International Journal of
Health, Medicine and Nursing Practice
(IJHMNP)

Factors Associated with Hallux Valgus Deformity in Enugu Metropolis, Southeast, Nigeria

CARI Journals

International Journal of Health, Medicine and Nursing Practice
ISSN 2710-1150 (Online)
Vol.8, Issue No.1, pp 8 - 21, 2025
www.carijournals.org

Factors Associated with Hallux Valgus Deformity in Enugu Metropolis, Southeast, Nigeria

Okwara, Blasius Okechukwu[1*] Asomugha, Azuoma Lasbrey[2], Duru, Ndubuisi Ebere[3], Enemuo Vincent Chidi[4], Nnama TochukwuNnamdi[5], Okwara, Anulika Perpetua[6], Eze, Chinonso Blessing[7], Ugbala, Amaechi[8].

[1*] Department of Orthopaedics & Trauma, University of Nigeria Teaching Hospital, Ituku/Ozalla, Enugu, Nigeria.

[2] Department of Anatomy, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.

[3] Department of Orthopaedic Surgery, National Orthopaedic Hospital, Enugu, Nigeria.

[4] Department of Surgery, University of Nigeria Teaching, Ituku/Ozalla, Enugu, Nigeria.

[5] Department of Anatomy, Alex Ekwueme Federal University Ndufu-Alike Ikwo, Ebonyi State, Nigeria.

[6] Department of Nursing Services, National Orthopaedic Hospital, Enugu, Nigeria.

[7] Department of Plastic and Reconstructive Surgery, National Orthopaedic Hospital, Enugu, Nigeria

[8] Department of Surgery, Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State, Nigeria.

http://orcid.org/0000-0003-0866-5181

Accepted: 16th Mar 2025 Received in Revised Form: 30th Mar 2025 Published: 13th Apr 2025

Abstract

Purpose: The purpose of this study was to examine factors associated with hallux valgus such as body mass index (BMI), footwear; types of footwear and duration of footwear use, occupation, as well as foot injury in Enugu metropolis, Southeast, Nigeria

Methodology: This work is a cross-sectional study carried out on a total of 1,110 participants between ages of 11 and 80years of which 1000 of them completed and returned their questionnaires, 516 were females, whereas, 484 were males. This work explored some of the factors associated with hallux abductovalgus deformity like body mass index, type of footwear and duration of use of the footwear. The stratified sampling technique was used in this research. The data was collected into specially designed pro-forma and was analyzed using Statistical Package for Social Science (SPSS version 21). The findings were presented in tables and figure.

Findings: The participantsweights and heights were used to calculate the body mass index (BMI). The BMI ≥30 had 22 (15.1 %) and 8 (11.8%) of the male and female participants with hallux valgus deformity respectively. 19 (12.0 %) of the male and 15 (15.6 %) of the female with hallux valgus were in BMI range of 25 – 29.99, while, 15 (8.3 %), males and 57 (16.2 %) females with hallux valgus deformity were within the BMI 18.5 – 24.99.

Unique Contribution to Theory, Policy and Practice: In this study, several factors like body mass index (BMI), occupation, footwear, types of footwear, duration of footwear useand foot injury were associated with hallux abductovalgusdeformity. Since hallux abductovalgus deformity is a common deformity affecting the foot and its prevalence increased with wearing of high heeled tight-fitting shoes, it should therefore be advocated that flat, spacious shoes should be used regularly by both male and female folks to reduce the prevalence of hallux valgus and its associated complications, health and socioeconomic burden.

Keywords: *Hallux Abductovalgus, Hallux Valgus, Factors, Body Mass Index, Metatarsophalangeal Joint, Deformity. Adductus Angle.*

BACKGROUND

Hallux valgus is a common deformity, leading to the formation of bunions and difficulty walking in footwears[1,2]. It affects individuals of all ages[1]. Hallux valgus deformity consists of medial deviation of the first metatarsal, and lateral deviation of the sesamoids [2].The term hallux valgus defines a subluxation of the first metatarsophalangeal (MTP) joint characterised by lateral deviation and/or rotation of the great toe, and medial deviation of the first metatarsal, which is combined with a prominence, with or without medial soft-tissue enlargement of the first metatarsal head[3,4,5]. It is not a single, but rather a complex first ray deformity, which is associated with abnormal foot mechanics and is often accompanied by deformities and symptoms in lesser toes[3, 6, 7].

Hallux abductovalgus (HAV) or hallux valgus (HV) can also be defined as a deviation of the great toe (hallux) towards the midline of the foot. An abductus angle of greater than 15 degrees is considered abnormal[8]. Hallux abductovalgus deformity refers to a fore foot deformity in which the hallux is abducted and in a valgus position, often associated with the development of a painful bursa, more commonly known as a bunion[9]. Hallux valgus is a very common problem in western societies[10] and in our society[11].

The two main factors contributing to the development of hallux abductovalgus include congenital causes[12] and inappropriate footwear[13]. Several factors have been reported to be associated with hallux valgus including genetic predisposition, structural factors, sex, age, BMI, foot pain, pes planus and footwear[14]. Genetic factors are important in the formation of tumors, people who get bunions are usually genetically predisposed to this bone displacement, and may cause its onset by wearing improperly fitting shoes, or by running or walking in a way that cause stress to the feet[15]. Another common cause for bunions is wearing high heeled shoes resulting in the weight of the body in these shoes pushing the toes into an unnatural position, possibly causing bone displacement[15].

It is important to understand risk factors for hallux valgus in order to prevent or minimize progression of the disorder since hallux valgus is thought to contribute to impaired balance and gait, and to increased risk of falls[14,16,17,18].

The purpose of this study was to examine potential clinical risk factors associated with hallux valgus such as body mass index (BMI), footwear; types of footwear and duration of footwear use, heredity, occupation, as well as foot injury in a population-based cohort of community-dwelling people with clinically assessed foot examations.

MATERIALS AND METHODS

This study was carried out in Enugu metropolis consisting of three local government areas: Enugu North, Enugu South and Enugu East. According to the 2006 Nigerian census, the Enugu metropolitan area has an estimated population of 722,664(Enugu East: 245,440, Enugu North: 279,119, Enugu South: 200,105)[19].

This is a descriptive cross sectional study. This study is a survey study of all respondents which focuses on respondents' variables like sex, age, height, weight, BMI, occupation, shoe wearing and their knowledge of foot deformities.

The stratified sampling technique was used in this research. There are about thirty eight wards in Enugu metropolis; twelve in Enugu East and thirteen in each of Enugu North and Enugu South. About four wards were randomly selected in Enugu East for the data collection, while, five wards were selected each from Enugu North and Enugu South. Three hundred and seventy questionnaires were used in each local government council. The participants were recruited by visiting their place of work or place of abode.

Ethical approval was obtained for this study. A written consent form was given to the subjects after appropriate explanation of the research procedures was made to them. These forms were signed by the subjects who agreed to participate in the study. In other words, only subjects who signed the consent form were used in this study. They were made aware of the option to withdraw from the study at any time without any adverse consequences.

The instruments used were structured questions, like a structured interview, done by the researcher and his colleagues. A validated foot evaluation was performed using a standardized, weight-bearing clinical examination of the foot to assess the presence of several common foot conditions. Weighing balance for weight measurement and stadiometer for height measurement were used.

The heights of the participants were measured using the Stadiometer, model SD 10441, manufactured in 2003. This was recorded in centimeters (cm) but converted to metres (m) by dividing the values by 100, three readings were taken and their mean used. At the time of measuring the height, the participants were asked to remove their shoes, place their heads in the Frankfort plane with their back, buttocks and heels against the height scale. The arms were by the sides with the heels together and toes apart. Then moveable headboard was brought on top of the head with sufficient pressure to compress the hair. This is to obtain the possible maximum height. In taking this measurement, (WHO) standard anthropometric measurement protocols were followed[20] .

The weight of the participants were measured using Bathroom weighing balance made by Camiry, model BR 9011, manufactured in 2014. The weight is recorded in Kilograms (kg). The participants were asked to stand at the centre of the weighing balance without support and place their heads in the Frankfort plane. This is to ensure even distribution of the participants' weight on both feet. Also, heavy jewelleries, shoes, belts, sweaters (and heavy clothing) were removed with pockets emptied. The measurement was taken on three occasions and their average used. This is to obtain the possible weight of the subjects and this was corrected to the nearest 0.1kg. In taking this measurement, (WHO), standard anthropometric measurement protocols were followed[20].

The respondents' weights and heights were used to calculate their respective body mass index (BMI). The body mass index (BMI) is a value derived from the mass (weight) and height of an individual. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m^2, resulting from mass in kilograms and height in metres.

Hallux Valgus Angle (HVA) was measured with goniometer. HVA formed by the intersection of the longitudinal axes of the first metatarsal and the proximal phalanx[21]. The HVA was categorized as normal (< 15°), mild (15–20°), moderate (21–39°), and severe (≥ 40°). The normal range of motion (ROM) of the big toe at the first metatarsophalangeal joint is 70 degrees extension (dorsiflexion) and 45 degrees flexion (plantarflexion) [22].Donatelli (1990) established a procedure according to which goniometer readings are taken. The patient lies prone and the foot is stabilized with one hand. The arms of the goniometer were placed on the long axis of the first ray and the first proximal phalanx in a participant sitting or standing erect[23]. The common goniometer was found to have a high degree of intratesterreliability[24]. The consenting individuals aged from 11 to 80 years were included in this study. The participants with ages below 11years and above 80years were excluded from this work. Individuals with recent history of lower limb surgeries, fracture in the lower extremity or with lower limb prosthesis were not recruited for this study. Moreover, individuals with diabetic neuropathy and those refusing consent were not included in this research work.

In this study, 1110 questionnaires were distributed to the respondents, only1000 questionnaires were correctly filled and returned to the researcher, 73 of the questionnaires were incompletely filled and 37 questionnaires were not returned. Therefore, the percentage of the correctly filled returned questionnaire is given by: number of questionnaires returned divided by total number of questionnaires multiply by 100, that is {1000 ÷ 1110 × 100} which is 90.1 %. The questionnaires were administered to respondents during their respective working break hours, in their offices, workshops, shops and homes by the researcher and his colleagues. In order to minimize the sample selection bias, the researcher and his colleagues distributed the questionnaires to the potential respondents in a random order. The researcher did not know whether the respondents had hallux valgus or not prior to distributing the questionnaires. The questionnaires were filled by the participants, where the participants cannot read nor write, the researcher and his colleagues explained and filled the questionnaire. The researcher and his colleagues took the observations to ascertain the accuracy of the necessary measurements like taking readings of the height, weight and detecting the presence or absence of the foot disorder being examined. The hallux valgus angle (HVA) was measured using the goniometer in the feet of the respondents.

The data collected was analyzed using statistical package for social science version 21 (SPSS 21). The result was presented in tables and charts as may be indicated. The simple percentage formula was used to check the number of responses to the total number of questions asked. The simple percentage formula is the number of specific response divided by the total number of respondents (NR) multiply by 100 %. The findings were presented in tables and figures.

RESULT

The participantsweights and heights were used to calculate the body mass index (BMI). The BMI ≥30 had 22 (15.1 %) and 8 (11.8%) of the male and female participants with hallux valgus deformity respectively. 19 (12.0 %) of the male and 15 (15.6 %) of the female with hallux valgus were in BMI range of 25 – 29.99, while, 15 (8.3 %), males and 57 (16.2 %) females with hallux valgus deformity were within the BMI 18.5 – 24.99. None of the participants with hallux valgus had BMI less than 18.5 as seen in **table 1.1.**

Of the all the respondents that returned their questionnaires, 864 (86.4 %) had normal feet with hallux valgus angle of less than 15 degrees: (HVA <15), whereas, 136 representing 13.6 % of the respondents had hallux valgus deformity with hallux valgus angle greater than 15 degrees: (HVA >15). Furthermore, 83 respondents representing 61.0 % (males 14.7 %; females 46.3 %) of those with hallux valgus deformity had moderate form, while, 32 participants representing 23.6 % had severe form of the deformity, of which 27 (19.9 %) were males and 5 (3.7 %) were females. 21 (15.4 %) of respondents had mild forms of hallux valgus, of which 9 (6.6 %) were males and 12 (8.8 %) were females as revealed in **table 1.2.**

Meanwhile, 20 (14.7 %) of the respondents were of a view that occupation (profession) was a risk factor/cause of hallux valgus deformity, 59 (43.4 %) opined that wearing of shoes was responsible for the development of the deformity. 13 (9.5 %) and 42 (30.9 %) of the respondents believed that foot injury and hereditary were causative factors for the development of hallux valgus respectively. 2 (1.5 %) of the respondents did not know any risk factor or cause for the deformity. This is seen in **table 1.3.**

It was revealed that 972 (97.2 %) of the respondents have been wearing shoes while, 28 (2.8 %) of them said that they do not wear shoes. Of the 972 respondents in the study that normally wear shoes, 356 (36.6 %) wore shoes for period less than 5 hours in a day, of this number, 31 (22.9 %) have hallux valgus. 392 (40.3 %) wore shoes for a period between 5 to 10 hours in a day, here, 43 (31.9 %) of them had hallux valgus, whereas, 224 (23.0 %) wore shoes for greater than 10 hours daily, in this group are 61 representing 45.2 % of the participants with hallux valgus in the shoe-wearing participants as shown in **table 1.4.**

Furthermore, 612 representing 62.9 % of the respondents normally put on flat shoes; of this 19 (3.1 %) had hallux valgus whereas 593 (96.9 %) did not have hallux valgus, of the 176 (18.1 %) that normally put on high heeled shoes; 53 (30.1 %) with hallux valgus put on high heeled shoes, while 123 (69.9 %) of those without hallux valgus usually wore high heeled shoes. 88 (9.1 %) loafers shoes; 61 (69.3 %) of those without hallux valgus put on loafers shoes while 27 (30.7 %) of those with hallux valgus wore loafers shoes. 64 (6.6 %) wore broad spacious shoes; 58 (90.6 %) of them have normal feet while, 6 (9.4 %) of them have hallux valgus. 32 (3.3 %) put on tight shoes representing 27(84.4 %) with hallux valgus and 5 (15.6 %) of participants with normal feet.

Moreover, of the respondents that wear shoes, 808 (83.1 %) of them started wearing shoes at their childhood period, 140 (14.4 %) started at adolescent period, while, 24 (2.5 %) started putting on shoes in their adulthood as also depicted in **table 1.4.** 28 of the participants in the

study do not put on footwear, in this, 27 (96.4 %) of them had normal feet, whereas only one respondent (3.6 %) had hallux valgus deformity as depicted in **figure 1.1.**

Table 1.1: Distribution of sex with body mass index (BMI) and hallux valgus deformity.

BMI(kg/m^2)	MALE without hallux valgus	MALE with hallux valgus	FEMALE without hallux valgus	FEMALE with hallux valgus
<18.5 (under weight)	0 (0 %)	0 (0 %)	(0 %)	(0 %)
18.5 – 24.99 (normal)	165 (91.7 %)	15 (8.3 %)	295 (83.8 %)	57 (16.2%)
25 – 29.99 (overweight)	139 (88.0 %)	19 (12.0 %)	81 (84.4%)	15 (15.6 %)
≥30 (obese)	124 (84.9%)	22 (15.1 %)	60 (82.2 %)	8 (11.8 %)

Table 1.2: Respondents with different Grades of Hallux abductovalgus deformity

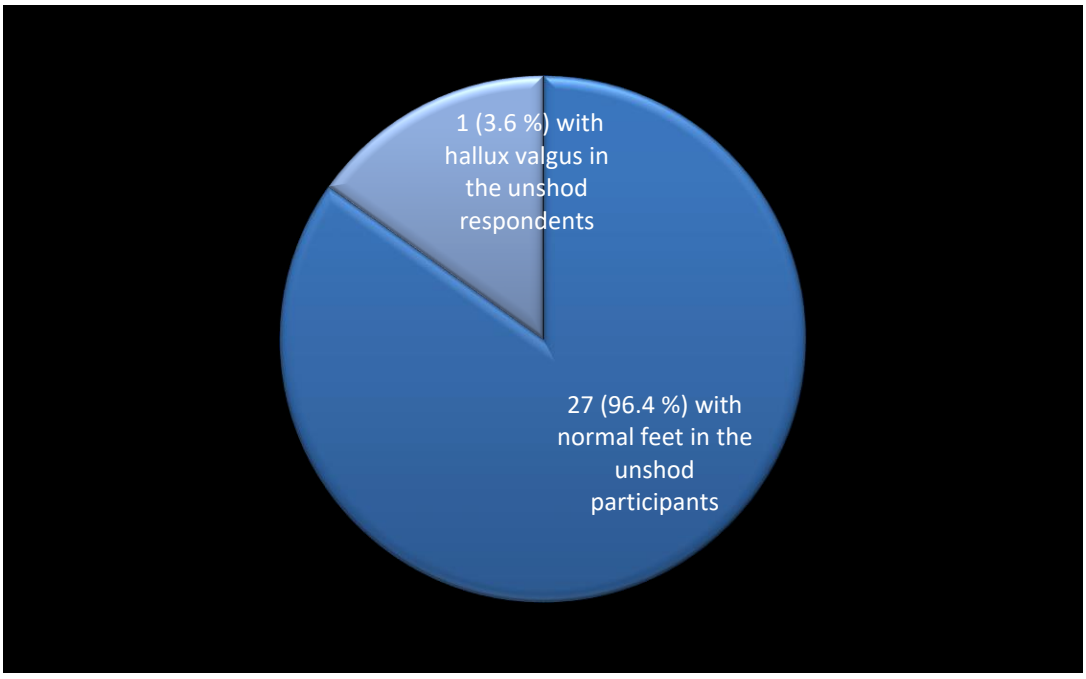
(n =136)		Males	Females
Yes if there is foot deformity: HVA > 15	136 (13.6 %)		
Mild 15 – 20	21 (15.4 %)	9 (6.6 %)	12 (8.8 %)
Moderate 21 – 39	83 (61.0 %)	20 (14.7 %)	63 (46.3 %)
Severe ≥ 40	32 (23.6 %)	27 (19.9 %)	5 (3.7 %)

Table 1.3:Possible causes/predisposing factors for hallux valgus deformity

	No of respondents (n =1000)	Percentage (%)
Occupation	20	14.7
Wearing of shoes	59	43.4
Foot injury	13	9.5
Hereditary	42	30.9

Table 1.4: Participants' shoe wearing characteristics and hallux valgus deformity.

	Frequency (n = 1000)	Percentage (%)
Does not wear shoes	28	2.8
Wears shoes	972	97.2
	Without hallux valgus	**With hallux valgus**
Greater than 10 hours	224 (23.1 %)	61 (45.2 %)
Greater than 5 hours but less than 10 hours	392 (40.3 %)	43 (31.9 %)
Less than 5 hours	356 (36.6 %)	31 (22.9 %)
Shoe type		
High heeled shoes	176 (18.1 %)	123 (69.9 %)	53 (30.1 %)
Flat shoes	612 (62.9 %)	593 (96.9 %)	19 (3.1 %)
Broad spacious shoes	64 (6.6 %)	58 (90.6 %)	6 (9.4 %)
Tight shoes	32 (3.3 %)	5 (15.6 %)	27 (84.4 %)
Loafer shoes	88 (9.1 %)	61 (69.3 %)	27 (30.7%)



Figuren1.1: Hallux valgus in unshod participants.

DISCUSSION

It is found in this work that increased BMI is associated with increased prevalence of Hallux valgus deformity in males and decreased prevalence of Hallux valgus in females as seen in **table 1.1.** This finding though unexpected, may be attributed possibly to the use of more fashionable high heeled shoes with narrow shoe box by females with normal BMI as oppose to overweight or obese females who are more likely to wear less constrictive flat shoes. This finding is in agreement with the study done by Nguyen *et al*[14], but differs with two previous studies done by Menz*et al*[25], in "Age and gender differences in disabling foot pain using different definitions of the Manchester Foot Pain and Disability Index" carried out on A random sample of 223 participants aged 27 to 90 years (88 males and 135 females) from the North West Adelaide Health Studyand Dufour*et al*[26], in their work entitled "characteristics associated with hallux valgus in a population-based foot study of older adults" done using 2 large (5, 124 adults from Framingham offspring cohort and 982 adults of census based group) population- based samples of residents of Framingham, Massachusetts reported that increased prevalence of hallux valgus was associated with a decreased, not an increased BMI. Roddy *et al*[27], reported no association between dichotomized BMI (>30 kg/m^2) and age-adjusted hallux valgus in both women and men, work by Cho *et al*[28], in a rural community of Koreans found that those with hallux valgus had significantly higher mean BMI than those without hallux valgus but there were no sex-specific data. Similarly, Frey and Zamora[29], in a study conducted on 1411 subjects at West Coast Sports Medicine Foundation, California, found that individuals of normal weight in an orthopaedic foot and ankle practice (62% women) had an increased likelihood of hallux valgus compared to overweight or obese individuals.

This work reveals that greater percentage of the participants with hallux valgus have moderate form of hallux valgus while, the mild form was the least common type. The study also shows that the majority of females have moderate form of hallus valgus whereas, males have more of the severe type as seen in **table 1.2.** This is in contrast to the work done by Dare *et al*,[11] and Cho *et al*[28], where mild hallux valgus was observed more than moderate hallux valgus. The research conducted by Daniel and Lobo-Louie[29], entitled "does wearing high-heeled shoe cause hallux valgus? A survey of 1, 056 Chinese females" reported that mild hallux valgus was most common, followed by moderate hallux valgus and then severe form of hallux valgus.

In **table 1.3** of this study, wearing of shoes, heredity, occupation and foot injury are implicated as risk factors/causes of hallux valgus deformity. This is in agreement with some reviewed literature that said the aetiology of hallux valgus is complex and multifactorial Dare *et al*[11], with footwear a contributing factor in a foot that is predisposed to develop hallux valgus[30,31,32] in their study revealed that hallux valgus may be affected by improper footwear, abnormalities in foot anatomy and foot biomechanics, limb inequality, occupational hazards, inflammatory joint diseases (Rheumatoid arthritis) and genetic factors[30,31,32]. The use of footwear has been implicated as an aetiology of hallux valgus[33,34] and there is low prevalence of hallux valgus in

unshod population [35]. Perera and Stephens[36], were of the view that hallux valgus develops slowly, suggesting a process of repetitive trauma; however, despite a perception that occupation[37] or excessive walking and weight-bearing[38] is important, there is no proven link between these and hallux valgus[39]. The only exception is a weak association with ballet dancing[40, 41]. Mann and Coughlin reviewed the literature on cumulative industrial trauma and dismissed any link between occupation and hallux valgus[42].

In this study, it is revealed that about 2.8 % of the participants in the study do not put on any footwear. This is surprising in these modern days, though, it might be related to either their religious and cultural inclinations. Of this unshod population, only 3.6 % have hallux valgus whereas 96.4 % have normal feet as illustrated in **table 1.4 and figure 1.1**. This finding also supports the claim that footwear is implicated as a cause of hallux valgus. This finding is in agreement with studies done by Barnicot and Hardy[43], in the "position of the hallux in West Africans conducted in Nigeria from towns within 30miles from Lagos using 652 subjects and compared with 134 local Europeans and MacLennan[44], which revealed low prevalence of hallux valgus in unshod populations. The work done by Sim- Fook and Hodgon[45], on 200 Chinese in Hong Kong found hallux vagus in 1.9 % of the bare footed and in 30 % of the shoe wearers and Shine[46], showed that hallux valgus is uncommon in unshod populations in a study conducted on 3,515 subjects in Island of South Atlantic with hallux valgus seen in 2 % of barefoot, 16 % of men and 48 % of women who had worn shoes for 60years. The work done by Hofmann[47], revealed the harmful effects of western footwear, they found lower prevalence of hallux valgus in individuals who live barefoot compared to those who wear western footwear in contemporary population. Engle and Morton[48], found no hallux valgus among the Congolese in their study with 674 subjects. O'Connor and Baxter[49], in their study noted that the development of hallux abductovalgus is rare in barefooted populations of the world [49] while, in a comparative study of ancient and modern human skeletal remains, Zipfel and Berger[50], studying skeletal collections from habitually shod and unshod populations, found that metatarsal pathologies were more severe in the shod populations and suggested that 'This result may support the hypothesis that pathological variation in the metatarsus was affected by habitual behaviour including the wearing of footwear and exposure to modern substrates[50]".

The researcher noted from this study that the risk of hallux valgus increases with the number of hours the participants put on footwear in a day as illustrated again in **table 1.4**. Though, some of the literatures reviewed here highlighted the effects of footwear on hallux valgus, none of them discussed the relationship between duration of footwear use and hallux valgus. It is also noted that the prevalence of hallux valgus is high on participants who put on high heeled shoes, tight and loafer shoes whereas, there was low prevalence of hallux valgus in participants who put on flat and broad spacious shoes also shown in **table 1.4.** This is in agreement with cross sectional studies done by Menz and Morris[51], which revealed that wearing shoes with an elevated heel is associated with hallux valgus and plantar calluses and Al-Abdulwahab and Al-Dosry[52], which stated that wearing shoes with a constrictive toe box is associated with hallux valgus

CONCLUSION

Hallux abductovalgus is a common structural foot deformity in which the angular deviation of the hallux is greater than 15 degrees toward the lesser toes with respect to the 1st metatarsal bone and appears as a medial bony enlargement of the 1st metatarsal head. In this study, several factors like body mass index (BMI), occupation, footwear, types of footwear, duration of footwear useand foot injury were associated with hallux abductovalgusdeformity. Hallux valgus deformity was found to increase with increasing BMI in males and decreases with increased BMI in females. In addition, it is found that the prevalence of hallux valgus was much higher in persons wearing shoes than those with unshod feet, with such increased prevalence seen more in participants who wear tight, high heeled shoes with constricted shoe box and loafer shoes than those who use flat and broad spacious shoes. It was also found that the prevalence of hallux valgus was related to the duration of footwear use.

RECOMMENDATION

Since hallux abductovalgus deformity is a common deformity affecting the foot and its prevalence increased with wearing of high heeled tight fitting shoes, it should therefore be recommended that flat, spacious shoes should be used regularly by both male and female folks to reduce the prevalence and its associated complications.

Authors Contributions: OBO, AAL and NTN conceptualized and designed the work. OBO, DNE, EVC, OPA, ECB and UA were involved in data collection and analysis. All the authors (OBO, AAL, DNE, EVC, NTN, OAP, ECB and UA) were involved in writing and revising the manuscript. The authors (OBO, AAL, DNE, EVC, NTN, OAP, ECB and UA) read and approved the final manuscript and also agreed to be accountable for all aspect ofthis study.

Ethical approval: Ethical approval was obtained for this study from Ethical Committee of Faculty of Basic Medical Sciences, College of Health Sciences, NnamdiAzikiwe University, Nnewi Campus, Nigeria with ethical approval number: NAU/CHS/NC/FBMS/131.

Informed consent: Before enrollment into this study, a written consent was obtained from each participant after appropriate explanation of the research procedure was made to them.

Declaration of Helsinki: This work was done in accordance to the principles of Helsinki Declaration.

Funding or financial support: The authors did not receive any funding or financial support for this work.

Conflict of Interest: The authors have no conflict of interest to declare.

REFERENCES

1. Cai, Y., Song, Y., He, M. *et al.* Global prevalence and incidence of hallux valgus: a systematic review and meta-analysis. *J Foot Ankle Res* **16**, 63 (2023). https://doi.org/10.1186/s13047-023-00661-9.
2. Wang XW, Wen Q, Li Y, Liu C, Zhao K, Zhao HM, Liang XJ. Scarf Osteotomy for Correction of Hallux Valgus Deformity in Adolescents. Orthop Surg. 2019 Oct;11(5):873-878. doi: 10.1111/os.12539. PMID: 31663288; PMCID: PMC6819182.
3. Brilakis EV, Kaselouris E, Markatos K, Mastrokalos D, Provatidis C, Efstathopoulos N, Chronopoulos E. Mitchell's osteotomy augmented with bio-absorbable pins for the treatment of hallux valgus: A comparative finite element study. J Musculoskelet Neuronal Interact. 2019 Jun 1;19(2):234-244. PMID: 31186396; PMCID: PMC6587079.
4. Sammarco VJ. Surgical Correction of Moderate and Severe Hallux Valgus. Proximal Metatarsal Osteotomy with Distal Soft-Tissue Correction and Arthrodesis of the Metatarsophalangeal Joint. J Bone Joint Surg Am. 2007;89:2520–2531. [PubMed] [Google Scholar]
5. Coughlin MJ, Mann RA. Hallux Valgus. In: Coughlin MJ, Mann RA, Saltzman CL, editors. Surgery of the foot and ankle. 8th Edition. St. Louis: Mosby; 2007. pp. 183–362. [Google Scholar]
6. Haines RW, McDougall A. The anatomy of hallux valgus. J Bone Joint Surg Br. 1954;36-B(2):272–93. doi: 10.1302/0301-620X.36B2.272. [DOI] [PubMed] [Google Scholar]
7. Brahms MA. Common foot problems. Foot Ankle Int. 1995;16(10):594–603. doi: 10.1177/107110079501601002. [DOI] [PubMed] [Google Scholar]
8. Ferrari, J, Hopkinson, DA and Linney, AD (2004). Size and shape differences between male and female foot bones – Is the female foot predisposed to hallux abducto valgus deformity? *Journal of American Podiatric Medical Association*. 94: 434–452.
9. Brantingham, J., Michaud, T., Deliman, A., Silverman, J., Snyder. R., Brantingham, C. (1994) Chirpractic management of the painful bunion, *Dynamic Chiropractic*.June 17, pp.30-32.
10. Vanore JV, Christensen JC, Kravitz SR, Schuberth JM, Thomas JL, Weil LS, Zlotoff HJ, Couture SD (2003). Diagnosis and treatment of First Metatarsophalangeal Joint Disorders. Section 1: Hallux valgus.*Journal of Foot and Ankle Surgery*. 42:112–123.
11. *Dare WN, Ebeye OA and Nsi CF (2015). The Prevalence of* hallux valgus among three ethnic groups in Delta state Southern Nigeria.*American-EurasianJournal of Scientific Research*. 10(2): 118-120.
12. Reid, DC (1992) Sports Injury Assessment and Rehabilitation, *Churchill Livingston*. 131, 148-149.

13. Schneider, W, Knahr, K (2001). Surgery for Hallux Valgus. The expectations of patients and surgeons, *International Orthopaedics Journal*, 6 (25): 382.
14. Nguyen US, Hillstrom HJ, Li W, Dufour AB, Kiel DP, Procter-Gray E, Gagnon MM, Hannan MT (2010). Factors associated with hallux valgus in a population-based study of older women and men: the MOBILIZE Boston Study. Osteoarthritis Cartilage. 18(1):41-6. doi: 10.1016/j.joca.2009.07.008. Epub 2009 Sep 1. PMID: 19747997; PMCID: PMC2818204.
15. Glasoe, WM, Yack, HJ &Saltzman, CL(1999). Anatomy and Biomechanics of the First Ray. *Physical Therapy Journal*,79(9), 854-859.
16. Keegan THM, Kelsey JL, Sidney S, Quensenberry CP., Jr. Foot problems as risk factors of fractures. Am J Epidemiol. 2002;155:926–31. doi: 10.1093/aje/155.10.926. [DOI] [PubMed] [Google Scholar]
    Menz HB, Lord SR. The contribution of foot problems to mobility impairment and falls in community-dwelling older people. J Am Geriatr Soc. 2001;49:1651–1656. [PubMed] [Google Scholar]
17. Menz HB, Morris ME, Lord SR. Foot and ankle characteristics associated with impaired balance and functional ability in older people. J Gerontol Med Sci. 2005;60A(12):1546–1552. doi: 10.1093/gerona/60.12.1546. [DOI] [PubMed] [Google Scholar]
18. Menz HB, Morris ME, Lord SR. Foot and ankle risk factors for falls in older people: a prospective study. J Gerontol A BiolSci Med Sci. 2006;61(8):866–70. doi: 10.1093/gerona/61.8.866. [DOI] [PubMed] [Google Scholar].
19. National Population Commission and National Bureau of Statistics Estimates (2016) Population Forecasts by State and Gender (2013-2016), 9. https://nigeriastat.gov.ng.
20. World Health Assembly, 48. (1995). World Health Report 1995: summary. World Health Organization. https://iris.who.int/handle/10665/177478
21. Hardy R, Clapham J (1959): Observations on hallux valgus.*Journal of Bone and Joint Surgery*, 33: 376–391.
22. Magee, DA (1997) Orthopaedic Physical Assessment,W.B. Saunders Company, Philadelphia, pp.4-5, 603, 618-621, 625, 659, 673-675.
23. Donatelli, RA. (1990). The Biomechanics of the foot and ankle, *F.A. Davis Company*, Philadelphia, pp. 92-94.
24. Rothstein, JM, Miller, PJ and Roettger, RF (1983) Goniometric Reliability in a Clinical Setting, *Physical Therapy Journal*. 63 (10): 1611-1615.
25. Menz HB, Gill TK, Taylor, AW, Hill CL (2011): Age and gender differences in disabling foot pain using different definitions of the Manchester foot pain and disability index. *BMC Musculoskeletal Disorder*. 12: 243-10.
26. Dufour AB, Casey VA, Golightly YM, Hannan MT (2014). Characteristics associated with hallux valgus in a population based study of older adults: The Framingham Foot Study.*Arthritis Care & Research*. 66:1880-1886.

27. Roddy, E, Zhang, W and Doherty M (2008). Prevalence and associations of hallux valgus in a primary care population. *Arthritis and Rheumatism Journal*, 59:857-868.
28. Cho NH, Kim S, Kwon DJ, Kim HA (2009). The prevalence of hallux valgus and its association with foot pain and function in a rural Korean community.*Journal of Bone&Joint Surgery*; 91:494–8.
29. Daniel Wu, Lobo Louie (2010). Does wearing high-heeled shoe cause hallux valgus? A survey of 1,056 Chinese females. *The Foot and Ankle Online Journal:* 3 (5): 1-5.
30. England MD (1954). The problem of hallux valgus. *Chiropodist* 9:275.
31. Johnston O (1959). Further studies of the inheritance of hand and foot anomalies. *Clinical Orthopaedics and Related Research*; 8:146 – 59.
32. Pique-Vidal, C, Sole, MT and Antich, J (2007). Hallux valgus inheritance: pedigree research in 350 patients with bunion deformity. *Journal of Foot and Ankle Surgery*, 46: 149-54.
33. Snijders CJ, Snijder JG, Philippens MM (1986). Biomechanics of hallux valgus and spread foot. *Foot Ankle Journal*. 7:26-39.
34. Coughlin MJ, Thompson FM (1995). The high price of high-fashion footwear.*Instructional course lectures*. 44:371-7.
35. Kato T, Watanabe S (1981). The etiology of hallux valgus in Japan. *Clinical Orthopaedics and Related Research*. 157:78–81.
36. Perera, AM and Stephens, MM (2011). The pathogenesis of hallux valgus. Current concepts review. *American Journal of Bone and Joint Surgery*. 93: 1650-61
37. Greer WS (1938). Clinical aspect: relation to footwear. *Lancet*. 232:1482-3.
38. Coughlin, MJ and Jones CP. (2007). Hallux valgus; demographics, etiology, and radiographic assessment. *Foot ankle international,* 28(7): 759-7.
39. Hung LK, Ho YF, Leung PC (1985). Survey of foot deformities among 166 geriatric inpatients. *Foot Ankle*. 5:156-64.
40. Coste F, Desoille H, Illouz G, Chavy AL (1960). Locomotor apparatus and classical dancing. *Rev Rhum Mal Osteoartic*. 27:259-67.
41. Einarsdottir H, Troell S, Wykman A (1995). Hallux valgus in ballet dancers: a myth? *Foot Ankle International*. 16:92-4.
42. Mann RA Coughlin MJ. (1981). hallux valgus. etiology anatomy, treatment and surgical considerations. *Clinical Orthopaedic Related Research*; 157: 31-41.
43. Barnicot NA, Hardy RH (1955). The position of the hallux in West Africans. *Journal of Anatomy*. 89:355-61.
44. MacLennan R (1966). Prevalence of hallux valgus in neolithic New Guinea population. *Lancet*. 1:1398–1400.
45. Sim-Fook L, Hodgson AR (1958). A comparison of foot forms among the non-shoe and shoe-wearing Chinese population. *American Journal of Bone and Joint Surgery*.40:1058–1062.

46. Shine IB (1965). Incidence of hallux valgus in a partially shoe-wearing community.*British Medical Journal*; 1: 1648 – 50.
47. Hoffmann P (1905). Conclusions drawn from a comparative study of the feet of bare-footed and shoe-wearing people. *American Journal of Orthopedics*. 3: 105 - 36.
48. Engle DJ (1931). Notes on foot disorders among natives of the Belgian Congo. *The Journal of Bone &Joint Surgery*, 13:311 - 8.
49. O'Connor PL, Baxter DE (1988). Developmental disorders: adult foot. In: Gould JS (ed). The *FootBook*. Baltimore: Williams & Wilkins.207.
50. Zipfel B, Berger L (2007). Shod versus unshod: the emergence of forefoot pathology in modern humans? *Foot*. 17: 205-213. *Clinical Orthopaedics and Related Research* 1979; 142: 10.
51. Menz HB and Morris ME (2005). Footwear characteristics and foot problems in older people. *Gerontology journal*; 51(5):346-351.
52. Al-Abdulwahab SS, Al-Dosry RD (2000). Hallux valgus and preferred shoe types among young healthy Saudi Arabian females. *Annals Saudi Medicine*. 20: 319 – 321.