Original research

Body Mass Index and predisposition of patients to knee osteoarthritis

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ABSTRACT

Introduction: Obesity is increasingly a prevalent comorbid with potentially substantial adverse effects on pre and postoperative outcomes on osteoarthritis patients. The ablative effect on the joint especially on the weight sustaining joints is the major consequence of osteoarthritis that causes pain and the obese are most susceptible.
Methodology: A retrospective cohort study, using a non-probability convenience sampling method. A self-administered twelve item questionnaire on the perception of knee osteoarthritis was used to determine the relationship of obesity with the development of knee osteoarthritis among patients visiting the surgery outpatient clinic of Hospital Universiti Sains Malaysia HUSM. Obesity was described as BMI $\geq 30 \, mg/kg^2$. Descriptive statistics were employed to describe the demographic data in frequency, mean, percentage, and standard deviation while independent T-Test was used to determine the association of obesity on the development of knee osteoarthritis.
Results: From the questionnaire analysis, the result revealed that there is a significant mean difference (P-value = 0.001) of BMI among the osteoarthritis group. The mean BMI of patients in the osteoarthritis group 40.97 (SD 3.59) was higher than the mean BMI of patients in the group without osteoarthritis 31.29 (S.D 0.71). Furthermore, it was observed that the mean of the group with osteoarthritis was very high indicating that the population group is highly obese when compared to the groups without osteoarthritis, thus implying that the presence of osteoarthritis can be associated with increasing weight.
Conclusion: Obesity is associated with the development of knee osteoarthritis, however, whether it starts or worsens osteoarthritis progression remains an inconsistent resolution, following these, more prudent research would be required to solve this quest.

1. Introduction

Obesity is increasingly prevalent comorbid with potentially substantial adverse effects and predisposition to osteoarthritis (OA). Obesity is rapidly becoming a growing plague in most countries due to changes in people's lifestyle and society, couple with the etiology of obesity which are multi-factorial (Agofure, 2017; Anyabolu, 2017; Boo et al., 2010; Simmonds et al., 2016; Van Dyck et al., 2015). Also, the combination of genetic and environmental factors, all together create a worrisome environment on its effect and predisposition of patients to knee arthritis as well as been comorbidity for various chronic diseases (Farinholt et al., 2013). Obesity is a long-standing comorbid condition strongly associated with osteoarthritis-related joint pain and functional impairment, most common among adults (Control and Prevention,

2011). Obesity has different classifications and definitions; nonetheless, the generally ratify is the definition by the World Health Organization (WHO), which defines obesity as a Body Mass Index (BMI) of $30 \, kg/m^2$ or more (Keke et al., 2015). In 2016, W.H.O global estimation about overweight and obesity shows that: over 1.9 billion adults aged 18 years and older were overweight, amongst these; more than 650 million adults were obese. 39% of adults aged 18 years and over (39% of men and 40% of women) were overweight. In all, approximately 13% of the world's adult population (11% of men and 15% of women) was obese in 2016 and the global prevalence of obesity has almost increased three-fold between 1975 and 2016. (Obesity and overweight - World Health Organization. https://www.who.int › Newsroom › Fact sheets › Detail, 16 February 2018).

Among arthritis, osteoarthritis is the most common cause of joint

problem especially at the weight-dependent region such as the knee joint, although, its occurrence has been reported in other joint areas of the body. But why the increasing prevalence? Probably it is still an under-recognized public health problem. Over the past several decades across the globe, there is an increasing prevalence of arthritis (particularly knee osteoarthritis) and concurrent with the growing obesity epidemic and aging population (Ackerman et al., 2015). Some researchers reported that the relationship between osteoarthritis and obesity was inconsistent (Jiang et al., 2012), while others described a strong association (King et al., 2013). Obesity presents significant co-morbidities that are associated with substantial health care setback and social costs: financially, obesity accounts for 2%–7% of worldwide healthcare costs (Thompson and Wolf, 2001).

Acknowledging the importance of obesity and its associated health consequences could help in the prevention of chronic diseases. Many patients share different preoperational views on perception and experience on osteoarthritis partly due to the information at their disposal and these perceptions focus on patient's knowledge and influence of osteoarthritis on quality of life (QOL) and disability because evaluation of patient-perceived disability is important to the clinical treatment of this chronic illness as it avails the clinicians with medically relevant information on the meaning of the condition for each patient. Hall et al. (2008) indicated that patient preoperative perceptive experience was more centered on the patients persistent pain, the impaired movement, leisure and social interest, and the resulting consequences to the patient's physical and psychological well-being, all of which heightens patients expectation on arthroplasty outcome which they presumed to be a total cure to their pain distress. A better understanding of perception and expectation of patients with OA will help clinicians to have a better comprehension of the demands and expectations of patients with osteoarthritis and help relate patients' health conditions to a wider scope of their lives Gignac et al. (2006).

Obesity is a recognized ill-health condition for developing joint pain and dysfunction and several types of research have directly associated obesity with knee joint disease. (Viester et al., 2013). The likelihood of developing knee and hip pain increase in proportion with increasing weight and, there is an almost threefold increase in the risk of developing end-stage joint arthritis (Salih and Sutton, 2013). Belmont Jr et al. (2014) and Dowsey et al. (2010) indicated that the increasing obesity prevalence will bring a hype in arthritis hike and this is likely to continue to rise unless a drastic approach is employed to reduce obesity. Grotle et al. (2008) reported that an elevated Body Mass Index was remarkably associated with hand and knee osteoarthritis, Niu et al. (2009) also upheld this similar view. Thus, given the multi-factorial etiology of obesity and osteoarthritis and its prevalence comorbid, the present study intends to determine the association between obesity and its predisposition to knee osteoarthritis among patients visiting surgery out-patients clinic of Hospital Universiti Sains Malaysia (HUSM).

2. Material and methods

2.1. Participants

In this study, a total of 86 patients with the complaint of arthritis-related joint pain or problems visiting the surgery outpatient clinic at the Universiti Sains Malaysia were recruited via convenience sampling method. Only the patients that met the inclusion criteria were included in the study. The participants included 38 male (44.2%) and 48 female (55.8%) patients and had a mean age of 55.4 years. The target populations were identified as Malay (75.6%), Chinese (10.5%), Indian (12.8%), and others (1.2%) but were all Malaysians.

2.1.1. Inclusion criteria

The inclusion criteria employed in classifying the age group used in this research work are ages between 18 and < 80 years old while the BMI range chosen is between 18.5 and $\geq 30.0 \, kg/m^2$.

2.1.2. Exclusion criteria

The exclusive criteria used in classifying the age group for the present study are as follows:

Extreme age group implies ages less than 18 and greater than 80 years old, patient with calculated BMI less than $18.5 \, kg/m^2$, and patient who has undergone bariatric treatment.

2.2. Data collection

This study was carried out in accordance with the Declaration of Helsinki; study approval was obtained from the Universiti Sains Malaysia Human Research Ethics Committee (USM/JePEM/18120810). Data were collected from April to June 2019 in the surgery outpatient clinic of Hospital Universiti Sains Malaysia HUSM. A self–administered 12-item arthritis-related questionnaire was employed in this retrospective cohort study, but, before administering the questionnaire to the patients, the patients were first approached and accorded detailed explanation of the study following which consent sheet agreeing to their self-volunteer participation were signed before being asked to complete the questionnaires. For simplicity of the data collection process, each questionnaire was coded before administering to trace missing values and to ease the data analysis process. The approximated time to finished the questionnaire was 10–15mins, such similar interviewer-administered approach was recommended by Chu et al. (2015), claiming it reduces interviewer and respondent bias. The researchers collected 100 completed osteoarthritis perception questionnaires, including 86 that responded to all the items. Thus, the final population target was 86 questionnaires with no missing values.

2.3. Questionnaire assessment of knee osteoarthritis

Even though the exact pathway by which obesity leads to articular cartilage degradation remains uncertain, contemporary researches have indicated mechanical, humoral and genetic factors as possible culprits (Sridhar et al., 2012). Even at this, there is still a huge problem in arthritis-related research caused by the difficulty of using symptoms to define the early presence of osteoarthritis as the features become apparent only once the disease has advanced and probably irreversible. Even though there are no acceptable reference standard criteria for reporting osteoarthritis, thorough evaluation and examination alone can create a confident rule-in diagnosis if certain features are present as explain below:

1. Three main symptoms (persistent knee pain, limited morning stiffness and reduced function) and three signs (crepitus, restricted movement and bony enlargement (Hunter et al., 2011; Zhang et al., 2010).
2. Clinical Osteoarthritis if 1, 2, 3, 4 or 1, 2, 5 or 1, 4, 5 are present: 1. Knee pain for most days of the previous month, 2. Crepitus and impaired joint movement, 3. Morning stiffness lasting 30 min or less 4. Age 38 years or older, 5. Bony enlargement of the knee on examination (Bijlsma et al., 2011).

In this study, the questionnaire assessment of knee osteoarthritis assesses osteoarthritis with respect to the three main features which are: age, persistent knee pain, stiffness, and limited function and movement. The questionnaire consists of 12 arthritis-related questions that assess knee pain (Q1, Q2, Q3, Q10, and Q12), stiffness and reduced function (Q4, Q5, and Q6) and restricted movement (Q7, Q8, Q9, and Q11). Each 12 item arthritis-related question has 5 options each to assess level of arthritis among the selected 86 patients visiting the surgery outpatient clinic of HUSM so as to determine the number of respondents likely to have obesity-related osteoarthritis by using a 5-point Likert scale defined as None, Very mild, Mild, Moderate and Severe from option (1–5). In the absence of any available cut - off point, a cut - off score was calculated from the 5-point options of each question. The first

Table 1
Summary of internal consistency of the patient visiting surgery out-patient clinic in HUSM based on Cronbach's alpha reliability.

Sub-scale	Number of items	Mean	Cronbach's alpha	Total-item correlation
Pain	5	2.02	0.872	0.614–0.778
Stiffness	3	1.71	0.894	0.755–0.842
Movement	4	1.85	0.847	0.650–0.705

Cronbach's alpha (α) of: $0.8 \leq \alpha \leq 0.9$ has good internal consistency.

3 options denote "None", "Mild" and "Very mild" conditions: A total score of 60 was obtained from the overall options and a score of "36 or less" was deemed as " having "No arthritis" while a score of "Over 36″ was deemed as "having arthritis", this is so because the first 3 options are considered as not having arthritis while the last 2 options which connote "Moderate and Severe" conditions are regarded as having arthritis.

2.4. Internal consistency of the patient visiting surgery out-patient clinic HUSM based on Cronbach's alpha reliability

The osteoarthritis-assessing questionnaire was developed by Dawson et al. (1998) with 12 items designed to specifically evaluate patients pre-operation perception of joint problems. Respondents were implored to respond to each item via a 5 - point Likert scale, each item has a scored from 1 to 5, from least to most difficulty or severity, and combined to produce a single score with a range from 12 (least difficulties) to 60 (most difficulties). The questionnaire was translated to the Malay language version and it was confirmed to be reliable. Reliability results are presented in Table 1 below. The internal consistency based on Cronbach's alpha was 0.872 for pain, 0.894 for stiffness, and 0.847 for restricted movement.

3. Statistical analysis

The statistical analyses used in this study was descriptive statistics (focuses on frequency, percentage, mean, and standard deviation) and inferential statistics (focused on the association between obesity and predisposition to knee osteoarthritis) wherein, both Pearson Chi-square and Independent T-Tests analysis were used to determining the association between BMI predispositions to Knee Arthritis. BMI was divided into 2 categories: non-obese 18–29.9 kg/m^2, and obese ≥ 30 kg/m^2. Categorical data are shown as percentages, and differences were analyzed by T-Test analysis. The data were examined and cleansed before the final analysis to ensure all values are entered appropriately and are within the correct range. The data were all initially entered in SPSS 24.0. A minimum and maximum value of each item were examined to ensure the value is within the range of each response option. Data were further screened for missing values and wrong data entry to ensure thorough and completeness of the questionnaire data.

4. Results and discussion

4.1. Presentation of results

4.1.1. Demographic of BMI and 12-items arthritis-relation questionnaires

The questionnaire included items on the patients' demographic characteristics (e.g., age, gender, and ethnicity), BMI groups and characteristics of questionnaire assessment of Knee arthritis. The descriptive mean of the height, weight, and BMI and the demographic characteristics of patients in BMI categories (nonobese and obese) visiting the surgery outpatient clinic of HUSM is presented in Table 2.

Out of the eighty six patients that participated in this study, the female and male ratio in both groups are 18 patients (46.2%) and 21 patients (53.8%) for non-obese and 30 patients (63.8%) and 17 patients

Table 2
Descriptive mean Table (N = 86).

Variables	Mean (S.D)
Height	1.62 (0.098)
Weight	83.97 (17.490)
BMI	32.07 (7.523)

Table 3
Demographic characteristics of patients visiting surgery out-patient clinic of HUSM (N = 86).

Variables	Non-obese n (%)	Obese n (%)	χ (df)	P-value
Gender			2.7 (1)	0.100
Male	21 (53.8)	17 (36.2)		
Female	18 (46.2)	30 (63.8)		
Age-group			6.1 (5)	0.293[a]
18–29	0 (0.00)	3 (6.4)		
30–39	5 (12.8)	6 (12.8)		
40–49	8 (20.5)	6 (12.8)		
50–59	9 (23.1)	12 (25.5)		
60–69	10 (25.6)	17 (36.2)		
70 - 79	7 (17.9)	3 (6.4)		
Ethnicity			3.2 (3)	0.309[a]
Malay	28 (71.8)	37 (78.7)		
Chinese	6 (15.4)	3 (6.4)		
Indian	4 (10.3)	7 (14.9)		
Other	1 (2.6)	0 (0.0)		
Job Status			0.8 (1)	2.522
Employed	17 (43.6)	25 (53.2)		
Unemployed	22 (56.4)	22 (46.8)		

[a] Fisher exact test.

(36.2%) for obese respectively, and are within the age range of 18 - < 80 years. The Employed and Unemployed ratio for both groups are 17 patients (43.6%) and 22 patients (56.4%) for non-obese and 25 patients (53.2%) and 22 patients (46.8%) for obese respectively.

Table 3 below showed the demographic characteristics of the patients visiting the HUSM clinic. The majority of the respondents were Malay: 28 patients (71.8%) and 37 patients (78.7%) for non–obese and obese respectively, making-up two-third of the whole sample population (N = 86), next are the Indians with 4 patients (10.3%) for non-obese and 7 patients (14.9%) for the obese, thirdly, are the Chinese with 6 patients (15.4%) for non-obese and 3 patients (6.4%) for the obese.

4.1.2. Body Mass Index BMI groups

Table 4 below describes the characteristic of BMI groups for with and without osteoarthritis. The result showed that among the group without osteoarthritis (NO-group): 38 patients (48.1%) are non-obese while 41 patients (51.9%) are obese. Among the group with osteoarthritis (YES-group): 1 patient (14.3%) is non-obese while 6 patients (85.7%) are obese. From Table 4, the percentage of the patients with osteoarthritis is higher in the obese group 85.7% than the percentage of non-obese 14.3%. The overall ratio of obese to non-obese in the "YES arthritis" groups is 6: 1 implying that the possibility of having knee osteoarthritis is a six-fold increase among obese individuals.

Table 4
Summary description of characteristics of BMI groups with/without knee osteoarthritis (N = 86).

Variables	Non-obese n (%)	Obese n (%)	χ (df)	P-value
Knee Osteoarthritis			3.0 (1)	0.121[a]
No	38 (48.1)	41 (51.9)		
Yes	1 (14.3)	6 (85.7)		

[a] Fisher exact test.

Table 5
Summary of characteristics of questionnaire assessment of knee Osteoarthritis, (N = 86).

	Item	Score				
		1 n (%)	2 n (%)	3 n (%)	4 n (%)	5 n (%)
Q1	Usual level of pain from knee	20 (23,3)	19 (22.1)	14 (16.3)	24 (27.9)	9 (10.5)
Q2	Pain from your knee at rest (non-activity)	50 (58.1)	18 (20.9)	10 (11.6)	5 (5.8)	3 (3.5)
Q3	Daily living activity interference due to knee pain	27 (31.4)	28 (32.6)	21 (24.4)	7 (8.1)	3 (3.5)
Q4	Trouble with washing and drying yourself	53 (61.6)	17 (19.8)	12 (14.0)	3 (3.5)	1 (1.2)
Q5	Trouble with getting in and out of car or public transport	40 (46.5)	26 (30.2)	17 (19.8)	2 (2.3)	1 (1.2)
Q6	Putting on socks/stockings/tights	50 (58.1)	22 (25.6)	9 (10.5)	3 (3.5)	2 (2.4)
Q7	Doing household shopping alone	53 (61.6)	25 (29.1)	6 (7.0)	1 (1.2)	1 (1.2)
Q8	Walking time before stop/rest due to pain	39 (45.3)	24 (27.9)	15 (17.4)	5 (5.8)	3 (3.5)
Q9	Difficulty climbing upstairs	26 (30.2)	28 (32.6)	19 (22.1)	9 (10.5)	4 (4.7)
Q10	Pain from standing up from sitting	36 (41.9)	32 (37.2)	13 (15.1)	4 (4.7)	1 (1.2)
Q11	Limping when walking	44 (51.2)	30 (34.9)	9 (10.5)	3 (3.5)	–
Q12	Pain wakes you in bed at night	62 (72.1)	15 (17.4)	4 (4.7)	3 (3.5)	2 (2.3)

1 = none or No days or Not at all or No trouble at all or No pain or Yes easily or No nights or rarely or No pain ≥ 30 min 2 = Very mild or only 1–2 days or a little bit or very little trouble/difficulty or 16–30 min or slightly painful or only 1–2 nights or sometimes/just at first. 3 = mild or some days or moderately or moderate trouble or moderate difficulty or 5-15 min or moderately painful or some nights. 4 = moderate or most days or greatly or extremely difficult or around the house or very painful or most nights. 5 = Severe or every day or totally or impossible to do or NO, impossible or unbearable or all the time or every night.
Interpretation: 1 = None, 2 = Very mild, 3 = Mild, 4 = Moderate and 5 = Severe.

4.1.3. Questionnaire assessment of knee osteoarthritis

From Table 5 below, twelve items were applied to assess and determined the presence and level of severity of arthritis among 86 patients visiting the surgery outpatient clinic of HUSM via a 12 item osteoarthritis-related questionnaires so as to determine the number of patients likely to have obesity-related osteoarthritis by using a 5-point Likert scale defined as None, Very mild, Mild, Moderate and Severe from option (1–5). Q1 shows level of pain experienced by patient, just above a third reported "Mild" – "Very mild" pain: 19 patients (22.1%) and 14 patients (16.3%) respectively, 24 patients (27.9%) reported "Moderate" pain, 9 patients (10.5%) reported "Severe" pain while 20 patients (23.3%) claimed to have "no pain". In Q2 and Q3 that assesses pain at rest (non-activity) and pain interference with daily activity respectively. For Q2, the majority: 50 patients (58.1%) reported "None" or meaning "No pain" at rest while very few: 3 patients (3.5%) reported "Severe" pain at rest. For Q3, most reported "Very mild" pain corresponding to 28 patients (32.6%) and few reported, "Severe difficulty" as 3 patients (3.5%). Q4, Q5, and Q6 assesses degree of stiffness because of pain from the knee and here, while majority in Q4, Q5, and Q6 reported "No pain" as (61.6%), (46.5%), and (58.1%) corresponding to 53, 40 and 50 patients respectively, only few reported "Severe difficulty" in Q4, Q5, and Q6 as follows: 1 patient (1.2%), 1 patient (1.2%), and 2 patients (2.4%) respectively in arrangement from Q4– Q6.

Besides, Q7, Q8, Q9, and Q11 assess movement difficulty because of pain from the knee, it, however, measures it under more strenuous activity (energy-demanding movement) i.e. doing household shopping by self, walking distance before stopping, climbing the staircase, and limping while walking. The majority reported: "no pain" (No difficulty) for Q7 and Q8 as 53 patients (61.6%) and 39 patients (45.3%) respectively while the majority reported "Very mild" pain (or little difficulty climbing stairs) in Q9: 28 patients (32.6%). Also for Q7, Q8, and Q9, "Moderate difficulty" in climbing stairs was reported by 1 patient (1.2%), 5 patients (5.8%), and 9 patients (10.5%) respectively while "Severe difficulty" of movement was reported by 1 patient (1.2%), 3 patients (3.5%), and 4 patients (4.7%) respectively. In Q10 which also assess pain character, the majority reported: "no pain" (No rising difficulty) as 36 patients (41.9%) while only 1 patient (1.2%) reported "Severe" rising difficulty.

The last two questions: Q11 and Q12 tell the extreme level of arthritis state: Q11 (Limping when walking) and Q12 (pain wake you up in bed at night) because of pain from the knee. Here, the majority reported "None" (or No limping or No waking at night) 44 patients (51.2%) and 62 patients (72.1%) for Q11 and Q12 respectively. Also for Q11, 3 patients (3.5%) reported "Moderate pain" (Limping most times) but there was no report of "Severe pain" (limping all the time). For Q12, 3 patients (3.5%) reported "Moderate pain" in bed at night (pain wakes Most times from bed at night) while only 2 patients (2.3%) reported "Severe night pain" (Every night) respectively.

4.1.4. Analysis of BMI predisposition to knee osteoarthritis

The result to determine the association between BMI predispositions to Knee osteoarthritis in HUSM is presented in Table 6. The result shown below revealed that there is a significant mean difference (P-value = 0.001) of BMI between the osteoarthritis group. The mean BMI of patients in the arthritis group 40.97(SD 3.59) was higher than the mean BMI of patients in the group without arthritis 31.29 (S.D 0.71). Knee osteoarthritis risk is vehemently linked with the patient's weight and no doubt that overweight is fast becoming a major known risk factor for knee OA.

4.2. Discussion

The general assumption is that obese individuals are prone to ablation of the subchondral cartilage of the joint (Lespasio et al., 2017), especially on the weight-dependent region of the joint (knee joint), besides this, obesity is an established risk factor for chronic illness i.e. diabetes mellitus, heart diseases, cancer, and arthritis (Calle et al., 2003). The result from this study showed that obesity is strongly associated with the progression of knee osteoarthritis, a similar association was narrated by Manek et al. (2003) and (Jiang et al., 2012). More so, a study by Changulani et al. (2008) reported that knee osteoarthritis increase is expected to bring a surge in knee replacement surgery which is seen as a lasting resolution to end-stage knee OA. This association is consistent with what some other research (Magliano, 2008; Wluka et al., 2013), has shown previously in their analysis that BMI predisposes to OA and in turn increases the possibility for knee replacement surgery demand.

Pedagogically, obesity is an increasing threat of pervasive proportions, presently affecting billions of people globally and causing a

Table 6
Independent T-Test to Determine the Association between BMI predispositions to Knee Arthritis among patients visiting the Surgery Outpatient Clinic HUSM.

Arthritis	Mean BMI (SD)	t (df)	P-Value
No	31.29 (0.71)	− 3.47 (84)	0.001
Yes	40.97 (3.59)		

detrimental socioeconomic impact worldwide (Sellayah et al., 2014), and it is an increasingly universal public health menace in the United States of America and the industrialized world (Heo et al., 2003). Globally, the rising incidence of obesity is a worrisome issue of constant media attention as OA is regarded as an illness of adult age (Gersing et al., 2017) and in this study, the mean age was 54.4 years with the majority belonging to the 50–59 years age-range. World Health Organization Global Health Observatory data in 2014 shows that worldwide, obesity occurs in 15% of women and 11% of men aged 18 and above (Fan et al., 2017) and in the United States, it is estimated that between 280, 000 and 325, 000 deaths per year are attributable to obesity (Allison et al., 1999). Several studies pointed out that there is increasing prevalence of arthritis (particularly knee osteoarthritis OA) over the past several decades in the globe and are said to be in concurrent with the growing obesity epidemic and aging population (Ackerman et al., 2015) bearing it in mind that cellular senescence is one of the hallmarks of aging (Mobasheri et al., 2015).

Looking at the rising figures of obesity across the globe and its association with osteoarthritis (fourth leading cause of disability by Fransen et al. (2011)) of the knee with yet incompletely understood mechanism by which it causes osteoarthritis but from Sridhar et al. (2012): is likely via combination of humoral, genetics and mechanical factors. The mechanism linking obesity with OA has been a topic of debate as many mechanisms have been put forward, among is the Wolff's law theory by Teichtahl et al. (2015) which explains that the loss of the bone dynamic tissues from strong mechanical stimulation or overload leads to bone property changes i.e. expanding subchondral bone region, loss of bone mass and trabeculae mesh network that provides tensile strength to the joint articular bone creates a degradation of the cartilage articular bone structures which causes knee OA development, this massive loading force theory on the joint articular surfaces was also narrated by Jiang et al. (2016). Aside from the latter models, Cheng et al. (2019) in their findings reported that co-implication of both genetics and environmental factor is another most likely mechanism. In all, the various explanations demonstrated that the strong association between obesity and the development of knee osteoarthritis are mediated by various factors and that these mechanisms are strongly consistent theory.

For long, the focus on obesity and joint functionality have posed a worrisome atmosphere to the clinician as the suggestion is that, obesity is commonly associated with chronic pain scenarios in the general populace, and pain complaints are common in obese patients. In this research, the study revealed a significant association between obesity and knee osteoarthritis as measured via the osteoarthritis-related questionnaire that assesses the main features of osteoarthritis: pain, stiffness, and functional limitation. Base on existing findings, it will be a profound argument that not only is obesity and pain from OA a public health concern, both conditions concurrently co-occur together. Haven't said that, several studies evaluating these associations have reported conflicting results, probably suggesting that, the relationship between obesity and osteoarthritis pain is not a direct one but is mediated by various factors such as genetic and environmental factors.

From this study results, the researcher was successfully able to established obesity as a high-risk factor for the development of knee osteoarthritis. However, the study thus experienced some limitations and among this latter are: data were obtained from only a specific university which might create a limited generalization of the results to other patients from other universities, self-administer methods and patient self-reported disease was employed in this study to determine obesity-osteoarthritis relation which could bring some bias due to subtle and false responses from the respondents, however, this plays no major concern to the reliability of the research, as the patients were informed that the researchers could not identify them, and their names were not included in the questionnaire, which could reduce the possibility of such bias. All respondents were assured of the confidentiality of the data and urged to answer honestly to all the items related to their point of view and not to seek second opinion from anybody when filling the questionnaires.

5. Conclusion

In conclusion, knee OA is steadily rising in the globe as noted in the rampant growth among the obese, and this increase in BMI is deemed the major culprit of this association, fast becoming an inevitable consequence of knee OA. This is an association that is strongly revealed by this study, hence, a rigorous approach to controlling obesity is highly recommended by the researcher to halt the increasing incidence of obesity and eventually knee OA in the globe.

Declaration of competing interest

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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