PREVALENCE, AWARENESS, TREATMENT AND SOCIO-ECONOMIC AND DEMOGRAPHIC DETERMINANTS OF HYPERTENSION AMONG ADULTS IN SALÉ-MOROCCO IN 2021: A CROSS-SECTIONAL SURVEY

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ABSTRACT

Background: Hypertension (HTN) is a major risk factor for cardiovascular disease. The purpose of this study was to assess the prevalence, awareness, treatment, and socio-economic and demographic risk factors of HTN in the adult population of Salé, Morocco. **Methods:** A cross-sectional study was conducted, in February 2021, using a stratified probabilistic sampling plan with two stages. Based on a questionnaire, we gathered information on hypertension and some socio-economic and demographic variables. **Results:** The overall prevalence of HTN among adults (18 years and older, N = 1308) in Salé was 10.2% (n = 133, 95% CI: 8.6%, 11.9%). This prevalence was equal to that recorded nationally in 2018; 8.2% of men and 12.0% of women were hypertensive. HTN prevalence increased with age in both sexes. Among hypertensive people, 96.2% (n = 128, 95% CI: 92.0%, 98.6%) were aware of their disease, and 73.9% (n = 98, 95% CI: 65.7%, 80.6%) were following regular treatment for raised blood pressure. It was also found that gender, age, educational level, marital status, occupation, smoking status, being either head of the household or not, and diabetes status were significantly associated with hypertension. **Conclusion:** Salé city is dealing with a serious and multiple health problems (stroke, myocardial infarction, renal failure, arteriopathy of the lower limbs, and risk of fetal mortality…) as well as costly therapy. Our research suggests that decision-makers and healthcare management in Salé should pay more attention to developing adequate hypertension preventive and treatment strategies.

Keywords: Prevalence, Hypertension, Epidemiology, Chronic disease, Risk factors, Salé-Morocco.

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*****Published in March 15, 2022*

INTRODUCTION

Non communicable diseases (NCDs), such as heart disease, stroke, cancer, diabetes, and chronic lung disease, account for over 70% of all deaths globally, according to the World Health Organization (WHO). Almost three-quarters of all NCD deaths occur in low and middle income countries, as do 82% of the 16 million people who die prematurely, or before reaching the age of 70 [1].

Hypertension, or high blood pressure, is a key risk factor for the development of various NCDs, including heart and brain illnesses. In 2015, the prevalence of hypertension was highest in low-income nations (28.4%) and lowest in high-income countries (17.7%), according to disaggregation by World Bank country income groups [2].

In terms of morbidity, Morocco is undergoing an epidemiological transition, transforming the global burden of morbidity caused by infectious diseases and perinatal problems into NCDs. Indeed, the state of health in Morocco is characterized by a significant decrease in mortality related to infectious diseases and a significant increase in the burden of morbidity related to NCDs, reflecting profound changes in the country's epidemiological structure [3]. As a result, NCDs, such as raised blood pressure (Hypertension), became a major public health problem in Morocco. Based on the 2018 National Survey on Population and Family Health (NSPFH-2018), the estimated reported prevalence of hypertension among adults (18 years and above) was 10.2%. Compared to men (6.9%), women (13.4%) had a higher frequency [4]. Furthermore, the National Survey on Common Risk Factors for NCDs (STEPS 2017-2018) reported a very high prevalence of raised blood pressure among adults in Morocco (29.3%) [3]. Due to the number of subjects involved, high blood

pressure is a serious public health problem in Morocco. In addition, hypertensive patient management (screening, assessment, follow-up, and long-term medication) is a significant load to bear. That is why hypertension is a priority in the 2025 Health Plan as well as in the National Strategy for the Prevention and Control of NCDs (2019-2029). The NSPFH-2018 and the National Survey on Common Risk Factors for NCDs (STEPS 2017-2018), are both excellent sources of national and regional data on reported hypertension and other chronic diseases. However, information is scarce at the provincial level, and the existing research is based on small and isolated groups. Consequently, extrapolating the results to the entire population of the city will result in inaccurate and biased conclusions. According to our literature review, no study of chronic disease prevalence and socio-economic and demographic determinants among the entire population of a Moroccan city had ever been conducted. So, we were required to perform, in February 2021, a cross-sectional survey on a representative sample of Salé's whole population to determine the prevalence of chronic diseases and investigate certain socio-economic and demographic variables of individuals affected. This city was chosen because it is part of the Rabat-Salé-Kénitra region, which has one of the highest percentages of people with at least one chronic disease in Morocco (23.5%, 5.0% were diabetics, and 7.3% were hypertensive) [4].

Therefore, this article presents the partial findings of the aforementioned survey. It is a contribution with the following objectives: 1) to determine the prevalence, awareness and treatment of HTN among adults in Salé; and 2) to identify socio-economic and demographic determinants of HTN in the studied population. In addition, we hoped to contribute to the advancement of knowledge about the severity of high blood pressure as well as the socio-economic and demographic characteristics of hypertensive people. We also believe that we can provide clear and trustworthy information to decision-makers in Salé to assist them in making decisions and implementing plans and initiatives to battle NCDs, including high blood pressure.

MATERIAL & METHODS

Study area:

Salé is a city in northwestern Morocco located on the right bank of the Bouregreg River, opposite the national capital Rabat, and acts as a commuter town. According to the 2014 Moroccan census, it had a population of 890,403.

Survey design & participants

Survey design

It was a questionnaire-based statistical household survey conducted in Salé in February 2021. The frame adopted for this survey was the set of basic Census Districts (CDs) constituted before the realization of the NSPFH-2018 at the prefecture of Salé. We excluded CDs that have already been taken up by the sample of the NSPFH-2018.

Our survey was successfully conducted on 466 households among a sample of 488 households randomly selected using a stratified probabilistic sampling plan with two degrees:

-**1st degree:** a systematic random sampling proportionate to the size of a probabilistic sample of CDs in each of the admitted strata (size in terms of households' number).

-**2nd degree:** equal probabilities systematic random sampling of households from each selected CD.

The following formula [5] was used to calculate the initial sample size n_0; normality of the population distribution was assumed:

$$n_0 = \frac{N.z^2.p(1-p)}{(N.\varepsilon^2+z^2.p(1-p)).\overline{H}} \quad (1)$$

With: n_0: initial sample size; N: total population in Salé; $\overline{H}$: average household size in terms of number of persons; z: set at 1.96 for a 95% confidence interval; p: proportion of the population suffering from at least one chronic disease; ε: margin of error allowed.

Once the initial sample size was calculated, it was then adjusted, based on population size, sampling design effect, and response rate [5]. Thus, taking into account the population size N, the formula for calculating the sample size became:

$$n_1 = n_0 \frac{N}{N+n_0} \quad (2)$$

Since the sample design was not a simple random, the sample size is adjusted to take into account the effect of the sampling design Deff using the formula: $\quad n_2 = n_1.\text{Deff} \quad (3)$

Finally, it was necessary to consider the response rate r. Hence, the final sample size was:

$$n = \frac{n_2}{r} \quad (4)$$

The sample size of the households to be selected was 444 households (with: N= 1,120,186 [6]; $\overline{H}$ = 4.3: average household size in the Rabat-Salé-Kénitra region [4]; z = 1.96: for a 95% confidence interval; p = 23.5%: proportion of the population suffering from at least one chronic disease in the Rabat-Salé-Kénitra region [4]; ε = 2%: margin of error allowed; Deff = 1.109: calculated based on the NSPFH-2018 [4]; r = 98.9%: household response rate [4].)

The sample size was chosen to eliminate, as much as possible, sampling mistakes caused by the fact that the data was collected on just a portion of the population. Another sort of mistake that might affect the survey is observation error, which occurs as a result of the risks related to the observation. It depends on the coaching rate, the quality and training of the interviewers, the clarity of the questionnaire, and other factors [7]. We expanded

the sample size by 10% to improve the accuracy of the results [8]. Consequently, the total number of households to be surveyed was 444*(1+10 %) = 488 households, distributed proportionately between urban and rural areas, with 93 % in urban (452 households) and 7% in rural (36 households), according to the 2014-2050 Population and Household Projections produced by the Moroccan High Commission for Planning in 2017.

Inclusion probabilities

Probability of CD inclusion

The selection of CDs was carried out inside of each considered strata. The probability of inclusion of Gdhi (CD "i" of the stratum "h" of the Commune/Arrondissement "d" in the sample of CDs of size ndh) was given by:

$$Pdhi = ndh * (Ndhi / Ndh) (5)$$

With: $Ndh = \Sigma_i Ndhi$, Ndhi: means the size of the Gdhi ; Ndh: means the size of the stratum "h" of the Commune/Arrondissement "d"

Probability of household inclusion

A systematic proportional probability sampling of households in each of the CDs considered (urban and rural area) was conducted.

The probability of inclusion of the household in the sample was given by:

$$Pdhij = (Pdhi) * (M / Sdhi) (6)$$

With M = Number of selected households and Sdhi = total number of households in the Census District Gdhi.

Participants:

We collected information on all individuals in the selected households without any selection criteria.

Data collection, variables & tools

The questionnaire of this study was performed based on the literature (particularly the NSPFH-2018 questionnaire) and the terms of reference for item construction. It was separated into three sections: the first dealt with sociodemographic data, the second with chronic disease information, and the third with measuring household well-being. Based on the questionnaire, we gathered information on socio-economic and demographic variables such as age, gender, area of residency, wealth index, educational level, marital status, household size, occupation, average monthly household income in MAD, smoking status, diabetes status, and being or not head of the household. The prevalence of hypertension was calculated by dividing the number of people reported as having hypertension by the adult population (18 years and older). We defined the prevalence of awareness of hypertension as the proportion of adults with hypertension who reported having been diagnosed with hypertension by a health professional or using blood pressure medication. The prevalence of treatment of hypertension was defined as the proportion of hypertension adults who reported taking blood pressure medication [9].

Statistical analysis & Data grouping

We used the Census and Survey Processing System (CSPro version 7.1, 2018) for data entry. The data were analyzed using the Statistical Package for Social Sciences software (SPSS version 26.0, 2019) and Microsoft Excel 2016.

According to recommendations from the World Hypertension League Committee (2014) [9], results were grouped and presented as numbers and percentages. The Chi-square test was used to examine the relationship between hypertension and major socio-economic and demographic variables. The 95% confidence interval was calculated using standard errors. Multiple logistic regression was used to identify actual determinants of Hypertensive individuals in Salé.

RESULTS

Socio-economic & demographic characteristics

Of the 488 households selected for this survey, 466 were successfully surveyed (a response rate of 95.5%). As shown (**Table 1**), our sample contained 1308 people aged 18 and over, 52.2% of whom were women, with a sex ratio of 92 men per 100 women and an average age of 42.86 (± 0.45) years. According to age, 25.6% belonged to the age group 18-29 years, 39.7% to the age group 30-49 years, 28.1% were aged 50-69 years and 6.6% were aged 70 and over. 92.2% of the population studied was concentrated in urban areas. 3.7% of the studied population belonged to the poorest quintile of well-being. 92% are either medium rich (19.6%), rich (35.3%) or richer (37.0%). Regarding the household size, more than half of the subjects studied (51.9%) belonged to households of sizes 1 to 4. 24.3% of the population studied had no level of education, and 16.8% had reached a higher educational level. Concerning marital status, 30% of individuals were single at the time of the survey, and 61.7% were married; 41.6% of the studied population were working, 15.4% were unemployed and 27.8% were homemakers. 13.8% lived in a household with an average monthly income of less than 3,000 MAD. The proportion of smokers and the proportion of heads of households was 14.6% and 35.6%, respectively. Diabetes affected 7.8% of adult population in Salé in 2021.

Table 1: Socio-economic & demographic characteristics, Salé-Morocco, 2021

	N	%
Gender		
Men	626	47.8
Women	683	52.2
Age group (y)		
18-29	335	25.6
30-49	520	39.7
50-69	367	28.1
70 & +	86	6.6
Area of residency		
Urban	1207	92.2
Rural	101	7.8
Wealth Index		
Poorest	46	3.5
Second	60	4.6
Medium	257	19.6
Fourth	462	35.3
Richest	484	37.0
Household size		
1-4	679	51.9
5-7	505	38.6
8 & +	124	9.5
Educational level		
None	318	24.3
Primary	235	17.9
Middle School	285	21.8
Secondary	251	19.2
Higher	219	16.8
Marital status		
Single	393	30.0
Married	808	61.7
Widowed	71	5.4
Divorced	37	2.8
Occupation		
Working	545	41.6
Unemployed	202	15.4
Retired	89	6.8
Student	89	6.8
Homemaker	364	27.8
Unable to work	20	1.5
Average household income (MAD / Month)		
<3000	180	13.8
3000-4999	428	32.7
5000-9999	396	30.2
10000 & +	304	23.3
Smoking status		
Current smoker	191	14.6
Former smoker	113	8.7
Non-smoker	1004	76.7
Head of the household		
Yes	466	35.6
No	842	64.4
Diabetes status		
Yes	102	7.8
No	1207	92.2
Total	**1308**	**100.0**

Prevalence, awareness & treatment of hypertension

Prevalence of hypertension
Our study revealed that the prevalence of hypertension among adults (18 years and above, N=1308) in Salé was 10.2% (n=133, 95% CI: 8.6%, 11.9%), 8.2% among men, and 12.0% among women. According to age, it was revealed

that hypertension affected 41.4% of individuals in the age group 70 and above, 20.8% in the age group 50-69, 3.8% in the age group 30-49, and 0.4% among those aged 18-29. Also, hypertension was 10.4% in the urban area and 7.1% in the rural area. Regarding the wealth index, hypertension rose from 9.7% among the poorest to 11.3% among the richest people. 11.9% of individuals living in a household containing 5-7 persons reported having hypertension. The prevalence of raised blood pressure declines when the educational level increases. It was 24% among people without any educational level, compared to 2.8% among those with high educational attainment. In addition, 12.8% of married people, 35.1% of widowed people, 23.7% of retired people, 18.2% of homemakers, and 31.4% of those unable to work were hypertensive. 6.6% of subjects living in households with a monthly average household income of less than 3,000 MAD, 18.9% of former smokers, and 15.0% of household heads reported hypertension. Among diabetic people, 38.7% were living with hypertension. (**Table 2**). P-values of the Pearson Khi-2 test, proved that gender, age, educational level, marital status, occupation, smoking status, being either head of the household or not, and diabetes status were significantly associated with hypertension (p-value < 0.05). Area of residency, wealth index, household size, and monthly average household income had no significant impact on hypertension.

Awareness & treatment of hypertension
Our survey showed that 96.2% (n=128, 95% CI: 92.0%, 98.6%) of hypertensive people were aware of their disease. No difference was observed between men (96.4%) and women (96.0%). The elderly were more aware of their condition compared to young people (100% against 92.1%, respectively). Overall, awareness was higher than 91% among all categories, except among singles (58.6%) and people with only secondary education (87.7%) (**Table 3**). Concerning the treatment of hypertension among hypertensive people, 73.9% (n=98, 95% CI: 65.7%, 80.6%) were following regular treatment for raised blood pressure (**Table 3**). Women (74.6%) took antihypertensive medications slightly more than men (72.8%) did. In addition, 92.3% of individuals aged 70 and above, 73.2% in urban areas, 91.2% among the poorest and 100% of those living with 8 people or more in the same household, regularly took HTN medication. Moreover, 88.9% of people with high educational levels, 100% of those divorced and those unable to work and 73.9% of hypertensive diabetics were following regular treatment. Only age was significantly associated with awareness

and treatment of hypertension (p-value<0.05).

Table 2: Prevalence of hypertension according to the main socio-economic and demographic characteristics, Salé-Morocco, 2021

	N	%	95% CI Lower bound	95% CI Upper bound	P-value	Total
Gender					**0.022**	
Men	51	8.2	6.2	10.5		626
Women	82	12.0	9.7	14.6		683
Age group (y)					**<0.001**	
18-29	1	0.4	0.0	1.4		335
30-49	20	3.8	2.4	5.8		520
50-69	76	20.8	16.8	25.1		367
70 & +	36	41.4	31.8	52.4		86
Area of residency					**0.262**	
Urban	126	10.4	8.8	12.3		1207
Rural	7	7.1	3.2	13.1		101
Wealth Index					**0.702**	
Poorest	4	9.7	3.0	19.4		46
Second	4	7.0	2.3	15.1		60
Medium	22	8.7	5.6	12.4		257
Fourth	48	10.4	7.9	13.4		462
Richest	54	11.3	8.6	14.2		484
Household size					**0.103**	
1-4	66	9.7	7.7	12.1		679
5-7	60	11.9	9.3	14.9		505
8 & +	7	5.8	2.6	10.8		124
Educational level					**<0.001**	
None	76	24.0	19.5	28.8		318
Primary	31	13.3	9.3	18.0		235
Middle School	8	2.7	1.3	5.2		285
Secondary	12	4.8	2.6	8.0		251
Higher	6	2.8	1.2	5.6		219
Marital status					**<0.001**	
Single	4	0.9	0.3	2.4		393
Married	103	12.8	10.6	15.2		808
Widowed	25	35.1	24.9	46.7		71
Divorced	1	3.5	0.3	11.9		37
Occupation					**<0.001**	
Working	29	5.4	3.7	7.4		545
Unemployed	11	5.3	2.9	9.2		202
Retired	21	23.7	15.7	33.2		89
Student	0	0.0	-	-		89
Homemaker	66	18.2	14.4	22.3		364
Unable to work	6	31.4	13.6	51.7		20
Average household income (MAD / Month)					**0.074**	
<3000	12	6.6	3.7	11.0		180
3000-4999	50	11.6	8.9	15.0		428
5000-9999	48	12.1	9.2	15.6		396
10000 & +	24	7.8	5.3	11.3		304
Smoking status					**<0.001**	
Current smoker	9	4.8	2.4	8.4		191
Former smoker	21	18.9	12.3	26.5		113
Non-smoker	103	10.2	8.5	12.2		1004
Head of the household					**<0.001**	
Yes	70	15.0	12.0	18.5		466
No	64	7.6	6.0	9.5		842
Diabetes status					**<0.001**	
Yes	39	38.7	29.2	47.9		102
No	94	7.8	6.4	9.4		1207
Total	**133**	**10.2**	**8.6**	**11.9**		**1308**

Table 3: Awareness & treatment of hypertension according to the main socio-economic & demographic characteristics, Salé-Morocco, 2021

	Awareness					treatment					Total
	N	%	95% CI Lower bound	95% CI Upper bound	P-value	N	%	95% CI Lower bound	95% CI Upper bound	P-value	
Gender					0.955					0.815	
Men	50	96.4	91.2	99.8		37	72.8	59.3	83.3		626
Women	79	96.0	90.6	99.0		61	74.6	64.2	82.9		683
Age group (y)					<0.001					<0.001	
18-29	0	-	-	-		0	-	-	-		335
30-49	18	92.1	71.6	97.9		9	46.4	25.1	66.2		520
50-69	74	97.3	91.8	99.4		56	73.8	63.0	82.6		367
70 & +	36	100.0	-	-		33	92.3	79.4	97.6		86
Area of residency					0.591					0.458	
Urban	121	96.3	91.5	98.5		92	73.2	64.8	80.2		1207
Rural	7	94.6	70.8	100.0		6	85.1	49.9	98.4		101
Wealth Index					0.658					0.341	
Poorest	4	91.2	55.5	100.0		4	91.2	55.5	100.0		46
Second	4	100.0	-	-		3	64.7	28.4	97.2		60
Medium	21	93.0	80.7	99.5		13	59.4	38.5	77.5		257
Fourth	46	96.5	87.3	99.1		36	74.7	61.5	85.5		462
Richest	53	97.3	91.7	99.8		43	78.4	67.5	88.7		484
Household size					0.731					0.207	
1-4	64	96.8	90.6	99.4		46	69.3	57.9	79.8		679
5-7	57	95.0	87.3	98.6		46	75.8	64.9	86.0		505
8 & +	7	100.0	-	-		7	100.0	-	-		124
Educational level					0.573					0.82	
None	73	95.2	89.8	98.9		60	78.4	68.8	86.9		318
Primary	31	100.0	-	-		23	75.0	57.1	87.0		235
Middle School	8	100.0	-	-		3	40.3	11.9	70.5		285
Secondary	11	87.7	67.2	99.1		7	56.4	31.2	82.0		251
Higher	6	100.0	-	-		5	88.9	44.2	98.1		219
Marital status					0.041					0.542	
Single	2	58.6	12.3	87.7		2	58.6	12.3	87.7		393
Married	100	96.5	92.4	99.2		74	71.3	62.6	79.8		808
Widowed	25	100.0	-	-		21	85.5	66.3	94.3		71
Divorced	1	100.0	-	-		1	100.0	-	-		37
Occupation					0.665					0.398	
Working	27	93.6	79.7	98.5		20	69.0	51.0	83.4		545
Unemployed	11	100.0	-	-		6	57.8	27.0	80.0		202
Retired	21	100.0	-	-		17	79.3	60.8	93.2		89
Student	0	-	-	-		0	-	-	-		89
Homemaker	63	95.1	88.4	98.7		49	74.4	62.8	83.6		364
Unable to work	6	100.0	-	-		6	100.0	-	-		20
Average household income (MAD / Month)					0.323					0.382	
<3000	11	96.7	67.2	99.1		7	58.8	31.2	82.0		180
3000-4999	47	93.5	84.8	98.3		36	72.4	58.6	83.0		428
5000-9999	48	100.0	-	-		39	81.1	68.6	90.3		396
10000 & +	22	93.8	75.9	98.2		17	70.1	51.1	85.9		304
Smoking status					0.469					0.394	
Current smoker	9	100.0	-	-		6	70.1	34.8	89.6		191
Former smoker	21	100.0	-	-		14	63.1	45.4	83.7		113
Non-smoker	98	95.0	89.7	98.1		79	76.5	67.9	84.1		1004
Head of the household					0.577					0.196	
Yes	68	97.0	91.1	99.4		55	78.9	67.9	86.9		466
No	61	95.2	88.0	98.7		44	68.4	56.8	79.1		842
Diabetes status					0.142					0.909	
Yes	39	100.0	-	-		29	73.9	59.3	86.0		102
No	89	94.6	88.7	97.9		69	73.9	63.9	81.5		1207
Total	128	96.2	92.0	98.6		98	73.9	65.7	80.6		1308

Main socio-economic & demographic determinants of hypertension

We assessed the relationship between various variables and the prevalence of HTN via multiple logistic regression. As presented in **Table 4**, we found that the odds ratios of the prevalence of HTN are significantly associated with gender, age, educational level, marital status, occupation, smoking status, being either head of the household or not, and diabetes status. The results of the multivariate analysis confirmed the univariate analysis results.

Table 4. Results of logistic regression analysis evaluating the effects of various variables on the prevalence of hypertension, Salé-Morocco 2021

	P-value	OR (95% C.I)
Gender	0.047	2.470 (1.013,6.026)
Age (y)	<0.001	1.056 (1.034,1.078)
Area of residency	0.131	0.410 (0.129,1.305)
Wealth index	0.515	2.072 (0.231,18.574)
Household size	0.087	1.489 (0.944,2.347)
Educational level	0.001	0.225 (0.094,0.540)
Marital status	0.044	3.027 (0.937,9.783)
Occupation	0.016	2.612 (0.571,11.950)
Average household income (MAD / Month)	0.650	0.674 (0.123,3.704)
Smoking status	0.048	1.955 (0.789,4.842)
Head of the household	0.034	1.820 (0.903,3.666)
Diabetes status	<0.001	3.043 (1.793,5.164)

OR : Odds Ratios; CI : Confidence Interval.

DISCUSSION

According to our study, hypertension affected 10.2% (95% CI: 8.6%, 11.9%) of adults (18 years and above) in Salé during 2021. This proportion is equal to that recorded nationally in 2018 [4]. Regarding gender, we found that women are at a higher risk of developing hypertension (12.0%) than men (8.2%) (p value < 0.05). This was justified by the fact that women are at a high risk of obesity, which is a major risk factor for hypertension [10,11]. In the studies of Eghbali et al. and Nikooyeh et al. [12, 13], it was reported that being a homeworker is one of the main causes of women's obesity. Garawi et al. proved that women were more likely than men to be overweight and attributed this to a lack of regular physical activity and a lack of adherence to a healthy diet [14]. Additionally, we found that the risk of developing hypertension increased significantly with age (p-value < 0.05), especially after the age of 50 years (20.8% of the age group 50-69 and 41.4% of the population aged 70 and over). This strong relationship between age and hypertension reported in our study has been well documented in many previous studies, as in the study of Dosso et al. in Ghana [15], in the study of Eghbali et al. in Isfahan-Iran [12], in the systematic review of Haghdoost et al. [16], and in other studies around the world [17,18,19,20]. Our study also showed that educational level was strongly associated with high blood pressure (p-value < 0.05). The risk of developing hypertension decreased significantly when the person had a high educational level. This relationship has also been reported in the study of Hoeymans et al. in the Netherlands [21]. Thereby, smoking status was significantly associated with hypertension in our study (p-value < 0.05). The same finding has been reported in Sleight's study [22]. In 2014, Thorolfsdottir and collaborators showed that the decrease in smoking contributes to the decrease in mean systolic blood pressure [23]. Furthermore, we concluded that diabetics were five times more exposed to the risk of developing hypertension than non-diabetics (p-value < 0.05). Similarly, it has been reported in many studies that diabetes is a major risk factor for hypertension [24, 25]. Additionally, the coexistence of hypertension and diabetes is frequent. In the study of Paul et al., hypertension and diabetes are often found together. When compared to the non-diabetic general population, diabetics have twice the rate of hypertension [26]. On the other hand, our study showed that the area of residency, wealth index, household size, and income had no significant effect on the risk of developing hypertension among the adult population in Salé. However, observed differences could be justified by the high urbanization rate in this city (92.2%). The population, therefore, has the same cultural, economic, geographical, and nutritional characteristics [27]. The method of sampling could also contribute to those differences. As a point of comparison, Modesti et al. showed that, compared with urban dwellers, rural dwellers had similar hypertension prevalence in Yemen [28]. The results of the univariate analysis of the socio-economic and demographic determinants of hypertension were confirmed by the multivariate analysis results.

In addition, our study proved that awareness and treatment of hypertension, among adults in Salé during 2021, were 96.2% (95% CI: 92.0%, 98.6%) and 73.9% (95% CI: 65.7%, 80.6%) respectively. The prevalence of awareness and treatment of hypertension was less than national levels (98.0% and 84.7%) respectively [4]. On the other hand, adults in Salé were more aware of their disease than people in Isfahan-Iran (69.2%) [12], in Ghana's Middle Belt (45.9%) [15], and Latin American countries (Argentina, Brazil, Chile, Colombia, Peru, and Uruguay) [29]. Moreover, we concluded that awareness and treatment depended just on age (p-value < 0.05). The prevalence of hypertension awareness and treatment was significantly higher in older age groups in our study, which could be related to the increased focus on health at later ages, as well as the higher likelihood of having hypertension and the larger experience of disease in older people. Mills et al. and Yusuf et al. have reported the same finding in 2016 and 2014 respectively [30, 31].

CONCLUSION

Our study revealed that, in 2021, Salé had a prevalence of hypertension of 10.2% among the population aged 18 and older. This proportion was equal to that recorded nationally in 2018. It was also found that age, educational attainment, economic activity, average monthly household income, and smoking were significantly associated with HTN. Therefore, we have pointed out that Salé is dealing with a serious health problem that includes several problems (stroke, myocardial infarction, renal failure, arteriopathy of the lower limbs, risk of fetal mortality, and others) as well as costly therapy. Furthermore, patients with pre-existing NCD conditions like hypertension and diabetes are more vulnerable and at higher risk of dying in the event of a health emergency like COVID-19, not only because they are more susceptible to the virus, but also because medical resources must be directed toward caring for COVID-19 patients. This emphasizes the importance of addressing risk factors such as obesity and mental health disorders early on in order to prevent NCDs.

Limitations: Our study has limitations because it was based on the statements of the interviewees. While measuring blood pressure with a blood pressure monitor is the only way to identify the actual prevalence of hypertension. A survey utilizing the WHO-recommended STEPWISE technique can help to solve this challenge. We acquired information on hypertension as well as some socio-economic and demographic characteristics using the questionnaire. However, other variables, such as daily tobacco use, alcohol intake, food hygiene, physical activity, and physical and biochemical measurement, can be more relevant and serve as stronger predictors of the risk of developing hypertension.

Implications for practice: Our research suggests that decision-makers and healthcare managers in Salé pay more attention to developing adequate hypertension preventive and treatment strategies. It is advocated to ensure easy and fair access to basic and local diagnoses. Blood glucose and pressure management among diabetics can also be included in the intervention by guaranteeing thorough monitoring in primary healthcare facilities and supporting a healthy lifestyle (diet, physical activity, blood pressure and lipid control, tobacco control, etc.). Civil society involvement can be helpful, particularly in improving public awareness of the dangers of hypertension.

REFERENCES

1. World Health Organization. Non communicable diseases country profiles 2018. Geneva. 2018; p.7. https://apps.who.int/iris/handle/10665/274512 [Accessed on 25/06/2021]
2. World Health Organization. World health statistics 2020: monitoring health for the SDGs, sustainable development goals. Geneva. 2020; p. 14. https://apps.who.int/iris/handle/10665/332070 [Accessed on 16/09/2021]
3. Ministry of Health (Morocco). National Survey on Common Risk Factors for Non-Communicable Diseases, STEPS, 2017-2018. Rabat. 2019; p. 12. https://www.sante.gov.ma/Publications/Etudes_enquete/Pages/default.aspx [Accessed on 22/09/2021]
4. Ministry of Health (Morocco). National Survey on Population and Family Health (ESPFH-2018). Rabat. 2019.https://www.sante.gov.ma/Publications/Etudes_enquete/Pages/default.aspx [Accessed on 22/09/2021]
5. Statistics Canada. Survey Methods and Practices. Ottawa. 2010: p.151-175. https://www150.statcan.gc.ca/n1/pub/12-587-x/12-587-x2003001-eng.pdf [Accessed on 11/11/2021]
6. Ministry of Health (Morocco). Projections des populations cibles des programmes de santé. Rabat. 2017. https://www.sante.gov.ma/Publications/Etudes_enquete/Pages/default.aspx [Accessed on 22/09/2021]
7. Eng J. Sample size estimation: how many individuals should be studied?. Radiology 2003; 227(2): 309-313. https://doi.org/10.1148/radiol.2272012051
8. Deming WE. Quelques méthodes de sondage. Revue de statistique appliquée. 1964 ; 12(4): 11-55. http://www.numdam.org/item/?id=RSA_1964__12_4_11_0 [Accessed on 22/09/2021]
9. Gee ME, Campbell N, Sarrafzadegan N, Jafar T, Khalsa TK, Mangat B, Poulter N, Prabhakaran D, Sonkodi S,

Whelton PK, Woodward M, & Zhang XH. Standards for the uniform reporting of hypertension in adults using population survey data: recommendations from the World Hypertension League Expert Committee. The Journal of Clinical Hypertension. 2014; 16(11): 773-781. https://doi.org/10.1111/jch.12387

10. Bloomgarden ZT. Third Annual World Congress on the insulin resistance syndrome: associated conditions. Diabetes Care. 2006; 29(2): 2165-2174. https://doi.org/10.2337/dc06-zb09

11. Seravalle G & Grassi G. Obesity and hypertension. Pharmacological research. 2017; 122: 1-7. https://doi.org/10.1016/j.phrs.2017.05.013

12. Eghbali M, Khosravi A, & Feizi A. Prevalence, awareness, treatment, control, and risk factors of hypertension among adults: a cross-sectional study in Iran. Epidemiology and health. 2018; 40: e2018020. https://dx.doi.org/10.4178%2Fepih.e2018020

13. Nikooyeh B, Abdollahi Z, Salehi F, Nourisaeidlou S, Hajifaraji M, Zahedirad M, Shariatzadeh N, Kalayi A, Balderlou FB, Salmasi JG, Entezarmahdi R, Ghorbannezhad Z, Lotfollahi N, Maleki M, & Neyestani TR. Prevalence of obesity and overweight and its associated factors in urban adults from West Azerbaijan, Iran: the National Food and Nutritional Surveillance Program (NFNSP). Nutrition and Food Sciences Research. 2016; 3 (2): 21-26. http://dx.doi.org/10.18869/acadpub.nfsr.3.2.21

14. Garawi F, Devries K, Thorogood N, & Uauy R. Global differences between women and men in the prevalence of obesity: is there an association with gender inequality? European journal of clinical nutrition. 2014; 68(10): 1101-1106. https://doi.org/10.1038/ejcn.2014.86

15. Dosoo DK, Nyame S, Enuameh Y, Ayetey H, Danwonno H, Twumasi M, Tabiri C, Gyaase S, Lip GYH, Owusu-Agyei S, & Asante KP. Prevalence of hypertension in the middle belt of Ghana: a community-based screening study. International journal of hypertension. 2019; 2019. https://doi.org/10.1155/2019/1089578

16. Haghdoost A, Sadeghirad B & Rezazadehkermani M. Epidemiology and heterogeneity of hypertension in Iran: a systematic review. Arch Iran Med. 2008; 11: 444-452. https://dx.doi.org/08114/AIM.0017

17. Kishore J, Gupta N, Kohli C, & Kumar N. Prevalence of hypertension and determination of its risk factors in rural Delhi. International journal of hypertension. 2016; 2016. https://doi.org/10.1155/2016/7962595

18. Vasan RS, Beiser A, Seshadri S, Larson MG, Kannel WB, D'Agostino RB, & Levy D. Residual lifetime risk for developing hypertension in middle-aged women and men: The Framingham Heart Study. Jama. 2002; 287(8): 1003-1010. https://doi:10.1001/jama.287.8.1003

19. Ziyyat A, Ramdani N, Bouanani NEH, Vanderpas J, Hassani B, Boutayeb A, Aziz M, Mekhfi H, Bnouham M & Legssyer A. Epidemiology of hypertension and its relationship with type 2 diabetes and obesity in eastern Morocco. Springerplus. 2014; 3 (1): 1-7. https://doi.org/10.1186/2193-1801-3-644

20. Tazi MA, Abir-Khalil S, Chaouki N, Cherqaoui S, Lahmouz F, Sraïri JE, & Mahjour J. Prevalence of the main cardiovascular risk factors in Morocco: results of a National Survey, 2000. Journal of hypertension. 2003; 21(5): 897-903.

https://journals.lww.com/jhypertension/Abstract/2003/05000/Prevalence_of_the_main_cardiovascular_risk_factors.13.aspx

21. Hoeymans N, Smit HA, Verkleij H, & Kromhout D. Cardiovascular risk factors in relation to educational level in 36 000 men and women in The Netherlands. European heart journal. 1996; 17(4): 518-525. https://doi.org/10.1093/oxfordjournals.eurheartj.a014903

22. Sleight P. Smoking and hypertension. Clinical and experimental hypertension. 1993; 15(6): 1181-1192. https://doi.org/10.3109/10641969309037104

23. Thorolfsdottir RB, Aspelund T, Capewell S, Critchley J, Gudnason V, & Andersen K. Population assessment of future trajectories in coronary heart disease mortality. PloS one. 2014; 9(1): e85800. https://doi.org/10.1371/journal.pone.0085800

24. Schutta MH. Diabetes and hypertension: epidemiology of the relationship and pathophysiology of factors associated with these comorbid conditions. Journal of the cardiometabolic syndrome. 2007; 2 (2): 124-130. https://doi.org/10.1111/j.1559-4564.2007.06368.x

25. Ucan O & Ovayolu N. Relationship between diabetes mellitus, hypertension and obesity, and health-related quality of life in Gaziantep, a central south-eastern city in Turkey. Journal of clinical nursing. 2010; 19(17-18): 2511-2519. https://doi.org/10.1111/j.1365-2702.2010.03295.x

26. Paul B, Sapra B, Maheshwari S, & Goyal RK. Role of losartan therapy in the management of diabetic hypertension. The Journal of the Association of Physicians of India. 2000; 48 (5): 514-518. https://europepmc.org/article/med/11273147

27. Mulè G, Calcaterra I, Nardi E, Cerasola G, & Cottone S. Metabolic syndrome in hypertensive patients: an unholy alliance. World journal of cardiology. 2014; 6 (9): 890. https://dx.doi.org/10.4330%2Fwjc.v6.i9.890

28. Modesti PA, Bamoshmoosh M, Rapi S, Massetti L, Al-Hidabi D, & Al Goshae H. Epidemiology of hypertension in Yemen: effects of urbanization and geographical area. Hypertension research. 2013; 36 (8): 711-717. https://doi.org/10.1038/hr.2013.14

29. Lamelas P, Diaz R, Orlandini A, Avezum A, Oliveira G, Mattos A, Lanasd F, Serond P, Oliverosd MJ, Lopez-Jaramilloe P, Oteroe J, Camachoe P, Mirandaf J, Bernabe-Ortizf A, Malagaf G, Irazolag V, Gutierrezg L, Rubinsteing A, Castellanab N, Rangarajana S, & Yusufa S. Prevalence, awareness, treatment and control of hypertension in rural and urban communities in Latin American countries. Journal of hypertension. 2019; 37(9): 1813-1821. https://doi: 10.1097/HJH.0000000000002108

30. Mills KT, Bundy JD, Kelly TN, Reed JE, Kearney PM, Reynolds K, Chen J, & He J. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. Circulation. 2016; 134 (6): 441-450. https://doi.org/10.1161/circulationaha.115.018912

31. Yusuf S, Rangarajan S, Teo K, Islam S, Li W, Liu L, Bo J, Lou Q, Lu F, Liu T, Yu L, Zhang S, Mony P, Swaminathan S, Mohan V, Gupta R, Kumar R, Vijayakumar K, Lear S, Anand S, Wielgosz A et al. Cardiovascular risk and events in 17 low-, middle-, and high-income countries. NEJM. 2014; 371 (9): 818-827. https://doi.org/10.1056/NEJMoa1311890