# Risk factors and chronic diseases (type 2 diabetes and arterial hypertension) in a population of Nador in North- East Morocco.

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**Abstract.** Type 2 Diabetes and Hypertension are the most emerging chronic diseases in the world and in Morocco. This study aimed to assess the influence of lifestyle risk factors (RF) on the occurrence of Hypertension and Type 2 Diabetes (T2DM) in an urban and rural community in north-east Morocco (Nador). This is a cross-sectional study, which took place from 1 June to 30 September 2019 in the frontline health centers. Patients over 18 years of age, consulting during the study period, and consenting were included lifestyle and other variables were studied in a structured questionnaire. A total of 397 adults were included. Among them, 61% were from rural areas and 39% from urban areas. The average age was 40.19 ± 15.68 years. The prevalence of diabetes was 27%, of which 72% were T2DM, and that of hypertension was 18%. The RF listed in this community were ranked in descending order as follows: disturbed sleep (46%), abdominal obesity (35%), eating less than 5 fruits and vegetables (25%) and stress (20%). According to the regression test, T2DM was significantly associated with abdominal obesity (p=0.000), sleep deprivation (p=0.000), blood pressure imbalance and hyperglycemia (p=0.000). While hypertension seems to be more related to stress (p=0.041), and physical inactivity (p=0.000). The influence of lifestyle on the occurrence of hypertension and T2D is not negligible in this community, so it is necessary to act on harmful behaviors (such as sleep deprivation and overweight) to better prevent them. Keywords: chronic diseases, HT, T2DM, lifestyle, risk factors, Nador, North-East Morocco

## 1 Introduction

In the XXIst century, the progress of vaccination and the application of hygiene measures have allowed the elimination or even the eradication of certain infectious diseases. In addition, aging populations, rapid urbanization, increased life expectancy, and changing habits, including unhealthy lifestyle practices, have resulted in a sharp rise in the incidence of non-communicable diseases (NCDs) at the expense of infectious diseases [1]. These NCDs, commonly referred to as chronic diseases (CDs), include cardiovascular disease, cancer, chronic respiratory disease and diabetes, and represent a growing global burden, accounting for seven out of ten deaths worldwide [2]. Current projections will rank NCDs among the top 10 causes of death worldwide by 2040, and the leading cause of death in the African region by 2030[3] of which the large proportion of these deaths is related to cardiovascular diseases followed by cancerous and metabolic diseases [4]. All share key behavioral risk factors that can be modified, including physical inactivity, smoking, alcohol consumption, and high fat intake [5]. These risk factors (RF) lead to physiological and metabolic changes such as obesity, hypertension, hyperglycemia and hyperlipidemia and are at the origin of certain chronic pathologies mainly cardiovascular diseases, certain types of cancer and diabetes mellitus [3]. A recent study showed that low- and middle-income countries had the highest risk of dying from CD, particularly in Africa, Central Asia and Eastern Europe [6]. Morocco, a North African country, is not spared from this alarming situation. According to the WHO, it is ranked among the first countries with a high prevalence of mortality from CD (80%) in the Eastern Mediterranean region.This exceeds the global average of 70% of deaths (World Health

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Orgabisation[7]**.** At the level of the eastern region of Morocco, it was found that the age of people with T2DM has started to decline, attacking the population in active phase is younger between 30 to 49 years with 19.74% [8]. In this sense, the assessment of CD prevalence is important for national health policy planners; therefore, this study aims to determine the prevalence of T2DM and hypertension and their behavioral and metabolic risk factors in the community of Nador in northeastern Morocco.

## 2 Material and methods

### 2.1 Region and population concerned

The Province of Nador is located in the North-East of Morocco, having an area of 3221 km2 and extending over a sea front of 153 km, with a strategic geographical position, a true Mediterranean gateway to Europe. According to the 2014 general population census, the inhabitants of the city of Nador number 565,426, of which 392,623 (69.4%) reside in urban areas and 172,803 (30.6%) in rural areas [9].

### 2.2 Type of study

The data of this study are from a cross-sectional survey, which took place from March 18 to June 30, 2019, in 10 frontline health centers in the city of Nador, four of which belonged to the urban environment, and six were located an in rural areas.

### 2.3 Sampling and questionnaire

The sample size was calculated using the formula ($n=Z^2$ P (1-P)/$e^2$), based on a prevalence of hypertension of 30%. The figure obtained by the calculation was increased by 20%, resulting in a size of 397 subjects. Sampling was carried out using a random technique that consisted of recruiting respondents until the determined number was reached in each health center (40 consultants). Subjects interviewed were 18 years of age or older and gave written consent before completing the survey. The questionnaire was divided into two parts: the first part included questions on sociodemographic (gender, age, residence, employment, level of education), clinical (self-reported diseases) and anthropometric (weight, height, body mass index BMI, waist circumference, hip circumference) data and the second part identified behavioral and metabolic lifestyle risk factors.

### 2.4 Definition of the study variables

Risk factors (RF) is a condition, behavior or pathology whose presence increases the likelihood of a disease. It can concern an individual or a group of people [10]. We have divided the RF into two main groups: behavioral and metabolic RF.

#### *2.4.1 Behavioral RF*

Refer to factors related to lifestyle and the immediate environment such as: Tobacco and alcohol consumption, sedentary behavior, stress, disturbed sleep, insufficient consumption of fruits and vegetables (less than 5 fruits or vegetables per day).

##### *2.4.1.1 For smoking*

responses were classified into three categories: smokers, former smokers and non-smokers. Physical activity was classified into two categories: less or more than 30min/day, at work or leisure time or transportation time (either walking or biking), the week before the survey [11].

##### *2.4.1.2 Stress Level*

Perceived stress scale (Cohen's PSS) consists in using self-declared indicators of stress, which aim to quantify one's feelings according to a scale of perceived stress ranging from little, medium, strong, very strong (0 to 4) [12].

##### *2.4.1.3 Disturbed sleep*

The estimation of sleep quality was quantified from patients' self-reports of nocturnal sleepiness leading to sleep discontinuity or decreased sleep duration < 8 hours [13].

#### *2.4.2 The metabolic Risk Factors (RF)*

##### *2.4.2.1Peripheral obesity*

The measurement of weight and height was used to calculate the BMI (ratio of weight in Kg to height squared). Peripheral obesity was defined based on a body mass index (BMI) > 30 kg/$m^2$ and overweight for a BMI between 25 and 29.9 kg/m2 according to WHO standards [14].

##### *2.4.2.2 Abdominal obesity*

After measuring the waist circumference (TH) and the hip circumference (TH) with a tape measure graduated to the millimeter, a ratio of waist circumference to hip circumference was then calculated. Abdominal obesity corresponds to 102 cm in men and 88 cm in women, the increased waist circumference (indicator of excess abdominal fat) was set > 100 cm in men and > 85 cm in women). They respect the recommendations of the World Health Organization (WHO) [15].

*2.4.2.3 Diabetic status*

Blood glucose was measured, fasting or postprandial, on capillary blood taken from the finger, using a blood glucose meter OneTouch®.

The subject was considered diabetic if the blood glucose level was ≥ 1.26 g/l, was fasting and his glycated hemoglobin was strictly above 7%. People with a value between 6.1 and 7 were classified as pre-diabetic according to WHO criteria [16].

*2.4.2.4 HbA1c*

A "*Biohermes*" device measured glycated hemoglobin with a Boronate affinity chromatography kit, using two reagents A (*before applying blood*) and B after applying the blood. The result is displayed after a few minutes; the ratio of HbA1c is expressed in percentage;

*2.4.2.5 Hypertensive status*

According to the WHO classification (1999), a person is classified as hypertensive if his or her SBP is greater than, equal to 140 mm Hg or his or her DBP greater than, or equal to 90 mm Hg [17].

### 2.5 Statistical analysis

Depending on the type of variables and their distributions (normal or non-normal), we performed non-parametric tests as an alternative to ANOVA: Kruskal-Wallis test, Mann-Whitney U tests, Chi-square test, non-parametric correlations (Spearman's Rho) and binary logistic regression.

Statistical data entry and analysis were performed using SPSS® version 22 software (IBM® SPSS® Statistics, Armonk, NY, United States). The significance level was set at 0.05.*

### 2.6 Ethical considerations:

This research was approved by the Moroccan Ministry of Health and Social Protection, obtaining the authorization of the regional director (*representative of the Minister of Health in the eastern region of Morocco*) to conduct this survey.
All ethical principles were respected in accordance with the principles stated in the *Declaration of Helsinki*: An informed consent written in Arabic and French was signed by each participant, the anonymity of the participants was guaranteed as no name or identifier was recorded, the questionnaires were then stored in a safe place, accessible only to the researcher, and the data extracted from the questionnaire were saved in a password protected computer.

## 3 Results

### 3.1 Sociodemographic and clinical characteristics

A total of 397 consultants aged over 18 years were included in the study. Our population is more or less young, its average age was 40.66 ± 16.39 years and the age group [18-33] years was the most represented with 41.30%.
According to sex, men represent (12.84%) and women (87.15%) with a sex ratio of 6.7. More than half of our consultants belonged to rural areas (60.70%), which explains why 47.07% lived in families of more than five people. More than one third (33%) of our population was illiterate and about 23% were without a job (Table 1).

**Table 1.** Sociodemographic and clinical data of the study population Number (n=397)

| Sociodemographic | Number | % |
|---|---|---|
| Age (years) average | 40.66 ans | |
| [18-33] | 164 | 41.30% |
| [34-49] | 106 | 26.70% |
| [50-65] | 99 | 25% |
| >66 | 28 | 7% |
| **Sex** | | |
| Men | 51 | 12.84% |
| Women | 346 | 87,15% |
| **Residence** | | |
| Urban | 155 | 39.04% |
| Rural | 241 | 60.70% |
| **Number of households per home** | | 3.77% |
| Only | 15 | 5.28% |
| Two | 21 | 13.60% |
| Three | 54 | 16.37% |
| Four | 65 | 43.07% |
| More than five | 171 | |
| **Medical coverage** | | |
| Without | 147 | 37.02% |
| insurance for the poor Obligatory | 235 | 59.19% |
| health insurance | 19 | 4.78% |
| **Occupation** | | |
| Without | 91 | 22.92% |
| Housewife | 186 | 46.85% |
| Student | 61 | 15.36% |
| Temporary function | 47 | 11.82% |
| Liberal profession | 15 | 3.77% |
| Employee | 04 | 1% |
| **School level** | | |
| Illiterate | 131 | 33% |
| Koranic school | 149 | 37.53% |
| Secondary | 49 | 12.34% |
| Superior | 68 | 1. 71% |
| **Home** | | |
| proprietor | 299 | 75.31% |
| Renter | 66 | 16.62% |
| Co-resident | 32 | 8.06% |

### 3.2 Prevalence of diabetes and hypertension among respondents

According to WHO criteria, the study identified 108 consultants with fasting hyperglycemia >1.26 g/l (Table 2), representing a prevalence of diabetes equivalent to 27.20%. Self-reported diabetes was estimated at 52.8% (57) of which (72%) 41 people had T2DM.

**Table 2.** Clinical data of the study population Number (n=397)

| Clinical | Number | % |
|---|---|---|
| **Self-reported hypertension (n=49)** | | |
| Yes | 49 | 12.34% |
| No | 348 | 87.65% |
| Age oh hypertension (average) | 2,52 ans | |
| **Self-reported diabetes (n=57)** | | |
| Age of diabetes (Average) | 7,78 ans | |
| Yes | 57 | 52.77% |
| **Hypertension and diabetes** | 25 | 6.29% |
| **Type of diabetes (n=57)** | | |
| Type 1 diabetes | 16 | 28.07% |
| Type 2 diabetes | 41 | 72% |
| **Diabetes treatment (57)** | | |
| Oral | 30 | 52,63% |
| Insuline | 08 | 14.03% |
| Association | 05 | 8.8% |
| Diet | 08 | 14.03% |
| Herbs | 02 | 3.5% |
| No traitement | 04 | 7.01% |
| **Fasting blood glucose** | | |
| Average | 1 ,27 | |
| <1,26 | 289 | 72.8% |
| >1,26 | 108 | 27.20% |
| **glycated hemoglobin (n=51)** | | |
| **<6** | 11 | 21.56% |
| **(prediabetes) =6.5** | 36 | 70.58% |
| **>7** | 04 | 7.84% |
| **SBP (average)** | 127.88 | |
| <14 | 323 | 81.36% |
| >14 | 74 | 18.63% |
| **DBP (average)** | 75.71 | |
| >9 | 55 | 13.85% |
| **SBP : systolique Blood pressure ; DBP : diastolique Blood pressure** | | |

To confirm the diabetic status of the remaining 51/108 consultants (47.22%), an Hb1ac test was performed. The results showed that most of them 40 people (37.07%) did not know their diabetes. Among them, 36 (90%) their Hb1ac was equal to 6.5% and 4 (10%) their Hb1ac was above 7mmol.
Half of the diabetics (52.63%) were under oral treatment while 24% did not continue any anti-diabetic treatment, 14% adopted a hypoglycemic diet, 3% used medicinal plants, and 7% refused the treatment. According to blood pressure values, on 2 occasions our investigations presented abnormal values of systolic and diastolic pressure with a prevalence of 18.63% (74 patients). Of these, 66.21% were under hypertensive treatment while 33.8% did not know their hypertensive status.

### 3.3 Prevalence of risk factors

The risk factors detected in the general population of Nador (**Figure 1a**) were ranked in order of frequency. The analysis of these frequencies showed that the first five risk factors were insufficient sleep 46%, overweight in all its forms (visceral 35% and peripheral (34% overweight and 28% obese)), hyperglycemia in 28%, consumption of less than 5 fruits and vegetables in 25% and stress in 20%. However, other factors were less frequent, such as a sedentary lifestyle (11%), smoking (4%) and alcohol use (1%). The cross-tabulation of risk factors with place of residence, Table 3 revealed that no correlation was found between these two parameters, so that the distribution of risk factors is similar without any significant difference between urban and rural areas. Whereas only 2 factors appeared to be related to residence: disturbed sleep was significantly related to urban area with p =0.03 RR 1.840 [1.224 - 2.765] and abnormal blood pressure values were associated with rural area with p=0.016 RR 0.644[0.375 -1.105].

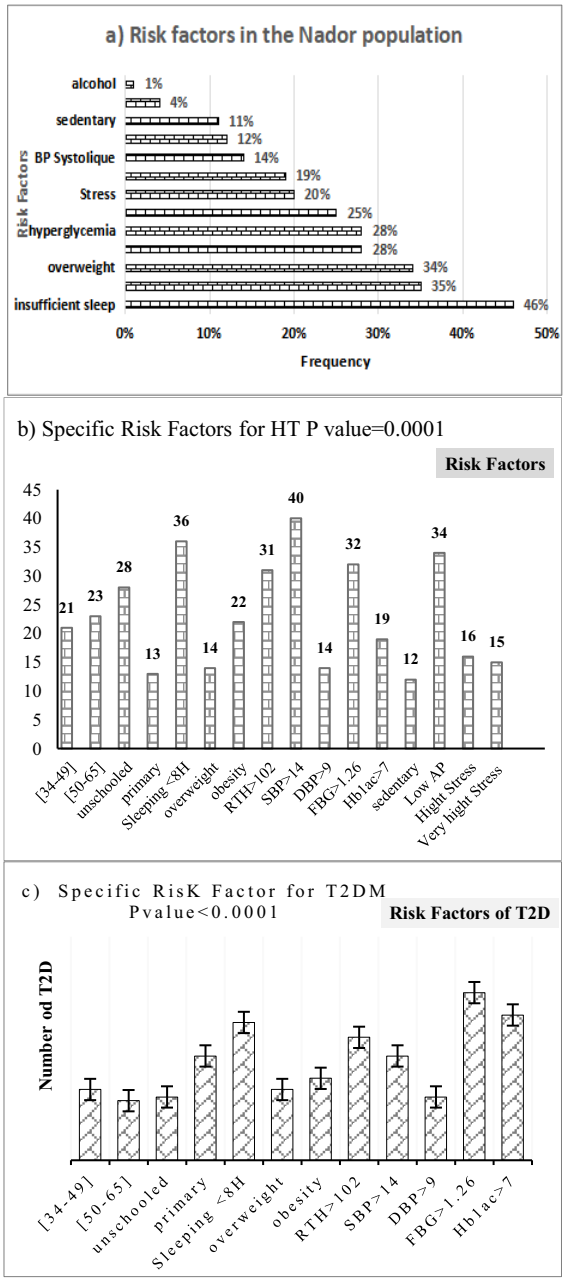


**Fig. 1.** Risk factors by type of pathology in the Nador population

In addition to this comparison, uni-variate and multivariate regression was performed to identify associations between RFs and HTA/DT2; the results are presented in the Table 3. The analysis of his

results shows that in the group of socio-demographic factors, particularly advanced age over 50 years predisposes the subject to a high risk of hypertension (RR 2.287[0.953-5.489]) and T2D (RR1.846 [1.098-3.102]), also the level of education was significantly associated with the 2 pathologies studied (**Figure 1b**). In the behavioral factors, the probability of having T2DM or hypertension was high, more than 3 times in people with disturbed sleep (<8H per day) than in people with normal sleep. High blood pressure was positively correlated with other behavioral factors such as stress (p=0.041) and physical inactivity (p= 0.000), but no relationship was found between T2DM and low fruit and vegetable consumption and smoking/alcohol use (**Figure 1c**).

For the group of metabolic factors, there appears to be a highly significant relationship between all risk factors and the presence of diabetic or hypertensive pathology at high levels, citing in this regard: Abdominal obesity was the leading predisposing factor for T2D or hypertension with a risk of 4 times that of a normal person. Also, one out of two people with peripheral obesity (BMI>25) is at risk of developing T2D or hypertension (RR 1.539 [0.558-2.215]) (**Figure 1b**). Based on RR analysis, adults with glycemic (fasting glucose or Hb1ac) or blood pressure (SBP or DBP) imbalances were more likely to have diabetes or hypertension (**Table 4**). So that a person with high blood pressure values had a risk of 7 times more to be diabetic and 41% to be hypertensive, also, blood sugar values higher than normal predispose people to the risk of diabetes type 2 (23 times more) and to hypertension with a risk 6 times more.

## 4 Discussion

In recent decades, the prevalence of lifestyle-related chronic diseases has increased rapidly in developing countries [18]. This is largely due to modifiable risk factors mainly hypertension, hypercholesterolemia and hyperglycemia which are the main causes of the disease burden [3].

In this context, our work aims to estimate the prevalence of T2DM and hypertension while deepening our analysis in search of behavioral and metabolic risk factors in the community of the city of Nador in northeast Morocco.

The first results of our survey revealed that the majority of the health centers' consultants were female 87.15%. In addition, several studies report that women consult more than men in case of chronic illness [19]. Moreover, these women have enough time to devote to the follow-up of their diseases because (47%) of them are unemployed.

**Table 3.** Risk factor by residence

| | Risque Factor | Population total (N=397) | Rural (n=241) | | Urban (n=156) | | P Value | RR IC 95% |
|---|---|---|---|---|---|---|---|---|
| | | | n | % | n | % | | |
| **behavioral risk factors** | **tobacco consumption**<br>Yes<br>Ex-smoker | 11(2.77%)<br>06(1.51%) | 07<br>06 | 2.90%<br>2.48% | 04<br>00 | 2.56% | 0.309 | RR 1.247<br>[0.349-4.454] |
| | **alcohol consumption**<br>Yes<br>Ex-alcoholic | 0<br>3(0.75%) | 0<br>1 | 0.41% | 0<br>2 | 1.28% | 0.330 | RR 0.321<br>[0.029 -3.568] |
| | **Insufficient consumption of fruit and vegetables**<br>< 5 fruits & vegetables | 98(24.68%) | 67 | 27.8% | 31 | 19.87% | 0. 059 | RR 1.523<br>[0.930 -2.495] |
| | **Physical inactivity**<br><60 min<br>60-150min | 44(11.08%)<br>277(69.77%) | 26<br>168 | 10.78%6<br>9.70% | 18<br>109 | 11.53%<br>69.87% | 0.786 | RR 0.835<br>[0.191-3.660] |
| | **insufficient sleep**<br>< 8h | 185(46.59%) | 98 | 40.66% | 87 | 53.84% | **0.003*** | RR 1.840<br>[1.224 – 2.765] |
| | **Stress**<br>Hight<br>Very hight | 129(32.49%)<br>79(19.89%) | 87<br>47 | 21.91%<br>11.83% | 42<br>32 | 27%<br>20.51 | 0.830 | RR 0.816<br>[0.461-1.446] |
| **FDR métabolique** | **Abdominal obesity** RTH<br>abnormal | 138(34.76%) | 88 | 36.51% | 50 | 32.05% | 0.211 | RR 0.820<br>[0.353 -1.256] |
| | **Overall obesity**<br>Overweight MC>25<br>Obesity<br>Morbid obesity | 134(33.75%)<br>76(19.14%)<br>35(8.81%) | 89<br>44<br>24 | 36.92%<br>18.25%<br>9.95% | 45<br>32<br>11 | 28.84%<br>20.51%<br>7.05% | 0.346 | RR 0.978<br>[0.940-1.018] |
| | **Capillary hyperglycemia**<br>>1.26g/l | 111(28%) | 64 | 26.55% | 47 | 30.12% | 0.439 | RR 1.193<br>[0.764 -1.862] |
| | **Hb1ac**<br>>7 mmol | 47(11.83%) | 27 | 9.95% | 20 | 12.82% | 0.502 | RR 1.073<br>[0.508 -2.256] |
| | **Blood pressure**<br>SBP>14<br>DBP>9 | 74(18.63%)<br>55(13.85%) | 51<br>41 | 21.16%<br>17.01% | 23<br>14 | 14.74%<br>8.97% | **0.016*** | RR 0.644<br>[0.375 -1.105]<br>RR 0.481<br>[0.253-0.915] |

**Table 4.** Relative risks associated with lifestyle behaviors by chronic disease type (Binary regression and Man Withney U test).

| Lifestyle-related RF | | Type 2 diabetes (n= 45) | | Hypertension (n=49) | |
|---|---|---|---|---|---|
| | | P value | RR IC 95% | P value | RR IC 95% |
| **Socio-demographic factors** | Age | **0.0001**** | 1.846 [1.098-3.102] | **0.0001**** | 2.287[0.953-5.489] |
| | Genre | 0.841 NS | 1.092[0.436-2.575] | 0.296 NS | 0.569[0.196-1.656] |
| | Education level | **0.000**** | 0.062[1.71-2.56] | **0.000**** | 0.370[0.239-0.573] |
| **Behavioral factors** | insufficient sleep | **0.000**** | 3.36[1.844-6.778] | **0.000**** | 3.699[1.895-7.219] |
| | Stress | 0.148 NS | 0.530[0.212-1.324] | **0.041*** | 0.433[0.042-4.416] |
| | Physical activity | 0.260 NS | 0.541[0.040-7.384] | **0.000**** | 0.371[0.207-0.664] |
| | Consumption of fruit and vegetables | 0.467 NS | 1.306[0.636-2.682] | 0.867 NS | 0.942[0.472-1.882] |
| | Tabaco | 0.206 NS | 0.732[0.115-4.674] | 0.189 NS | 0.795[0.040-15.878] |
| | Alcohol | 0.505 NS | 0.991[0.982-1.001] | 0.515 NS | 0.991[0.982-1.001] |
| Metabolic factors | Body Mass Index (kg/m2) | **0.000**** | 1.539[0.558-2.215] | **0.005*** | 1.87 [0.903-1.804] |
| | Abdominal obesity (RTH) | **0.0001**** | 4.208[2.267-7.809] | **0.0001**** | 3.879[2.079-7.239] |
| | SBP | **0.000**** | 7.940[4.216-14.950] | **0.000**** | 41.046[18.350-91.810] |
| | DBP | **0.000**** | 4.053[2.068-7.941] | **0.000**** | 2.995[1.487-6.033] |
| | Fasting Glycemia | **0.000**** | 71.837[21.692-238.136] | **0.000**** | 6.410[3.381-12.149] |
| | Hb1ac | 0.000** | 23.969[8.980-63.978] | 0.008* | 3.027[1.310-6.994] |

In this study, we found that 61% of our respondents belonged to the rural environment against 39% of urban origin, this result is explained by the number of rural health centers visited during our survey (6 rural centers against 4 urban), this justifies the fact that 47% of the participants lived in families of more than five members. This result corroborates with investigations from the 2018 National Population and Family Health Survey, which showed that the average size of a Moroccan household is 4.3 in urban areas versus 5.0 in rural areas [20]. The prevalence of hypertension was about 18.63% of which one person out of three was unaware of his disease. This prevalence is much lower than other studies conducted at the local (31.7%) and national (29.3%) levels [20,21]. In France, the ENNS 2006 study, carried out on a representative sample of adults aged 18 to 74, showed that less than a quarter of hypertensive patients were aware of their hypertension [22]. According to the fasting blood glucose results, hyperglycemia was found in 108 consultants, which represents an overall prevalence of diabetes of 27.20%. This rate is much higher than the one estimated by the WHO in Morocco in 2016 (12.4%) in the population aged 20 years and over [23]. In Ethiopia the prevalence was 5.9% (3.2% rural vs. 18.1% urban) [24]. This rate is similar to that reported in Bahrain (25,7%) [23]. The high prevalence of diabetes in this study confirms the dramatic increase in diabetes expected nationally and globally, especially in developing countries. According to IDF estimates, the prevalence rate of diabetes is highest in North Africa reaching 11% in 2017 [24]. Of the self-reported diabetics, 72% had type 2 diabetes. This rate is much higher than several national and international studies (11,9%, 10,2%,19%) [23,25]. In contrast, this rate was 91% in a population of diabetics in the eastern region [8]. Differences in T2DM prevalence in each region may be attributed to the study design, population, and diagnostic methods used to obtain these data.

Concerning the suspected diabetics (n=51), they underwent an Hb1ac test which showed that most of them (78.43%) were unaware of their disease, of which 36 were pre-diabetics (hb1ac=6.5) and four (hb1ac>7). According to Maoui et al. [24] more than half of the patients are unaware of their diabetes, which makes the reported prevalence often lower than that which actually exists.

**The main modifiable risk factors**

By integrating the residence parameter, no relationship was found with the risk factors, on the other hand Ramdani *et al* raised in his study conducted in 2014 that the frequency of HT in ruraus areas was higher (39.9%) than in urban areas (29%) (P< 0.001) [26]. According to the same study, there was a significant difference in the prevalence of T2DM which was higher in rural areas than in urban areas: with a OR de 9,59 (IC95% [3,6 - 25,48]) [26] [26]. Rosenthal et al explained this difference by the effect of stress in rural life, especially during periods of drought that sometimes last several years in a row. The relationship between stress and HT is well documented [27]. In our series, the modifiable risk factors that appeared to be related to the chronic pathologies studied (T2DM and hypertension) were either metabolic (abdominal obesity 35% or peripheral obesity 34% and obesity 28%), hyperglycemia 28% and imbalance in blood pressure values 18.63%) or behavioral (sleep deprivation 46%, stress 20% and physical inactivity 11%).

In the group of behavioral RF, disturbed sleep seems to be the first factor incriminated to have a direct influence on the two chronic pathologies, so that a person with a sleep disorder is three times more likely to have hypertension or diabetes. p<0.0001. This result is consistent with that found in the two studies (NHANS (National Health and Nutrition Examination Survey and MMAS2006 (Massachusetts Male Aging Study [28] conducted over a period of 8 to 15 years, lack of sleep <5 hours/nights increase the risk of hypertension and type 2 diabetes compared to subjects getting 7 hours of sleep [28]. According to the results communicated at the "World Conference on Sleep" in Tokyo in October 2011, "sleep disorders" represent more than 20% of the general population in developed countries, as an example in the United States, one third of the population has sleep disorders with a sleep duration of less than 7 hours/night [28]. Similarly, hypertension was positively correlated with other behavioral factors such as stress p<0.041, a finding consistent with the literature associating hypertension with psychosocial factors including stress [29]. Physical inactivity was also among the behavioral factors related to hypertension with p<0.0001. Sedentary lifestyle has long been incriminated in the pathogenesis of obesity and certain metabolic diseases such as hypertension and T2D [30]. The second group included metabolic risk factors such as overweight (visceral or peripheral), glycemic imbalance (hyperglycemia) and blood pressure imbalance (high blood pressure values). These factors, all unanimously influence the onset of chronic disease in a very significant way. Our study shows that the prevalence of T2DM and hypertension increases significantly in the presence of visceral obesity 35%, it increases the risk of disease four times more than a normal person. The mean TT in our population was 101.0 ± 8.53 cm with a prevalence of abdominal obesity of 35%. This frequency is much lower than the prevalence has reported in a meta-analysis involving 14 African and Middle Eastern countries 67.6%. On the other hand, our results are close to those of Spain 31.4% [25]. In addition, one in two people with peripheral obesity (34%) is at risk of developing T2D or hypertension (RR 1.539 [0.558-2.215]). This result is comparable to the rate reported in the city of Oujda 30,6 %. However, it is still lower than the rates of other regional studies: 43.8% in Casablanca and 49.0% in Laayoune or in Maghreb countries such as Tunisia (47%) [25]. The blood pressure values recorded among our respondents show that 18% had a systolic pressure higher than 14 and 14% a diastolic pressure > 9. Among these hypertensives, 66% were under hypertensive treatment while more than a third 33% were unaware of their disease. Blood pressure is the result of the force exerted by the blood on the artery walls. In fact, cardiovascular mortality doubles for every 20/10 mmHg increase in systolic/diastolic blood pressure [22]. It is the main risk factor for stroke and an important risk factor for cardiovascular morbidity and mortality, with a linear relationship between blood pressure level and cardiovascular risk regardless of age [22].

Finally, our study showed that the study population was highly exposed to modifiable metabolic or behavioral DRFs, confirming the nutritional transition phenomenon.

## 5 Conclusion

This study illustrated the high prevalence of diabetes 27% (72% T2DM) and hypertension 18% as well as the main factors affecting these 2 pathologies. In fact, the results of the study show that unhealthy lifestyle habits have a very strong influence on T2DM mainly lack of sleep 46%, abdominal obesity 35%, insufficient consumption of fruits and vegetables 25% and stress with 20%. While high blood pressure seemed to be more related to physical inactivity and stress (p<0.0001) & (p<0.041). Therefore, taking these factors into account can help policy makers prioritize the health needs of populations and contribute to the development of community-based prevention, promotion and care programs specific to each region. In perspective, a more in-depth study should be carried out in this population to verify its adherence to the Mediterranean diet especially with the detected high prevalence of obesity in this community and to investigate the impact of other factors that may influence this situation such as cohabitation with a Western population Melilla.

## Acknowledgments

We thank the professionals of the health centers who facilitated access, data collection and the realization of the survey.

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