Morphological and functional changes of cardiovascular system in postmenopausal women

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Abstract. – *Background:* The incidence of cardiovascular events in reproductive age women is 3 times lower than in men, whereas this ratio noticeably changes on menopausal beginning. Postmenopausal women are more exposed to the effects of risk factors, which are present in a noticeably different entity in physiological or surgical menopause; and in the latter wether on substitutive hormonal treatment or not.

Methods: This study, carried out in Rome and Latina, has involved 743 postmenopausal women, of whom 545 with physiological menopause and 198 with iatrogenic menopause.

Results: The average blood pressure value as well as the incidence of hypertension, hypercholesterolemia, diabetes mellitus, obesity and smoking have a significantly different trend in physiological versus iatrogenic postmenopausal women; and in the latter wether on substitutive hormonal treatment or not.

Conclusions: Studying life-style and evaluating risk factors in postmenopausal women, and giving an up-to-date view about the prevalence oh health conditions at risk, will allow us to promote both primary and secondary prevention actions.

Key Words:

Postmenopausal, Risk factors, Cardiovascular system.

Introduction

Menopause is a very delicate and important moment during the life of a woman. In fact, a lot of psychological and physical changes can be studied during this time. In the past, in medical science, menopause has always been considered not important, according to the spreading of a lot of cultural and moral prejudices against it. Today

cardiovascular disease (CVD), in particular coronary heart disease (CHD), is the first cause of death in postmenopausal women. For many years, male was the only sex considered in each study of the incidence of CHD risk factors, because the incidence of cardiovascular diseases was greater in males than females, according to the aging of the patient (young males suffer from CHD more than young females) and considering a greater mortality in the male group. Before menopause, the incidence of CVD in women is one third of the incidence of CVD in men, but in postmenopausal women there is an important change in this trend. After menopause, CHD is the first cause of death in women: 36% of women between 55 and 64 years and 55% of women over 75 are affected by this disease. Besides, 40% of all coronary events are fatal for women. Today, the incidence of CVD is lower in women before the age of 50 than in men (even if the lifestyle of a woman is the same of a man) but with aging such difference is cut down and the incidence of CVD can reach or even go beyond the male one. According to such data, there is an important relationship between menopause and morbidity and mortality caused by CVD, but the other aspect to consider is the social impact of menopause. In fact, within one generation women over 60 have increased from 9% to 13%. In the last 20 years a lot of factors, such as a lower number of births, the reduction of mortality, a longer lifetime and the increased prevalence of females in the population, especially in older population, have modified demographical characteristics of Italian population. According to this demographical trend, there is an increased number of older females (and so postmenopausal women) in the population. The goal of this work is to study the health and the lifestyle of women

Table I. Morphological and functional modification of cardiovascular system in postmenopausal women N° 743 Pz.

ASA Group	Number of patients	Percentage of total patient population
I	2485	76.4
II	739	22.7
III	32	0.9

after menopause. Furthermore, we give an up- to-date view about the prevalence of all risk factors that can be modified with a primary and secondary prevention.

Materials and Methods

During 24 months, 743 postmenopausal women have been studied at the Department of Obstetrics and Gynaecology and Cardiology Service (placed in Latina) of the University "La Sapienza" of Rome, Italy. Postmenopausal women were studied, indipendently from age (in the literature studies have been carried out in women of age 45 to 75). The onset of the menopause was determined by history, gynaecological exam, pelvic echo-doppler study and trans-vaginal echo-doppler study. In few participants, blood hormones were determined, as needed. All data were organized in two different groups: (A) physiological postmenopausal women; (B) surgical postmenopausal women. Each group was divided in two other groups, according to substitutive hormonal therapy (SHT) or not. Each subgroup was further classified according to the age interval (Table I). The method used to identify samples and collect risk factors (Table II), is the same used in other epidemiologic studies and widely described in the literature[2,3,4]. Young specializing physicians have been enrolled to make screening works while researches were employed to guarantee the quality of parameters and data obtained. All data have been shown using the average parameter for continuous variables and the proportion parameter for categorical variables, age-related, and considering Italian population in 2001. Because a lot of epidemiological studies[5-8] have shown there is a different prevalence of cardiovascular risk factors in a population according to the social, cultural and economic class considered, in this study some parameters, such as the incidence of arterial hypertension, diabetes mellitus, obesity and smoking, have been be analysed considering the cultural class of participants. The type of school attended (secondary school, high school and university) has been considered a good indicator of economic and social class: the incidence of cardiovascular risk factors has been studied within each of the 3 previous groups.

Results

Demographical Trend

Figure 1 shows the different delivery of the aging in Italian population in 1970 and 1995 (IS-TAT data), in order to obtain a technical comparison a for each age-group studied

Table II.

In each group the following parameters have been processed: months of menopause, SHT use and SHT timelength using, school attendance (secondary school, high school and university), age, height (cm), weight (kg), BMI, blood pressure (systolic and diastolic), familiarity with CVD, arterial hypertension (timelength and treatment), diabetes mellitus (timelength and treatment), dyslipidemia (timelength and treatment), hyperuricemia (timelength and treatment), clotting factors, CHD (presence of coronary heart disease), peripherical vasculopathy (arterial and venous), smoking, diet (Mediterranean diet and vegetarian diet), sport.

The method used to obtain pathological data about all these factors consists of two different parts: anamnestic data and diagnostic exams.

For example, the patient knew her disease, or evidence of abnormal values in association with clear abnormal signs by diagnostic tools were found out.

Arterial hypertension: abnormal blood pressure level + abnormal homely control blood pressure levels + abnormal echocardiogram + abnormal fundus oculi exam.

Diabetes Mellitus: high fasting blood glucose level + abnormal oral glucose tolerance test

Dyslipidemia: (abnormal fasting values, after a 20 days diet): this group encloses patients with hypercholesterolemia, or hypercholesterolemia + hypertriglyceridemia, or high LDL-cholesterol levels + hypertriglyceridemia

Hyperuricemia: several abnormal fasting blood lipids after a diet of 20 days.
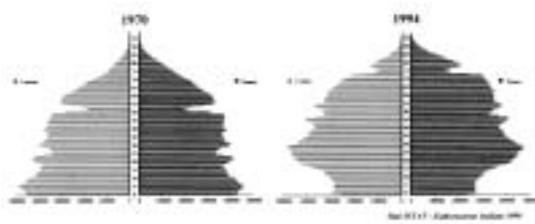
Figure 1. Age Pyramid ad for 1970 and as for 1994.

The outcome of the present study has been reported in tables and charts.

Waching the above, the statistical difference among the various groups is clearly understood and its significativity is confirmed by the T-Student value written next.

Cardiovascular risk factors
- Tables IIIa and IIIb show the delivery of systolic and diastolic blood pressure respectively found in physiological and iatrogenic postmenopausal women. The T-Test is calculated.
- Tables IVa and IVb respectively show the percentage of hypertensive physiological and iatrogenic postmenopausal women.
- Tables Va and Vb respectively show the percentage of physiological and iatrogenic postmenopausal women affected by dyslipidemia
- Tables VIa and VIb respectively show the percentage of physiological and iatrogenic postmenopausal women affected by diabetes mellitus
- Tables VIIa and VIIb respectively show the delivery of BMI in physiological and iatrogenic postmenopausal women. The T-test is calculated.
- Tables VIIIa and VIIIb respectively show the percentage of smoking physiological and iatrogenic postmenopausal women.
- Tables IXa and IXb show the percentage of smoking physiological and iatrogenic postmenopausal women in relation to educational qualification.

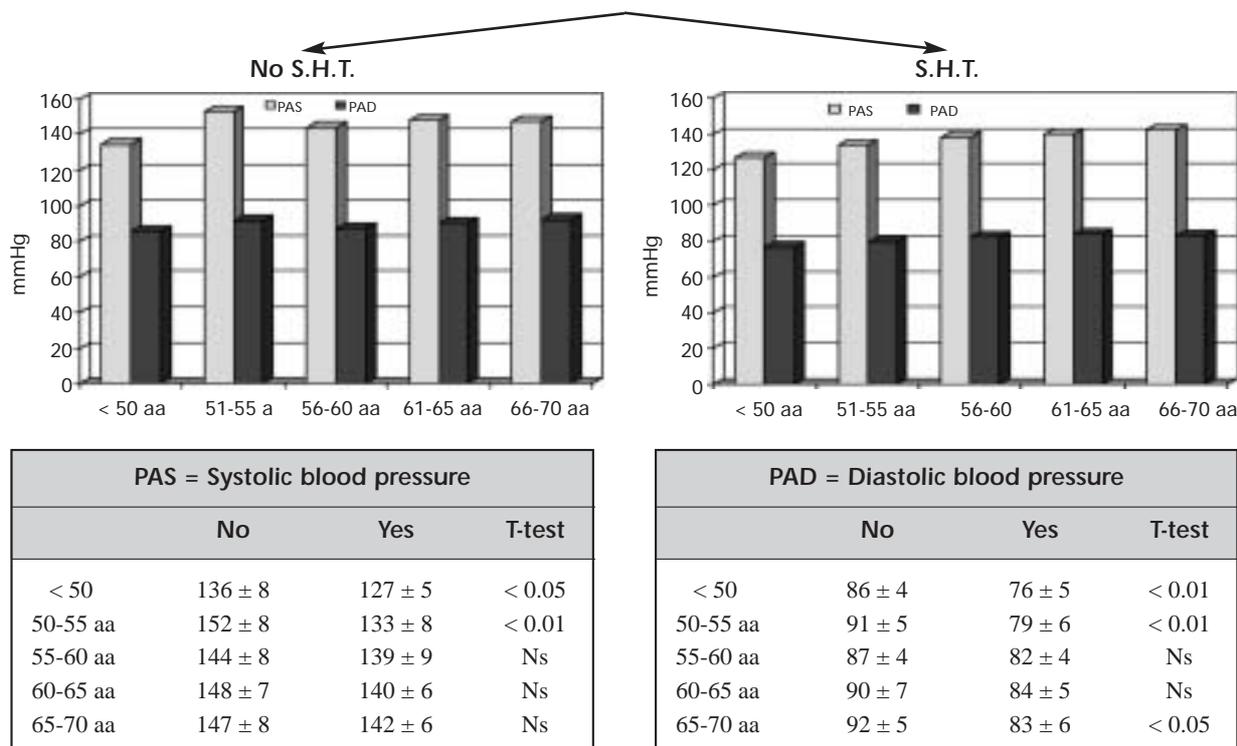**Table IIIA.** Systolic and diastolic blood pressure in physiological postmenopausal women.
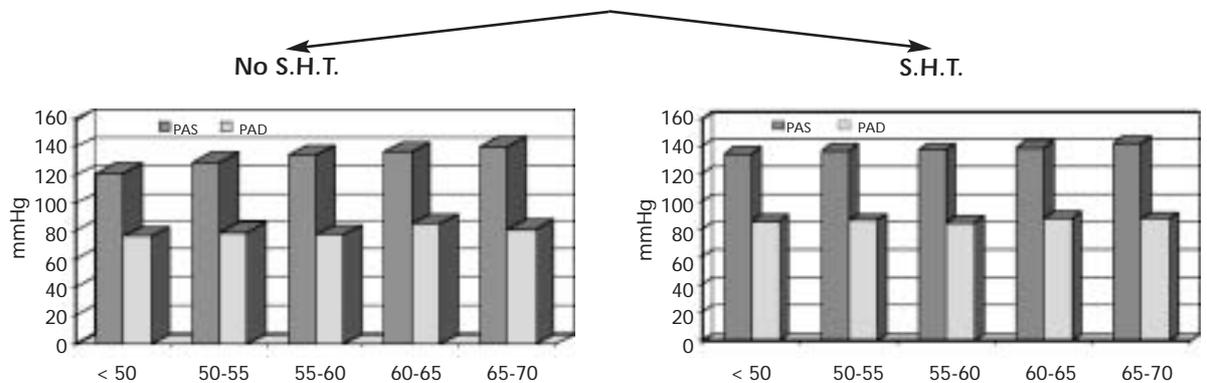
PAS = Systolic blood pressure			
	No	**Yes**	**T-test**
< 50	122 ± 6	135 ± 7	< 0.01
50-55 aa	130 ± 5	137 ± 4	< 0.05
55-60 aa	135 ± 9	138 ± 6	Ns
60-65 aa	137 ± 7	140 ± 8	Ns
65-70 aa	141 ± 6	143 ± 7	Ns

PAD = Diastolic blood pressure			
	No	**Yes**	**T-test**
< 50	77 ± 5	86 ± 6	< 0.05
50-55 aa	80 ± 4	87 ± 5	< 0.05
55-60 aa	78 ± 5	85 ± 5	< 0.05
60-65 aa	86 ± 6	89 ± 6	Ns
65-70 aa	82 ± 7	88 ± 7	Ns

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table IIIB. Systolic and diastolic blood pressure in surgical postmenopausal women.

PAS = Systolic blood pressure			
	No	**Yes**	**T-test**
< 50	136 ± 8	127 ± 5	< 0.05
50-55 aa	152 ± 8	133 ± 8	< 0.01
55-60 aa	144 ± 8	139 ± 9	Ns
60-65 aa	148 ± 7	140 ± 6	Ns
65-70 aa	147 ± 8	142 ± 6	Ns

PAD = Diastolic blood pressure			
	No	**Yes**	**T-test**
< 50	86 ± 4	76 ± 5	< 0.01
50-55 aa	91 ± 5	79 ± 6	< 0.01
55-60 aa	87 ± 4	82 ± 4	Ns
60-65 aa	90 ± 7	84 ± 5	Ns
65-70 aa	92 ± 5	83 ± 6	< 0.05

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Conclusions

In the last century, in our Country, the involvement of women in all demographical changes has been more important than the involvement of men, if we consider a higher lifetime (and so a higher postmenopausal timelength) and an increased role of women in work-life of the society of our times. The menopause is a very important break-point in the life of a woman, because it plays a role for many psychological and biological changes of the woman, and for very important changes in mortality and morbidity coefficients. In healthy people, cardiovascular diseases are the most frequent statistically. A lot of cardiovascular risk factors worsen during postmenopausal time and according to some authors, some risk factors, like smoking, can bring on an anticipation of menopause. Considering the study outcome, several interesting data are already known, but others may be new.
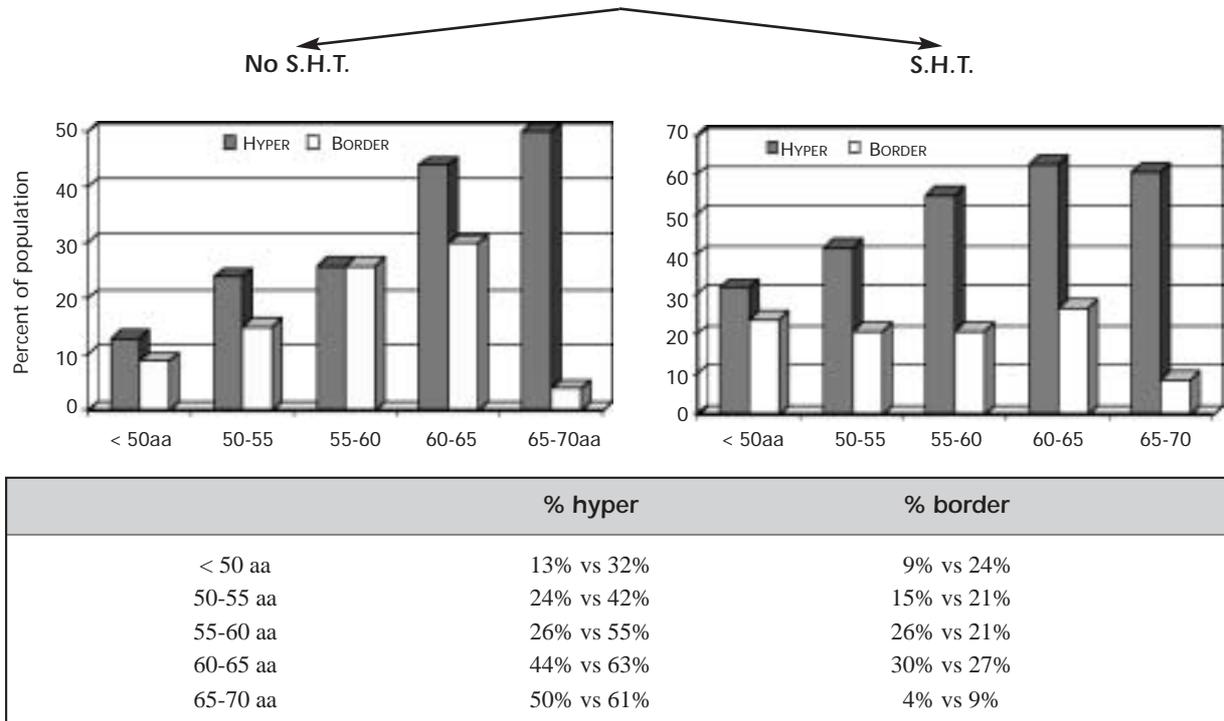
• Many just known cardiovascular risk factors (such as arterial hypertension, diabetes mellitus, dyslipidemia, obesity, clotting disorders and smoking) increase with the post-

menopausal duration, but such increase occurs with a significant statistical difference between physiological and iatrogenic postmenopausal women, and, among the latter, between women taking SHT and women who don't.

• We confirm, as reported in the literature, that risk factors have a different impact in physiological postmenopausal women, according to SHT or not. But we do not share literature's data about the complete lack of such an impact in women on SHT. As for the latter group risk factors are present but with a different trend and impact, especially age-related and treatment duration-related.

• In the group of surgical postmenopausal women, cardiovascular risk factors (such as arterial hypertension, diabetes mellitus, dyslipidemia, obesity, clotting disorders and smoking) show up and increase with postmenopausal timelegth, but in a different manner compared to physiological menopause. Women on SHT show a lower incidence in cardiovascular risk compared to the ones without SHT, but the percentage difference tapers to become statistically insgnificant with menopausal aging and increase in treatment duration.
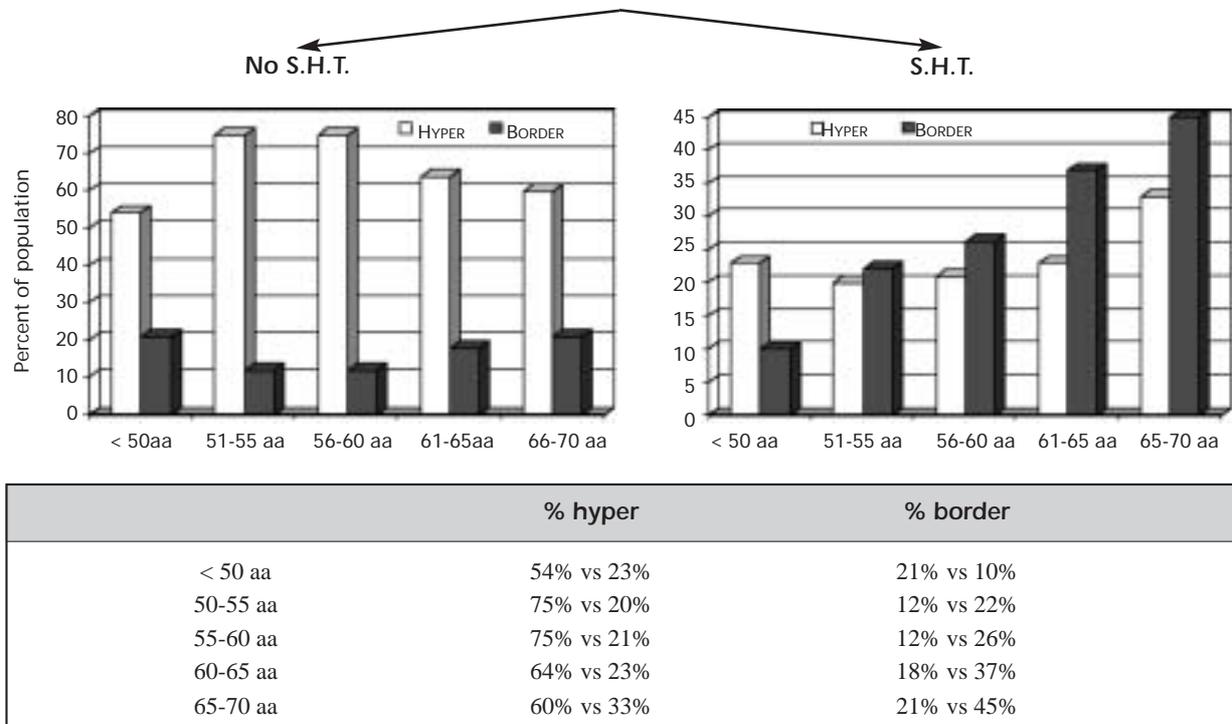
Table IVA. Percentage of hypertensive physiological postmenopausal women

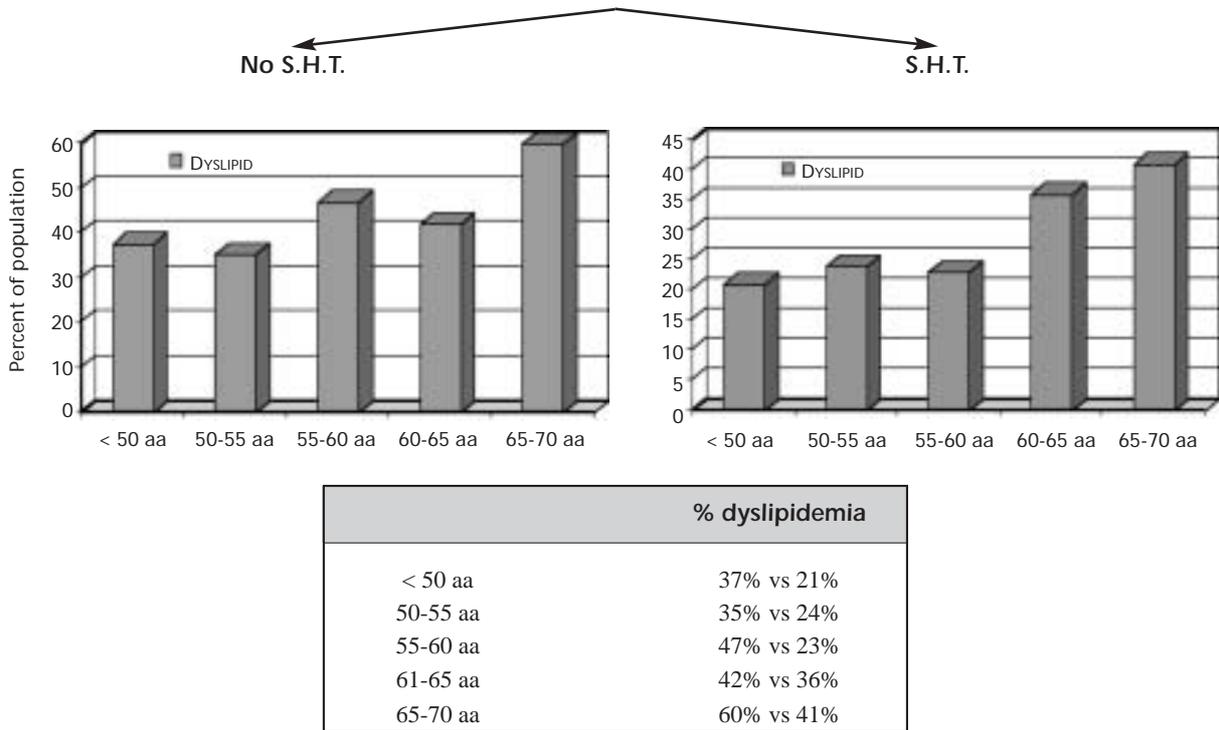|	% hyper	% border
< 50 aa	13% vs 32%	9% vs 24%
50-55 aa	24% vs 42%	15% vs 21%
55-60 aa	26% vs 55%	26% vs 21%
60-65 aa	44% vs 63%	30% vs 27%
65-70 aa	50% vs 61%	4% vs 9%

Hyper = % hypertensive; Border = % Border-line; No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table IVB. Percentage of hypertensive surgical postmenopausal women.

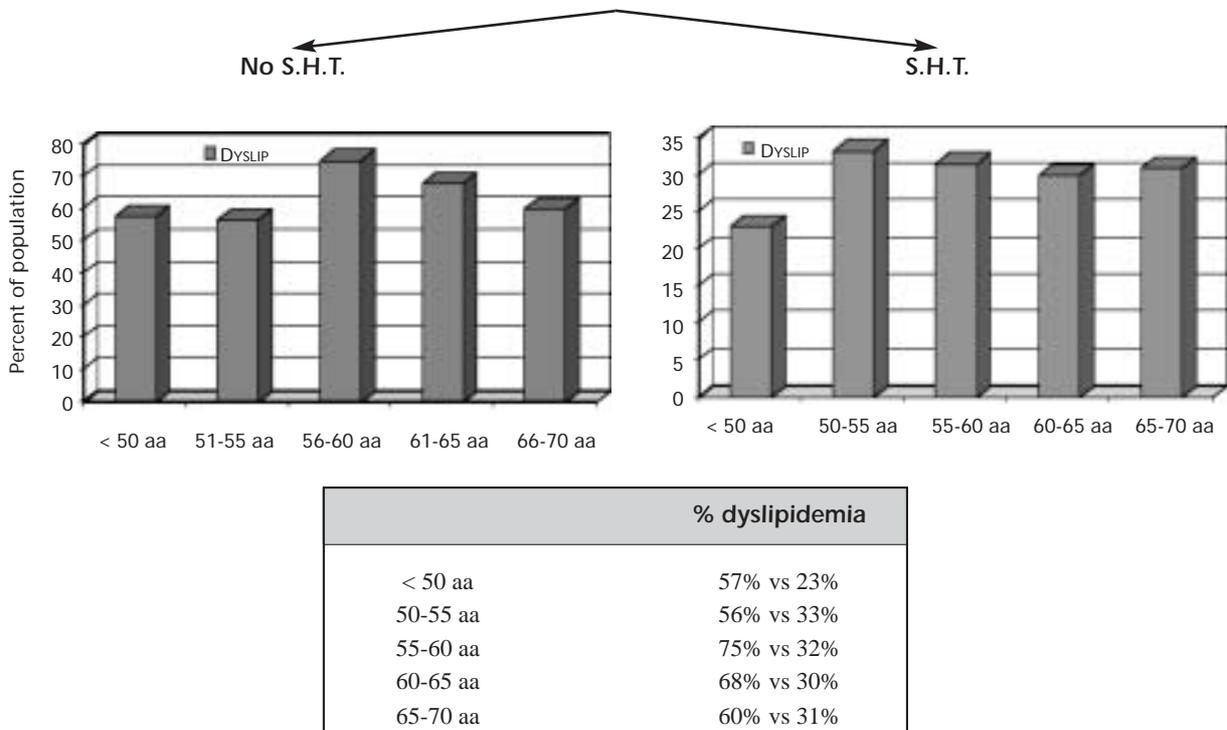|	% hyper	% border
< 50 aa	54% vs 23%	21% vs 10%
50-55 aa	75% vs 20%	12% vs 22%
55-60 aa	75% vs 21%	12% vs 26%
60-65 aa	64% vs 23%	18% vs 37%
65-70 aa	60% vs 33%	21% vs 45%

Hyper = % hypertensive; Border = % Border-line; No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table VA. Percentage of physiological postmenopausal women affected by dyslipidemia.

No S.H.T.   S.H.T.

	% dyslipidemia
< 50 aa	37% vs 21%
50-55 aa	35% vs 24%
55-60 aa	47% vs 23%
61-65 aa	42% vs 36%
65-70 aa	60% vs 41%

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table VB. Percentage surgical postmenopausal women affected by dyslipidemia.

No S.H.T.   S.H.T.

	% dyslipidemia
< 50 aa	57% vs 23%
50-55 aa	56% vs 33%
55-60 aa	75% vs 32%
60-65 aa	68% vs 30%
65-70 aa	60% vs 31%

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table VIA. Percentage of physiological postmenopausal women affected by diabetes.

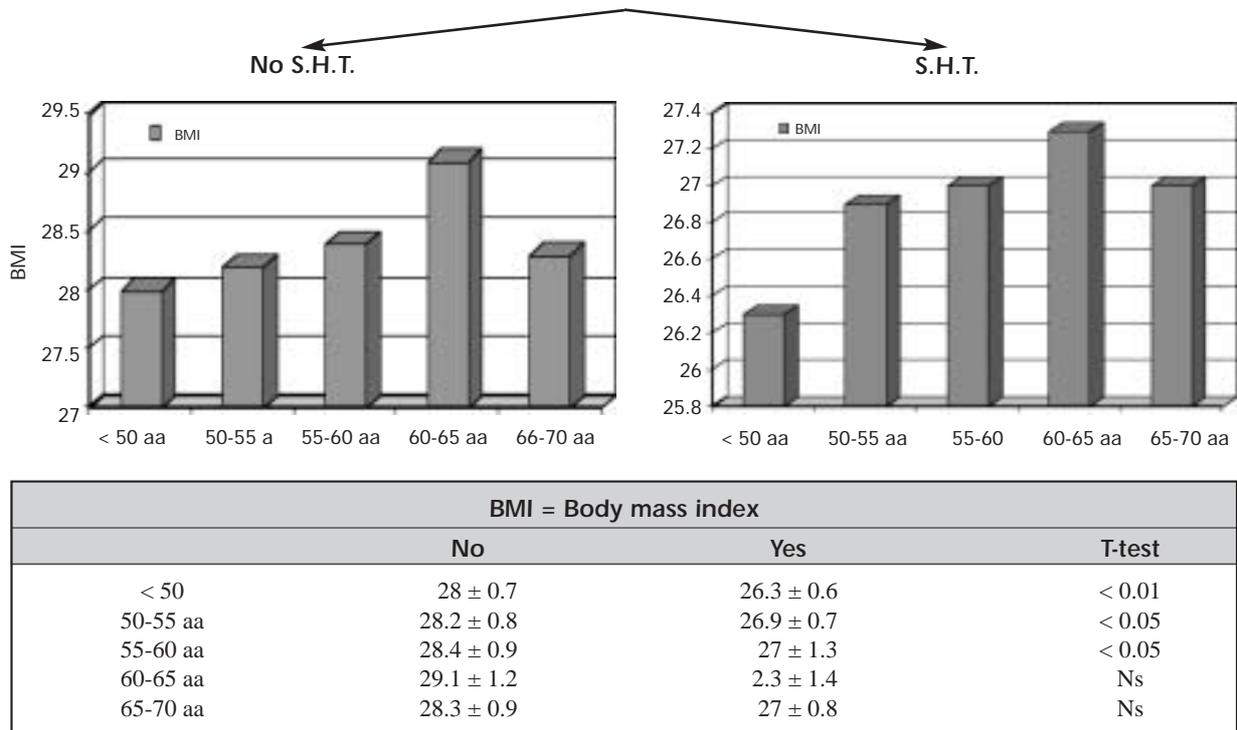|	% diabetes
< 50 aa	12% vs 11%
50-55 aa	9% vs 12%
55-60 aa	12% vs 10%
60-65 aa	10% vs 9%
65-70 aa	60% vs 18%

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table VIB. Percentage surgical postmenopausal women affected by diabetes.

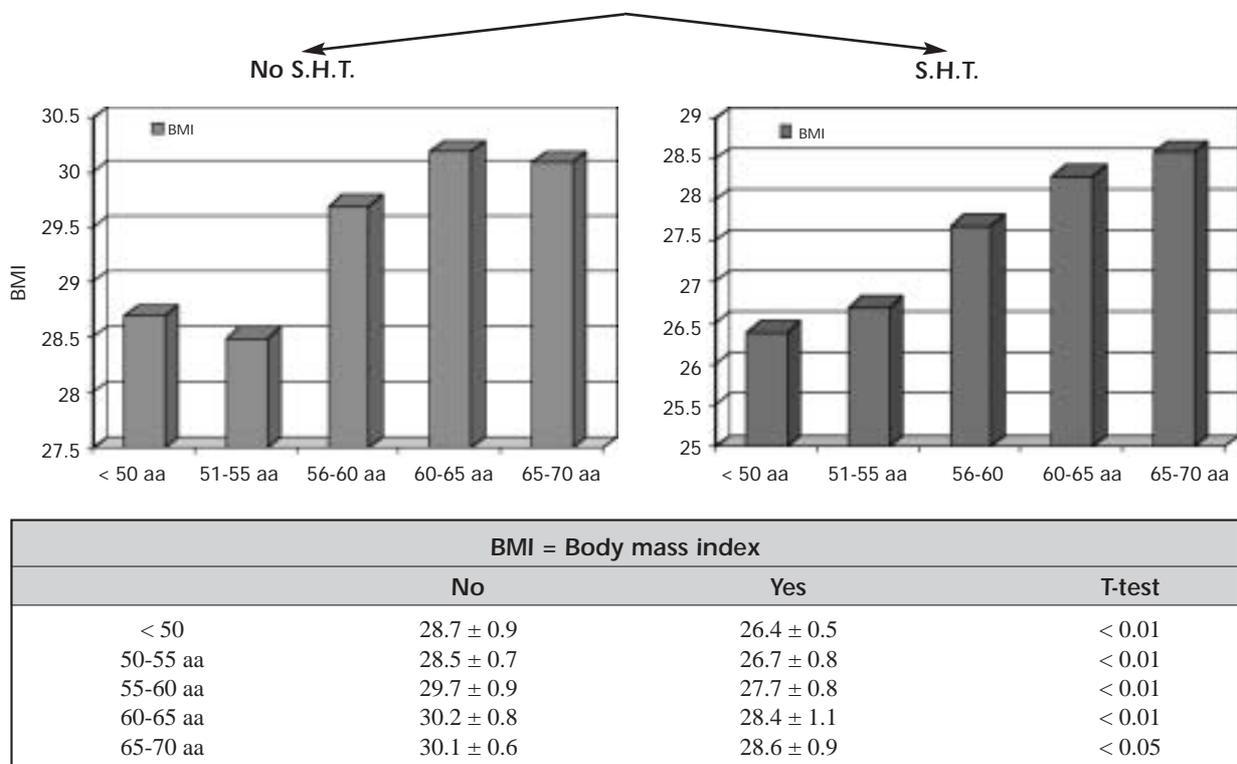|	% diabetes
< 50 aa	18% vs 8%
50-55 aa	12% vs 16%
55-60 aa	25% vs 21%
60-65 aa	28% vs 25%
65-70 aa	30% vs 26%

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table VIIA. The delivery of BMI in physiological postmenopausal women.

No S.H.T.   S.H.T.

BMI = Body mass index			
	No	**Yes**	**T-test**
< 50	28 ± 0.7	26.3 ± 0.6	< 0.01
50-55 aa	28.2 ± 0.8	26.9 ± 0.7	< 0.05
55-60 aa	28.4 ± 0.9	27 ± 1.3	< 0.05
60-65 aa	29.1 ± 1.2	2.3 ± 1.4	Ns
65-70 aa	28.3 ± 0.9	27 ± 0.8	Ns

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table VIIB. The delivery of BMI in surgical postmenopausal women.

No S.H.T.   S.H.T.

BMI = Body mass index			
	No	**Yes**	**T-test**
< 50	28.7 ± 0.9	26.4 ± 0.5	< 0.01
50-55 aa	28.5 ± 0.7	26.7 ± 0.8	< 0.01
55-60 aa	29.7 ± 0.9	27.7 ± 0.8	< 0.01
60-65 aa	30.2 ± 0.8	28.4 ± 1.1	< 0.01
65-70 aa	30.1 ± 0.6	28.6 ± 0.9	< 0.05

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

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Table VIIIA. The percentage of smoking physiological postmenopausal women.

	% smok	% ex smok
< 50 aa	37% vs 24%	0% vs 0%
50-55 aa	15% vs 27%	20% vs 0%
55-60 aa	12% vs 25%	24% vs 4%
60-65 aa	9% vs 20%	16% vs 5%
65-70 aa	6% vs 16%	15% vs 9%

No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table VIIIB. The percentage of smoking surgical postmenopausal women.

	% smok	% ex smok
< 50 aa	26% vs 16%	14% vs 0%
50-55 aa	22% vs 24%	19% vs 0%
55-60 aa	18% vs 18%	21% vs 5%
60-65 aa	12% vs 14%	25% vs 10%
65-70 aa	5% vs 10%	28% vs 13%
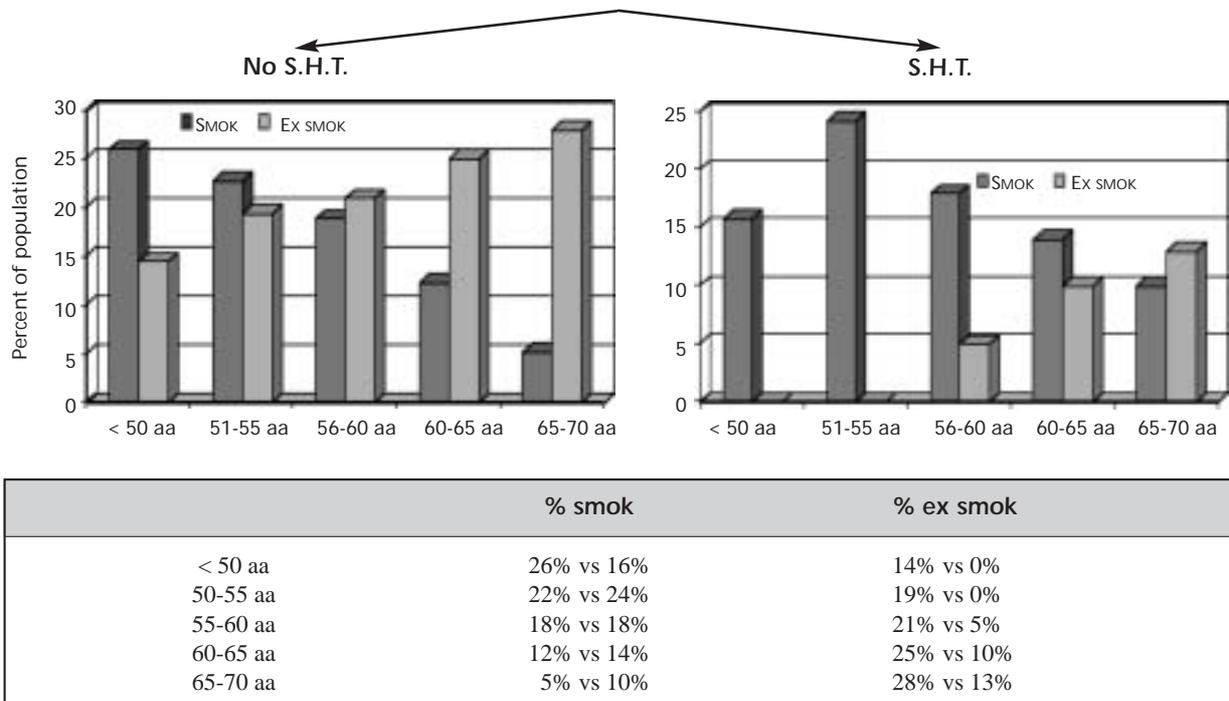
No S.H.T. = substitutive hormonal therapy not; S.H.T. = substitutive hormonal therapy.

Table IXA. The percentage of smoking physiological postmenopausal women in relation to educational qualification.

No S.H.T.
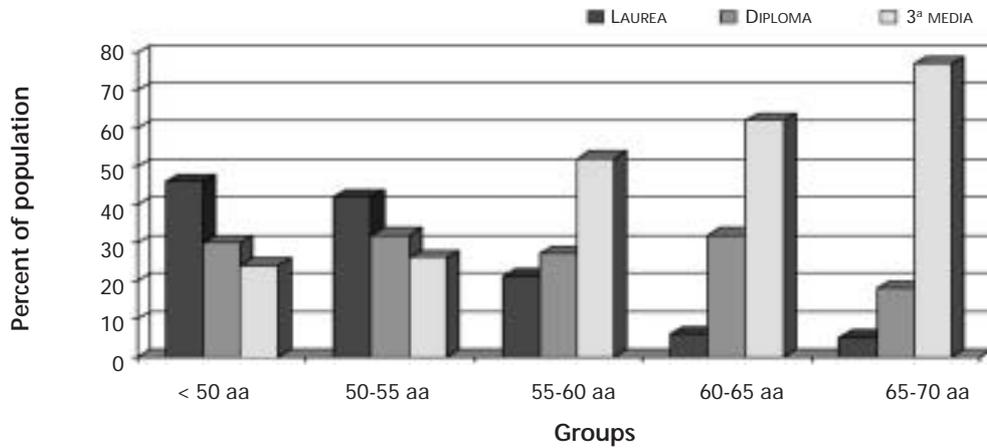
No S.H.T. = substitutive hormonal therapy not.

In agreement with other authors, the presence of cardiovascular risk factors in elderly women shows we need specific indicators of health (morbidity, mortality, prevalence of cardiovascular risk factors) for a better using of primary and secondary prevention, and to precociously identify all those conditions that can improve quality of life in this population.

Women over 65, the most vulnerable, are today a large part of world population and demographic studies show a steady increasing trend for the next years[16].

Many authors have shown that a good change of lifestyle during menopausal time, and in presence of cardiovascular risk factors, can reduce morbidity and mortality for CVD also in elderly women[17].

According to other authors, a good lifestyle during premenopause improves health conditions in later years. All these strategies can improve the life-quality and lifetime, and reduce public health system expense[18-20]. In agreement with other works, we have found that some social and economic factors, pointed out by cultural level,

Table IXB. The percentage of smoking physiological postmenopausal women in relation to educational qualification.

S.H.T.
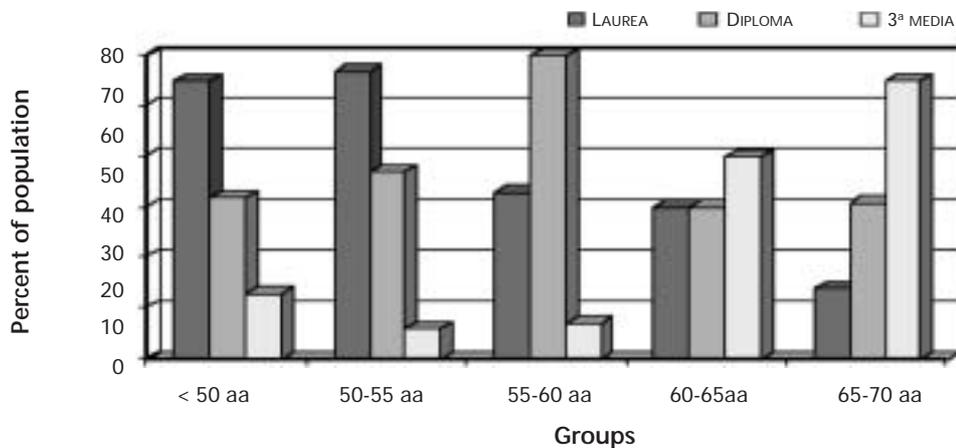
S.H.T. = substitutive hormonal therapy.

are related to risk factors increase. Our study has highlighted as the level of education rises, the blood pressure level decreases, BMI decreases, diabetes mellitus and obesity decrease in incidence. This trend may be due to a greater care that highly cultured women address towards health problems, or to a better compliance of such women to specific drug treatment improving therapeutic outcome. An opposite trend is true for smoking, which is more spread in social classes with average-high level of education. According to some psychologists, this particular trend seems to be the consequence of the feeling of competition/revenge felt by women against men[21,23].

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