAL ACITIVTY WORK	PHYSICAL ACTIVITY HOME	PHYSICAL ACTIVITY LEISURE TIME
	StandardisedBeta							
Upper Gastrointestinal System	15.927	0.096	0.113	0.180	-0.098		0.116	-0.142
Liver and Gallbladder	12.156	0.075	0.212	0.084				-0.095
Small Intestines	11.588	0.071	0.161	0.124	-0.102			-0.087
Large Intestines	6.738	0.043	0.105		-0.096		0.075	-0.072
Mineral Needs	11.278	0.070	0.203	0.085				-0.067
Necessary Amino Acids	19.089	0.112	0.281	0.151	-0.085			-0.081
Carbohydrate Metabolism	6.297	0.079	0.218	0.129	-0.087	0.073		-0.104
Vitamin Needs	7.919	0.050	0.163	0.130				-0.110
Adrenal	6.811	0.043	0.180	0.087				-0.074
Hypophysis	16.059	0.096	0.235	0.125	-0.066			-0.058
Thyroid	15.306	0.092	0.286	0.155				-0.087
Andrologic	3.588	0.039		0.145				-0.101
Gynaecologic	6.886	0.070		0.155	-0.134			-0.132
Cardiovascular System	14.944	0.090	0.248	0.195				-0.110
Kidneys and Bladder	5.063	0.032	0.162			0.085		-0.074
Immune System	3.873	0.025	0.112	0.071				-0.091

DISCUSSION

The findings of the present investigation showed that residents of the Municipality of Laconia follow a sedentary lifestyle with reduced physical activity in the workplace and at home, but also during leisure time. From the evidence gathered it appears that physical activity at work decreases as age increases, especially at the 55-65 age range. Men as usual participate in occupations with greater demands on physical activity, while women are more active at home, and as is customary in Greece undertake cooking and cleaning activities more frequently than men. Farmers have less physical activity at work than the self-employed and private employees, a fact that is extremely worrying since it is paradox (due to the manual tasks in agricultural activities that require higher physical activity levels). Civil servants have more physical activity at home that self-employed individuals and civil servants, since they seem to have more time to devote to household activities.

Few of the permanent residents of the Municipality of Laconia exercise regularly, while most of them prefer to watch television or sit rather than walk or exercise. Only 1 in 4 has moderate intensity physical activity during leisure time (e.g., walking, swimming, etc.), while only 1 in 10 exercise regularly (e.g. gym, sports, etc.).

Women are slightly more active than men in their leisure time, but the difference is very small and statistically insignificant. Single individuals have more intense physical activity in their leisure time than married individuals, perhaps because they have less obligations and the time to devote to exercising. It was also found that as the educational level increases the individuals have higher intensity physical activity during leisure time, perhaps because they are more aware of the benefits that may arise. The residents of urban and semi-urban zones have greater physical activity during leisure time than those in rural areas. Also, from the evidence gathered, it appears that physical activity during leisure time decreases at the ages 55-65. People with obesity have lower levels of physical activity at work, home and during leisure time. Finally, private sector employees have more physical activity in their free time compared to self-employed individuals and civil servants.

The risk levels that have been identified by the research for the 16 systems of the human organism are also a cause for concern. The risk levels associated with the upper gastrointestinal system, the needs for amino acids, the metabolism of carbohydrates, the adrenal glands, the pituitary, the thyroid, the gynaecological problems, the cardiovascular and the immune systems are extremely alarming, as problems, big and small, are reported by over a third of the population studied. Multiple regression analysis results showed that physical activity during leisure time significantly reduces the problems that are associated with all systems of the human organism studied and increases in the intensity of physical activity and exercise can prevent the development of non-communicable diseases.

The lifestyle that has been adopted in the developed world over the past decades has led to the reduction of the opportunities for individuals to consume energy, when they move from one place to another, in their working environment or at home (Koplan & Dietz, 1999). The dramatic decrease of physical activity in developing countries is attributed to urbanisation, and the increased availability of motor means of transport, which have replaced walking and cycling, and the widespread use of machinery in the workplace instead of manual tasks (Swinburn et al., 2004). Scientists have increasingly pointed out that regular physical activity constitutes a key element for the prevention of obesity and weight control. Apart from the basic role in maintaining a healthy body weight, regular physical activity reduces the risk inter alia of coronary heart disease, stroke, type 2 diabetes, colon and breast cancer, osteoporosis, fractures, osteoarthritis, depression and erectile dysfunction (Dunstan et al., 2012). Important health benefits have also been associated with walking for half an hour a day, but also greater reductions of risk for a longer duration or intensity physical activity (Greenhaff & Hargreaves, 2011).

The guidelines on physical activity levels that have been employed internationally, recommend that all healthy adults between the ages of 18 and 65 years, should undertake moderate intensity aerobic physical activity (i.e. strength) for at least 30 minutes, five days per week, or vigorous-intensity aerobic exercise for at least 20 minutes, three days each week (Haskell et al., 2007). Moderate intensity physical activity relates to the consumption of 3.5-4.3 kcal/min (e.g., walking at 5-7 km/hour or cycling at 8-14 km/hour), while vigorous-intensity physical activity relates to the consumption of ≥7.0 kcal/min (e.g., walking at > 8 km/hour or cycling at >16 km/h). In a prospective study that was undertaken by Wen et al. (2011), 416,175 men and women were observed over a period of twelve years, from 1996 to 2008. Compared to the inactive group, those that exercised regularly for 15 minutes a day had a 14% lower risk of death from all causes and over 3-years longer life expectancy. Each additional 15 minutes of daily exercise further reduced mortality by 4% and the risk of death from cancer by 1%.

Limitations

The investigation was based mainly on recall questionnaires. Many scientists have raised doubts about the effectiveness of recall questionnaires (Michael &Hiller, 1991), due to the reduced memory of the participants or the deliberately incorrect answers that may be given, as many of the items listed can be considered interference in personal life or personal data, and may lead to wrong conclusions. Also, the questionnaire that was developed for the survey made extensive use of scientific terminology, although attempts were made to make its language as simple as possible. However, in many cases it had to be filled out by the participants with the help of the researcher in order to avoid mistakes. Despite the efforts made, the researcher cannot ascertain whether the questionnaires were filled out correctly by the participants.

The individual questionnaire for the assessment of the physical activity levels and the one for the assessment of the non-communicable risk factors have been used separately in many surveys. However, they have never been used in conjunction for finding associations between physical activity and non-communicable disease risk factors. This creates doubts as to their effectiveness in capturing the correct data required and whether these correspond to the reality.

The methodology of this research was based solely on quantitative methods, as they allow the approach of a larger sample of the population and statistical analysis of the data collected. However, the use of mixed methods with the application of quantitative and qualitative tools (e.g., semi-structured interviews, focus groups, observation) may have led to different results and conclusions, or provided more detail, allowing better or more extensive

collection of information. Mixed methods would have allowed the triangulation of the data and increased the validity of the research. Future surveys will need to take this into consideration.

Although the sample used in this study was fairly large, representing approximately 2% of the permanent residents of the Municipality of Laconia, possibly it was not enough to uniquely identify the physical activity levels and the risk levels for the development of non-communicable diseases. Moreover, from the total 1.204 questionnaires that were distributed only 912 (89.41%) were returned to the researcher. The level of non-response for various reasons was 10.59%. The results may have been different if there was 100% participation, as people that refused to participate may not have done it for random reasons.

CONCLUSIONS

All individuals must be oriented towards adopting a healthy lifestyle, which involves a proper diet and regular exercise in order to lower the risk for development of many non-communicable diseases. The ideal would be to adopt this healthy lifestyle from childhood and throughout life, because this will help individuals to have well-being and good health throughout their life.

The findings of the present study showed a significant impact of physical activity on the risk for development of non-communicable diseases that involve 16 systems of the human organism studied. However further research is needed to analyse the relationship between physical activity levels and specific problems that can develop in the human body and the intensity of physical activity may not by itself be a unique determinant. Significant impact is expected from the frequency and type of physical activity (e.g., aerobic exercise, weight training, sport, etc.). Future investigations should focus not only on the intensity of physical activity, but also on other factors such as the type and frequency. The questionnaires adopted should assess all aspects of physical activity, as well as the energy consumption related to it during specific time periods.

The methodology of this research was based on the quantitative research paradigm. However, a more integrated approach using both quantitative and qualitative primary data collection methods should provide a more complete picture on the lifestyle and physical activity levels of the permanent residents of the Municipality of Laconia. There is also a need for research that includes other regions of the Greek territory, so that comparisons can be made, enabling more in-depth generalisations to the wider population of Greece.

ACKNOWLEDGEMENTS

The authors want to thank the study subjects for their willingness to participate. This study was conducted with the support of the University of Peloponnese.

The authors report no conflict of interest in the reporting of the data.

REFERENCES:

1. Booth, F.W. and Chakravarthy, M.V. (2002): Cost and **c**onsequences of sedentary living: New Battleground for an Old Enemy, 2002. President's Council of Physical Fitness and Sports Research Digest, Series 3 (16). President's Council on Physical Fitness and Sports, Washington, D.C.

2. Boule, N.G., Haddad, E., Kenny, G.P., Wells, G.A. and Sigal, R.J. (2001): Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. J. Am. Med. Assoc., 286 (10): 1218–1227.

3. Cherkas, L.F., Hunkin, J.L., Kato, B.S., Richards, J.B., Gardner, J.P., and Surdulescu, G.L. (2008): The association between physical activity in leisure time and leukocyte telomere length. Arch. Intern. Med., 168 (2): 154–158.

4. Coleman, M. P. Alexe, D.M., Albreht, T. and McKee, M. (2008): Responding to the challenge of cancer in Europe. Ljubljana: Institute of Public Health of the Republic of Slovenia.

5. Dunstan, D., Howard H., Healy, G.N. and Owen, N. (2012): Too much sitting—a health hazard. Diabetes Res. Cl. Pract.,97(3): 368–376.

6. ELSTAT-Greek statistics agency. Statistical data for the Greek population, Athens, Greece: ELSTAT.

7. European Heart Network European cardiovascular disease statistics (2008): Brussels, European Heart Network.

8. Greenhaff, P. L. and Hargreaves, M. (2011). Systems biology in human exercise physiology: is it something different from integrative physiology? J. Physiol.,589(5): 1031–1036.

9. Haskell, W.L., Lee, I.M., Pate, R.R. (2007): Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Med. Sci. Sports Exerc.39:1423-1434.

10. Hiller, J.E., Michael, A.J. (1991): Ecological studies. In: Margetts,B.M. and Nelson, M. (eds.) Design concepts in nutritional epidemiology. New York, NY: Oxford University Press.

11. James,W.P., Jackson-Leach, R., Ni Mhurchu, C., Kalamara, E.,Shayeghi, M., Neville, N.J., Nishida, C., and Rodgers, A. (2004): Comparative quantification of health risks: global and regional burden of disease attribution to selected major risk factors. Geneva: World Health Organisation.

12. Koplan J. P. and Dietz, W. H. (1999): Caloric imbalance and public health policy. J. Am. Med. Assoc., 282: 1579–81, 1999.

13. Martin, C.K., Church, T.S., Thompson, A.M., Ernest, C.P. and Blair, C.N. (2009): Exercise dose and quality of life: a randomized controlled trial. Arch. Intern. Med., 169:269-278.

14. Martin-Moreno, J.M, Soerjomataram, I. and Magnusson, G. (2008): Cancer causes and prevention: A condensed appraisal in Europe in 2008. Eur. J. Cancer, 44 (10): 1390–1403.

15. Papakonstantinou, A. (2010): The effects of protein uptake for glycaemic response in individuals with type 2 diabetes mellitus. Doctoral thesis, Harokopio University, Athens, Greece.

16. Stocks T., Lindahl B. and Stattin P. (2007): Hälsosam livsstil tycks minska risken for cancer. Nytt stöd for hypotesen att övervikt och högt blodsocker ökar cancerrisken [A healthy lifestyle seems to lower the risk of cancer. New evidence for the hypothesis that overweight and high blood sugar increase the risk of cancer]. Läkartidningen, 104 (51–52): 3867–3870.

17. Swinburn, B., Egger, G. and Raza, F. (1999): Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. Prev. Med., 29(6): 563–570.

18. Warburton D.E., Nicol C.W. and Bredin, S.S. (2006): Health benefits of physical activity: the evidence. Can. Med. Assoc. J., 174 (6):801–809.

19. Weatherby, D. (2004): Signs and symptoms analysis from a functional perspective–A question by question guide (2nd Ed.), USA: Bear Mountain Publishing.

20. Wen, C.P., Wai, J.P., Tsai, M.K., Yang, Y.,C., Cheng, T.Y.D.,Lee, M.C., Chan, H., T., Tsao, C.T., Tsai, S.P. and Wu, X.W. (2011): Minimum amount of physical activity for reduced mortality and extended life expectancy: A prospective cohort study. Lancet, 378:1244-1253.

21. Whelton, S.P., Chin, A., Xin, X. and He, J. (2002): Effect of aerobic exercise on blood pressure: A meta-analysis of randomized, controlled trials. Annals Intern. Med., 136 (7): 493–503.

22. World Health Organisation (WHO) Regional Office for Europe (2011): Risk factors. Geneva, Switzerland: WHO Regional Office for Europe.

23. Yates, T., Khunti, K., Bull, F., Gorely,T. and Davies, M.J. (2007): The role of physical activity in the management of impaired glucose tolerance: A systematic review. Diabetologia, 50(6): 1116–1126.

24. Terzopoulos,B. and Sarafis, P. (2015):The general health of the Greek population today. Indicators and factors of the deterioration of health, morbidity and mortality indicators. The contribution of prevention, health promotion and health education. Greek Mag. Nurs.Scie., 5(2):15-25.