Obesity and the susceptibility of the occurrence of lower limbs osteoarthritis in a cohort of women from El Jadida province

Abstract

Introduction: obesity has aroused these last time a significant interest because of his strong association with osteoarthritis by the worsening of the mechanical constraints exerted on the articulation. Considered as degenerative disease and debilitating, the prevalence of osteoarthritis does not cease to increase due to the increase in both the life expectancy and the prevalence of obesity. The objective of this study is to assess the link between obesity and the susceptibility of the occurrence of the osteoarthritis of the lower limbs in a sample of women.

Methodology: The study was undertaken on 137 women from 11 urban and rural localities of an agricultural province of Morocco, El Jadida. The evaluation of symptomatic the susceptibility of the occurrence of osteoarthritis of the lower members among the participants was performed using the Moroccan version of the WOMAC index for the lower limbs. Another questionnaire has allowed collecting socio-demographic data and anthropometric measurements in the surveyed in order to establish the relationship between obesity and the occurrence of osteoarthritis risk.

Results: The study data show that the female population surveyed was 45±13years old and mostly obese (77%). The susceptibility of osteoarthritis of the lower limbs in both forms is much more expressed at the age > 50 years with a rate of 22%. Three dimensions WOMAC (pain, stiffness and functional embarrassment) are felt much among postmenopausal women than those in age to procreate (9.53±5.95 vs 5.61±5.0); (3.74±2.63 vs 2.47±2.36) and (31.08±19.55 vs 21.50±16.63) respectively. The perception of WOMAC pain and functional repercussion related to the susceptibility of osteoarthritis are expressed much among women having a morbid obesity with respective averages (15.40; 48.80 vs 6.12; 23.12). For the waist/hip (WHR), the pain and the functional embarrassment perceived by the WOMAC are reported much among women having an android morphotype (86.13%) than those with a gynoïde morphotype (5.10%).

Conclusion: The study results report a link between obesity and the risk of occurrence of osteoarthritis. His prevention is important and his magnitude varies according to the age and to the osteoarthritis location. The Data is also discussed according to the energy impact.

Keywords: Obesity, BMI, WHR, knee osteoarthritis, coccyx osteoarthritis, Womac

Introduction

Obesity has become a major health problem that leads to an excess of morbidity and mortality. According to the World Health Organization the year 2016 has registered more than 1.9 billion adults who are overweight. In Morocco, 30% of the population is considered overweight and the prevalence of obesity is estimated at 14%. For some time, obesity aroused a great interest because of his potential variability and his association with osteoarthritis. This is defined as a disease of all the articulation and his environment, preventing the patients from moving without feeling pain or maintaining their physical activity, nevertheless, osteoarthritis remains largely underestimated by the authorities of health.

In Morocco, osteoarthritis constitutes 16% of the consultations in rheumatology and represents a cause of important disability whose prevalence is not precise. The frequency of osteoarthritis does not cease increasing because of the ageing of the population and the increase in the prevalence of obesity, which has a heavy socio-economic impact because of his frequent association with other serious diseases.

In fact, the prevalence of osteoarthritis increases significantly with age and is further aggravated by obesity. This trend of aggravation of the complications of osteoarthritis is also observed between the age and the difference related to the sex with a clear separation of the prevalence for each sex following the menopause. Admittedly, the harmful effect of obesity remains stronger at the woman than the man and is related to a bilateral attack than unilateral for all the compartments of the knee. In the determinism of osteoarthritis, several mechanical genetic and biochemical factors come into play but obesity plays a key role both in the bearing articulations, but also nonbearing.
In addition, obesity is an important risk factor in the etiology of osteoarthritis by the aggravation of the mechanical constraints exerted on the articulation. Indeed, the obese people or those who make plumpness are more likely to suffer from a Knee and coccyx osteoarthritis with varying degrees of alteration of the quality of life.11

In particular, knee osteoarthritis is highly related to obesity and epidemiological studies have demonstrated a distinctive link between body mass index (BMI) and the risk of developing knee osteoarthritis.12 In deed, one kilogram per square meter too much above a BMI of 27 increases the risk of osteoarthritis in women by 15%.11 On the other hand, the development of osteoarthritis is also linked to adipose tissue responsible for metabolic disorders related to excess body weight and mechanical stress on cartilage.14

In addition, the causal link between obesity and the risk of coccyx osteoarthritis remains less obvious especially for bilateral forms.15 On the other hand, being overweight is a factor that aggravates symptoms and leads to arthroplasty more quickly.

In this study, the aim was to study the association between obesity and the risk of lower extremity osteoarthritis based on the clinical symptomatology seen by the Womac in his Moroccan version in a population of El Jadida province in Morocco.

**Population and method**

**Population**

The study was carried out in the province of El Jadida between the month of March and August 2017 and touched 11 localities concerned with urban environment and rural. Schematically, on the level of each locality, all the women resident were recruited of more than six months to the province of El Jadida and having agreed to take part in this investigation.

**Method**

Two questionnaires were used for the data collection. The first includes the age of answering, the age of procreation and the anthropometric measurements while the second questionnaire collects information on assessing osteoarthritis susceptibility using Western Ontario and McMaster Universities (WOMAC). It is a validated index, largely used for the evaluation of the osteoarthritis of the lower extremities and which was the object of a cross-cultural adaptation in Moroccan dialect.6,17 This questionnaire captures the specific aspects perceived by recruited adherents who may suffer from knee osteoarthritis and/or hip osteoarthritis to provide information on the occurrence of pain, stiffness and functional limitations induced by osteoarthritis. The score of each of these 24 questions is measured with a Likert scale with 5 possible answers of 0 (no gene) to 4 (maximal gene). A higher score for each under-scale corresponds to a worse condition. The under-scale of the pain understands five questions about the degree of pain (for example, pain with walk), with a varying under-score from 0 to 20. The subscale of stiffness includes two questions about the severity of stiffness (after the first wake up and later in the day) with a sub-score ranging from 0 to 8. As for the functionality, it includes 17 questions on the degree of difficulty expressed during the realization of activities (for example going down stairs) this sub-score varies from 0 to 68.18

**Anthropometric measurements**

Anthropometric measurements are taken on the participants according to the standards recommended by WHO.19 The height is measured to the nearest millimeter by means of a wall height heels jointed legs straight arms dangling and shoulders relaxed. The weight is measured using a standard weight scale in kg to the nearest 0.1kg. The participants are without shoes and lightly dressed.

For the measurement of the abdomen, the surveyors stand with their feet separated by 2.5cm, with straight legs arms dangling and shoulders stretched the tape measure is placed uncompressed midway between the iliac crest and the last rib at the end of an exhalation. As for the hips, the participants are standing the ribbon is placed around the buttocks at the level of the symphysis pubis and the fleshy part of the buttocks feet being joined. The calculation of the Size/Hip or WHR ratio was measured to better target how the fat mass is distributed on the body.20

The body mass index is calculated by dividing the weight in kg by the square of the height expressed in meters: BMI = Weight (kg)/height (m²). The BMI is divided into six categories according to the WHO classification in 2014:21 Participants with BMI<18.5 are considered lean, BMI>18.5 kg/m² are considered normal weight. Those with risk of being overweight if BMI >25, obese class 1 if BMI >30, obese class 2 (BMI>35) and morbid obesity if BMI>40.

**Statistical analyses**

The data analysis was performed using SPSS for Windows (version 23.0). The descriptive analysis was performed to describe the characteristics of the participants in this study namely sociodemographic variables, anthropometric measures as well as the perception of pain stiffness and functional limitations following knee osteoarthritis and/or hip osteoarthritis.

The Pearson correlation was performed comparing age with the three WOMAC dimensions namely: pain stiffness and functionality perceived by the participants. The Bonferroni correction for multiple comparisons was applied using simultaneous confidence intervals to determine significant differences between the means of the groups.

**Ethical consideration**

A free and enlightened assent was obtained from all the participating ones at the time of the study. They were informed on the subject of the study and with the possibility of stopping their participation under investigation constantly if they wish it. All the data collected within the framework of this study were the object of a strictly confidential treatment.

**Results**

The survey involved a sample of 137 women from 11 urban and rural locations in El Jadida province. The average age of the survey is 45±13years, the age group [30; 35] is being the most representative with a rate of 43.8%.

In Table 1, the Pearson correlation of the three dimensional WOMAC and the age-dependent variable show a statistically significant association of pain perception, stiffness and lower limb function that increases with age.

Table 2 shows that the pain, the stiffness and the functional embarrassment are significantly felt much among postmenopausal women than those in age to procreate with respective averages(9,53±5,95 vs 5,61±5,0) ; (3,74±2,63 vs 2,47±2,36) et

Table 3 shows that no statistical significance was observed between the BMI classes and the perception of WOMAC stiffness. Conversely, for the WOMAC pain and function dimension, the participants having a morbid obesity test more pain and of functional embarrassment than those of the other classes of BMI with a respective average of (15.40 ; 48.80), the result being significant.

In Table 4, the occurrences of the classes of the BMI were subdivided according to the localization of the risk of which has occurred of osteoarthritis. The study participants who report not having osteoarthritis represent 56.2% of whom 23.4% are overweight. The hip osteoarthritis form accounts for 16% of the cases of which 5% have an obesity classifies 1, while 9.5% of adherent attest to have knee osteoarthritis. Participants who claim to have both forms of osteoarthritis account for 18.2%, 8 of whom have obesity class 1.

Table 5 indicates that participants with a gynoide and android morphotype (WHR<0.80; WHR>0.85) manifest more functional gene (22, 71; 27, 97) and pain (6, 14; 8, 13) lower limbs than those with an android morphotype (n=7). The results are significant in these two WOMAC dimensions.

Referring to Bonferroni comparisons, the Table 6 shows a statistically significant difference between the group averages. Patients in the study with a high hip size ratio are those with knee osteoarthritis or isolated or associated hip osteoarthritis., and feel more pain, stiffness and embarrassment functional than those which have asymptomatic forms.
Table 4 The prevalence of different osteoarthritis locations by BMI class (%)

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>N</th>
<th>Womac pain Mean</th>
<th>Womac pain SD</th>
<th>Womac functionality Mean</th>
<th>Womac functionality SD</th>
<th>Stiffness womac Mean</th>
<th>Stiffness womac SD</th>
<th>Womac Total Mean</th>
<th>Womac Total SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight (1)</td>
<td>31</td>
<td>6.12</td>
<td>5.5</td>
<td>23.12</td>
<td>18.12</td>
<td>2.41</td>
<td>2.41</td>
<td>31.67</td>
<td>4.40</td>
</tr>
<tr>
<td>Overweight (2)</td>
<td>48</td>
<td>6.87</td>
<td>5.4</td>
<td>23.81</td>
<td>19.12</td>
<td>3.12</td>
<td>2.54</td>
<td>33.81</td>
<td>3.42</td>
</tr>
<tr>
<td>Obesity class 1 (3)</td>
<td>41</td>
<td>8.58</td>
<td>5.8</td>
<td>29.75</td>
<td>19.12</td>
<td>3.29</td>
<td>2.56</td>
<td>41.63</td>
<td>4.11</td>
</tr>
<tr>
<td>Obesity class 2 (4)</td>
<td>12</td>
<td>6.91</td>
<td>6.3</td>
<td>22.00</td>
<td>18.80</td>
<td>3.16</td>
<td>2.75</td>
<td>32.08</td>
<td>7.63</td>
</tr>
<tr>
<td>Morbid obesity (5)</td>
<td>5</td>
<td>15.40</td>
<td>2.07</td>
<td>48.80</td>
<td>16.48</td>
<td>5.20</td>
<td>2.94</td>
<td>69.40</td>
<td>8.27</td>
</tr>
<tr>
<td>Total</td>
<td>137</td>
<td>7.53</td>
<td>5.81</td>
<td>26.18</td>
<td>16.68</td>
<td>3.09</td>
<td>2.57</td>
<td>36.81</td>
<td>2.18</td>
</tr>
</tbody>
</table>

P-value: 0.009

BMI, body mass index; SD, standard deviation

Adjustment for multiple comparisons: Bonferroni. The mean difference is significant at the 0.05 level.

*BMI categories – underweight<18.5kg m⁻²; normal weight, 18.5–25kg m⁻²; overweight >25–30kg m⁻²; obese1 >30kg m⁻²; obese2 >35kg m⁻²; Morbid Obese >40kg m⁻².

Table 5 The distribution of WOMAC dimensions by waist-hip ratio

<table>
<thead>
<tr>
<th>WHR Category</th>
<th>N</th>
<th>Womac pain Mean</th>
<th>Womac pain SD</th>
<th>Womac functionality Mean</th>
<th>Womac functionality SD</th>
<th>Womac stiffness Mean</th>
<th>Womac stiffness SD</th>
<th>Womac Total Mean</th>
<th>Womac Total SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHR &lt; 0.80 (1)</td>
<td>7</td>
<td>6.14</td>
<td>1.92</td>
<td>22.71</td>
<td>6.05</td>
<td>3.00</td>
<td>0.92</td>
<td>31.85</td>
<td>8.46</td>
</tr>
<tr>
<td>0.80≤ WHR&lt;0.85 (2)</td>
<td>12</td>
<td>2.41</td>
<td>0.69</td>
<td>10.66</td>
<td>3.68</td>
<td>1.58</td>
<td>0.41</td>
<td>14.66</td>
<td>4.59</td>
</tr>
<tr>
<td>WHR &gt; 0.85 (3)</td>
<td>118</td>
<td>8.13</td>
<td>0.53</td>
<td>27.97</td>
<td>1.71</td>
<td>3.25</td>
<td>0.24</td>
<td>39.36</td>
<td>2.35</td>
</tr>
<tr>
<td>Total</td>
<td>137</td>
<td>7.53</td>
<td>0.49</td>
<td>26.18</td>
<td>1.59</td>
<td>3.09</td>
<td>0.21</td>
<td>36.81</td>
<td>2.18</td>
</tr>
</tbody>
</table>

P-value: 0.004

WHR, waist/hip ratio; WC, waist circumference; SD, standard deviation

Adjustment for multiple comparisons: Bonferroni. The mean difference is significant at the 0.05 level.

Table 6 Distribution of WOMAC according to the different locations of osteoarthritis

<table>
<thead>
<tr>
<th>WHR Category</th>
<th>N</th>
<th>Womac pain Mean</th>
<th>Womac pain SD</th>
<th>Womac functionality Mean</th>
<th>Womac functionality SD</th>
<th>Womac stiffness Mean</th>
<th>Womac stiffness SD</th>
<th>Womac Total Mean</th>
<th>Womac Total SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic(1)</td>
<td>77</td>
<td>5.46</td>
<td>0.62</td>
<td>18.36</td>
<td>1.87</td>
<td>2.49</td>
<td>0.27</td>
<td>26.32</td>
<td>2.61</td>
</tr>
<tr>
<td>Hip osteoarthritis (2)</td>
<td>22</td>
<td>8.72</td>
<td>1.05</td>
<td>34.36</td>
<td>3.92</td>
<td>2.40</td>
<td>0.51</td>
<td>46.27</td>
<td>5.16</td>
</tr>
<tr>
<td>Knee osteoarthritis (3)</td>
<td>13</td>
<td>9.46</td>
<td>1.55</td>
<td>34.23</td>
<td>4.70</td>
<td>4.23</td>
<td>0.77</td>
<td>47.92</td>
<td>6.46</td>
</tr>
<tr>
<td>Both forms (4)</td>
<td>25</td>
<td>11.84</td>
<td>0.95</td>
<td>38.92</td>
<td>2.94</td>
<td>4.28</td>
<td>0.49</td>
<td>55.04</td>
<td>4.11</td>
</tr>
<tr>
<td>Total</td>
<td>137</td>
<td>7.53</td>
<td>0.49</td>
<td>26.18</td>
<td>1.59</td>
<td>2.57</td>
<td>0.21</td>
<td>36.81</td>
<td>2.18</td>
</tr>
</tbody>
</table>

P-value: 0.000

Adjustment for multiple comparisons: Bonferroni. The mean difference is significant at the 0.05 level.

**Discussion**

The results of this study show that we are in front of a female population, the median age is 45, 35±13.11 years with a rate of 43.8%. Overweight women present 35% and obese women exceed 42%. A significant statistical effect was observed between the sensation of pain stiffness and the functional WOMAC gene perceived by the participants in our study, and which increases with age and menopause. The susceptibility of osteoarthritis in both forms is manifested much more in the age group >50 years with a rate of 22%. The susceptibility of osteoarthritis in both forms is manifested much more in the age group >50 years with a rate of 22%. This corroborates with the data of meta-analyses which found strong indications that the prevalence of osteoarthritis increases with the years. Indeed, one of the most important American studies relating to the prevalence of the osteoarthritis carried out by Lawrence and all shows that women are more at risk after the age of 50 to 55. Moreover, starting from this critical age for the women, the level of severity of the attacks to the knee is more advanced in these last with the menopause than the men.

For the BMI variable, the results of our study illustrated a statistically significant link between BMI, WOMAC pain and functional gene dimension, and which are much expressed among women having a morbid obesity with respective averages (15.40; 48.80). Actually, many studies suggest that obesity accelerates progression of knee osteoarthritis29–31 and an increase of five units of BMI is significantly associated with an increased risk of developing knee osteoarthritis.24 Conversely with the knee osteoarthritis, the alliance between obesity and progression of hip osteoarthritis is not proven and was not significant in the Rotterdam cohort analyzing the impact of BMI on the progression of hip and knee osteoarthritis.29 Nevertheless our results point to a positive association between the increase in BMI and the risk of osteoarthritis in both forms (knee and hip osteoarthritis).

Moreover, many transverse and longitudinal epidemiological studies highlighted a significant link between the index of body mass (BMI) and the incidental risk of developing osteoarthritis,30 but few studies that have been interested in weight-to-height ratio (WRH) or poor distribution of body fat are frequently associated with (mechanical) complications, responsible for joint pathologies (in particular knee osteoarthritis and hip osteoarthritis).31 In our study, the pain and the functional embarrassment perceived by the WOMAC are expressed much among women who have one WRH>0,85 (n=118) and less felt in those with android-like obesity WRH<0,80(n=7). Thus, the comparison made by the method of Bonferroni proves a very significant link between the WRH and the perception of three dimensions WOMAC according to the various localizations of osteoarthritis. Our results are consistent with the hypothesis that an abdominal accumulation of fat overload could cause mechanical complications especially the gynoïde form responsible for joint diseases such as knee osteoarthritis and hip osteoarthritis.31

### Conclusion

Obesity is a real public health problem that requires a large-scale prevention strategy. The results show moreover the importance of obesity in the etiology of osteoarthritis. His prevention is important and his extent varies according to the age and localization of osteoarthritis. The management of obesity can prevent the pain stiffness and disability associated with osteoarthritis.

### Acknowledgments

None.

### Conflicts of interest

The author declares no conflicts of interest.

### References

1. OMS. *Obesity and overweight checklist*. 2017. 311 p.


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