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Original Research

Spinal deformities among professional load porters in a Nigerian urban market

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ABSTRACT

Aim: Individuals who earn their living by carrying marketers' heavy groceries on their heads (professional load porters) are very common in Nigerian markets. The possible link between habitual carrying of heavy load on the head and spinal deformity has however not been investigated. This study was aimed at documenting the impact of load-carrying on the head on professional load porters' spine by comparing the prevalence of spinal deformities among them and sex and age matched controls. **Methods:** Participants were 52 (23 male, 29 female) load porters and 52 (24 male, 28 female) age and sex-matched controls. The plumb line method was used to screen all participants for spinal deformity in the saggital and frontal planes. Data analysis involved descriptive statistics of mean, frequency and percentages and Chi-square test at α; = 0.05. **Results:** No significant difference between load porters' age (31.52 ± 7.8 years, range = 20-50 years) and that of the controls (30.10 ± 8.1 years, range = 20-50 years) but controls had significantly higher body mass index and weight. No significant difference between prevalence of spinal deformity in load porters (28.8%) and controls (25.5%); and between male (39.1%) and female (20.9%) load porters. Scoliosis (23.1%) was the most common deformity in load porters while lordosis (15.4%) was most common among controls. **Conclusion:** There was no significant difference in spinal deformity prevalence between load porters and controls though the prevalence was higher in load porters. However, we could not conclude that carrying heavy loads on the head causes spinal deformities among professional load porters.

KEY WORDS: Head load carriage, professional load porters, spinal deformities

INTRODUCTION

Manual material handling is still quite prevalent in most occupations and virtually unavoidable during daily activities. All methods of transporting heavy loads are believed to have evolved intuitively but major differences exist between nations and sometimes between cultures or tribes in the same nation. The back pack is commonly used for manual load transport in western nations [1] while the yoke and head pack are the most commonly used methods in developing nations [2]. In Nigeria, the head pack is more common in the western and eastern parts of the country while the yoke is more popular in the north. The back pack mode of load transportation is of limited practical use in occupational settings not only because of the extra time required to pack the items in the pouches but also for the limited amount and type of load that is permitted by the physical dimensions of the pack [1].

Carrying loads on the head (head pack) is a very common practice in many African countries. Professional load carriers/porters in many developing countries use their heads to carry loads that could be as heavy as 100 kg on a regular basis for many years [3]. Over the years, there has been an emergence of the physically demanding occupation of commercial load carrying (popularly called "alaaru" or "alabaru" among the Yorubas in the west of Nigeria). The occupation is engaged in by male and female of varying age groups as a way of surviving downturns in the economy. In South-West Nigeria, professional load porters whose ages may range from 10 to 70 years and above are commonly seen in the markets where they assist shoppers to carry their groceries of varying weights over varying distances for paltry economic reward.

Although the human cervical spine can withstand substantive compressive loads *in vivo*,[4] repeated carrying of heavy loads on the head stresses the spinal structures and constant/habitual carrying of load on the head predisposes the spine to some degree of deformity [5,6]. It has been opined that regular carrying of heavy loads on the head over a prolonged period of time could be an important etiological factor in the development of spinal deformity [4,7]. Furthermore, elimination of cervical and lumbar lordosis has been reported to be more common in commercial load carriers than non-load carriers [8]. Despite the increasing popularity of commercial load carrying, the occupational hazards of the practice that may not be apparent to those who engage in the occupation have not been studied. Thus, though previous studies have looked at the association between regular load-carrying on the head and cervical spondylosis;[5-8] the effect of the occupation on spinal alignment of those who engage in it has not been reported.

Furthermore, since elimination of cervical and lumbar lordosis has been reported to be more common in commercial load carriers in a previous study, we hypothesized that this may lead to more spinal deformities among professional load porters. The prevalence of spinal deformities in professional load porters in Bodija market, Ibadan, Nigeria and their age-matched non-load porters was hence compared in this study. Bodija market is one of the largest markets in Ibadan. Ibadan, located in the south-west of Nigeria is the country's third largest city by population (2,550,593) and the largest by geographical area (1,189.2sq. mi).[9] The market is named after Bodija, a popular urban district in Ibadan.

METHODS

Participants

The study group comprised 52 (male = 23, female = 29) adult professional load porters who have been engaged in the occupation for at least 2 years at the time of the study, had no self-reported musculoskeletal disorder of the spine, and gave no history of disorders such as infantile poliomyelitis, congenital abnormalities of the spine, idiopathic scoliosis or chronic low back pain that could have predated their engagement in the occupation and predispose to spinal deformity. They were also screened for obvious musculoskeletal deformities such as limb length discrepancy or pelvic tilt. The control group comprised 52 (male = 24, female = 28) age and sex-matched individuals who met all the inclusion criteria for the study group except that they had no history of habitual or regular load carrying on the head. Participants in the control group had no unique characteristic that could either lead to or protect against development of spinal deformities. All participants were recruited into the study through purposive sampling.

Procedure

The study's protocol was approved by the University of Ibadan/University College Hospital Institutional Review Committee (UI/IRC/04/0065) while participants gave informed consent to take part in the study. Participants were screened individually (with their backs exposed) for spinal deformity/deviation in the sagittal and frontal planes using the protocol described by Kendall *et al* [10]. Data were collected in 2008 over a 6-month period.

Side view

Participants stood erect on a posture board while a plumb line was resting on a base point just anterior to the lateral malleolus. One of the researchers stood at the side of the participant to note any posterior or anterior deviation of the pelvis and the knee from the plumb line.

Back view

The participant was asked to stand erect on the posture board with the plumb line resting on a base point midway between the heels of the standing participant. One of the researchers then stood behind the participant to check the hips and shoulders for any asymmetry as well as the spine for any spinal deformity such as a right or left lateral deviation of the spine from the plumb line thus suggesting scoliosis, exaggerated or excessive lumbar lordosis and a posterior rounded upper back for thoracic kyphosis.

Forward bend test

Finally, participants were further screened for scoliosis using the Adam's forward bend test [11,12]. For this test, the participant assumed a forward bend position while one of the researchers sat in front of the participant with her eyes leveled with the participant's back to enable comparison of the two halves of the upper thoracic and lumbar regions of the participant's back. Participant was considered to have scoliosis if there was any of the following: A thoracic or lumbar para-vertebral prominence during the forward bend test, and/or a lateral deviation of the spine or asymmetry of shoulder or hip levels with the participant in standing. All participants were screened by one of the authors; a Physiotherapist with 15 years' clinical experience to ensure reliability of the data.

Data Analysis

Data were summarized with descriptive statistics of mean, standard deviation and percentages and further analyzed with Chi-square test and *t*-test at 0.05 α level. All data that were analyzed with parametric statistic were subjected to the Shapiro–Wilk test of normality. Analysis was done using SPSS Inc., version 15.0 444 N Michigan Ave., Chicago, IL 60611.

RESULTS

The mean age, body weight, height, and body mass index (BMI) of participants in both groups are presented in Table 1. The load porters' age (31.52 ±7.80 years; range = 20-50 years) was not significantly different from that of the controls (30.10 ± 8.12 years; range = 20-50 years). Participants in the control group had significantly higher body weight and BMI. The load porters have been engaged in the occupation for 3.27 ± 2.54 years (range = 2-15 years, median = 2.0 years). The prevalence of spinal deformity among the professional load porters and controls are presented in Table 2. Fifteen (28.8%) of the load porters compared to 13 (25.0%) of the controls had one form of spinal deformity or the other but there was no significant difference in the prevalence of spinal deformity in the two groups. A breakdown of the spinal abnormalities [Table 3] indicated that the most common spinal deformity among the load porters was scoliosis found in 12 (23.1%) while the most common deformity among the controls was lordosis found in eight (15.4%) of the group. With the breakdown, there was however a significant difference in the prevalence of spinal deformities in load porters and non-load porters [Table 3]. Postural alignments among participants in both groups are presented in Table 4. In the side view, 59.6% of the load porters and 50.0% of the controls had normal head alignment, 100% of the load porters and 90.4% of the controls had normal pelvic

alignment while all participants had normal knee alignment. In the back view, 71.3% of the load porters and 75% of the controls had normal alignment. Prevalence of spinal abnormalities in male and female load porters is compared in Table 5. Significant differences were not found in the distribution of spinal abnormality, head deviation and pelvic deviation between male and female load porters though the prevalence was higher in male load porters than their female counterparts. There was no significant association between years of experience as load porter and presence of spinal deformity though spinal deformities were more common in the first 5 years on the vocation [Table 6].

DISCUSSION

Control participants had significantly higher body weight and BMI than the load porters, otherwise the groups were comparable.

Table 1: Participants' physical characteristics

Professional load porters (n=52)		Controls (n=52)	*P*	CI (95%)
	Mean±SD	Mean±SD		
Age (years)	31.52±7.80	30.10±8.12	0.367	−1.69 to 4.54
Weight (Kg)	53.75±6.41	62.26±11.33	<0.001	−12.09 to −4.93*
Height (m)	1.67±0.07	1.67±0.09	0.667	−0.02 to 0.04
BMI (kg/m^2)	19.18±1.45	22.45±3.87	<0.001	−4.41 to−2.14*

*Significant between-group difference at α=0.05. BMI: Body mass index, SD: Standard deviation

Table 2: Comparison of prevalence of spinal deformity in professional load porters and controls

	Spinal deformity		χ^2	*P**
	Present	Absent		
Load porters	15	37	0.195	0.658
Controls	13	39		
Total	28	76		

*Chi-square test

Table 3: Comparison of spinal deformities in professional load porters and control participants

Spinal deformity	Load porters		Non-load porters		χ^2	*P**
	N	%*	*N*	%		
Scoliosis	12	23.1	3	5.8	12.23	0.016
Kyphoscoliosis	0	0	1	1.9		
Lordosis	1	1.9	8	15.4		
Kyphosis	2	3.8	1	1.9		
Normal	37	71.2	39	75.0		

*Chi-square test

This finding might suggest that the load porters had better fitness in terms of their body composition. More importantly, this finding has bearing on this study's outcome because increased BMI has been reported to have a protective effect for developing spinal deformities [13]. The number of vertebral deformities has also been reported to increase as weight, BMI or fat mass increase in women but with decrease in total mass in men [14].

The main objective of this study was to compare the prevalence of spinal deformities in professional load porters and their age and sex-matched controls. Although a slightly higher percentage (28.8%) of the load porters compared to 25% of the controls had spinal deformity, the difference between the groups did not reach statistical significance. There is no previous study on spinal deformities among load porters with which we could compare findings from our study. This is because previous studies have focused on radiological evidence of cervical spondylosis among load porters and non-load porters. Thus, no significant association was found between woodbearing (carrying bundles of firewood on the head) and degenerative changes in the spine though the height of the vertebral bodies from C3 to C6 and the intervertebral discs of woodbearers were significantly lower than for the control group [3]. A probable reason for the lack of significant difference between load porters and controls in this study may be the duration of time for which the load porters have been engaged in the occupation. This may especially be so because the incidence of cervical spondylosis among load carriers has been found to be significantly associated with duration of occupation as well as weight of the load [15]. Although the range of their years on the occupation was 2-15 years, the modal number of years was just 2 years and this may not be long enough for any significant change in the spinal alignment that would be identifiable by visual inspection used in this study. Our finding must however be interpreted with caution in view of the reported link between both BMI and body weight and development of spinal deformities [13,14]. The lower prevalence of spinal deformities may hence be a reflection of the reported protective effect of increased BMI for the development of spinal deformities.

Load bearing on the head, particularly when heavy loads are involved have been found to produce more radiographic degenerative signs, much stiffness in the neck and more pain than in the control group [3]. Regular heavy load carrying on the head has also been found to play an etiological role in cervical spondylosis; the prevalence of cervical spondylosis being higher in load carriers than controls [7,14]. Load bearers are believed to stiffen their necks in order to bear the weight with consequent hypertrophy of the trapezius muscle [6] and

Table 4: Postural alignment of head, pelvis and knee among participants

Postural alignment	Load porters *n* (%)				Controls *n* (%)			
	Side view			Back view	Side view			Back view
	Head	Pelvis	Knee		Head	Pelvis	Knee	
Normal	31 (59.6)	52 (100)	52 (100)	37 (71.2)	26 (50.0)	47 (90.4)	52 (100.0)	39 (75.0)
Lateral deviation	0 (0.0)	0	0	12 (23.1)	0	0	0	3 (5.7)
Anterior deviation	14 (26.9)	0	0	2 (3.8)	26 (50.0)	5 (9.6)	0	2 (3.8)
Posterior deviation	7 (13.5)	0	0	1 (1.9)	0	0	0	8 (15.4)

Table 5: Comparison of prevalence of spinal deformities between male and female professional load porters

	Male *n*=23	Female *n*=29	χ^2	*P*
Presence of spinal deformity			2.13	0.15
Present	9	6		
Absent	14	23		
Type of spinal deformity			2.87	0.41
Scoliosis	7	5		
Lordosis	1	0		
Kyphosis	1	1		
Normal	14	23		
Head deviation			3.36	0.19
Anterior	9	5		
Posterior	2	5		
Normal	12	19		

Table 6: Association between presence of spinal deformity and years of experience as professional porter

Experience (years)	Present	Absent	χ^2	*P*
2-5	8	9	2.420	0.49
6-9	1	2		
1-13*	0	2		
14-17	0	1		

*Chi-square test

carrying heavy loads on the head have been found to change the pattern of degenerative changes in the cervical spine with a shift in the degeneration from the fifth intervertebral disc space to higher levels and accentuation of the straightening of the lordotic curve [8]. Also, Levy [16] using lateral radiographs demonstrated that porters who carried 90 kg on the head had the physiological cervical lordosis straightened with the cervical spine assuming a more vertical position. This is probably the reason why the prevalence of anterior deviation of the head among load porters in this study was 26.9% in comparison to 50% among the controls and why a higher percentage of load porters than controls had spinal deformity.

Previous studies among load carriers have focused on the impact of the axial loading from load carrying on the head on the cervical spine especially in connection with the etiology of cervical spondylosis. Findings from this study however seem to suggest that carrying heavy loads on the head may have its effects on the whole spine. Thus, 23.1% of the load porters as against 5.3% of the controls had scoliosis. Woodbearers in Congo have been noted to walk with exaggerated swinging of the hips in order to gain speed without losing balance [3]. Load porters also often use one of their hands (occasionally the two) to support the load on their heads thus reducing the contribution of arm swinging to gait and consequent alteration of the posture with resultant elevation of the shoulder on the side of the supporting arm which may culminate in the development of scoliosis over a prolonged period of time.

Another objective of this study was to compare the prevalence of spinal deformities in male and female load porters. Although 39.1% of male load porters compared to 20.7% of female porters had spinal deformity, we found no significant difference in the prevalence of any of the postural abnormalities between male and female load porters. Jäger *et al* [6]. had similarly observed higher prevalence of cervical spondylosis in male load porters than their female counterparts thus suggesting that the cervical spine of male and female load porters may be differentially affected by habitual carrying of load on the head. The higher prevalence of spinal deformity and cervical spondylosis among load porters may be connected with the likelihood of male porters carrying heavier loads which may subject them to greater axial loading. Incidentally, the prevalence of cervical spondylosis among load carriers has been reported to be associated with duration of occupations and that those who carried heavier loads suffer more from cervical spondylosis [15].

The relatively high percentage (25%) of spinal deformities among non-load porters should be of concern to the health authorities because of the long run impact of spinal deformities on the respiratory system. We suspect that the high prevalence of spinal deformities among the control participants is a consequence of unfavorable working and living conditions of average Nigerians. For instance, many sit for long hours on benches or low stools (without back support or arm rests) which encourage poor posture. Even at night, they either sleep on springy beds or sleep on bare floor. It is hence necessary to promote good ergonomics and back hygiene among this group of people. Participants with spinal deformity in this study were educated on ergonomics and posture correction and further referred to nearby hospitals for further attention when necessary.

Limitations

A major limitation of this study was the method used to assess participants' posture. Although the plumb line method that was used is acceptable and reasonably valid for screening purposes, its findings cannot be as accurate as those from either X-ray imaging or non-contact optical method. However, the plumb line method is cost-effective and easy to use for screening in a public place like the market. Furthermore, the state of the load porters' spine before engaging in the occupation could not be ascertained while the limitation of a cross-sectional study in drawing a cause-effect relationship is well established. Findings from this study hence need to be considered cautiously considering the study's design, lack of control over factors outside load carrying on the head that could have impacted on the load porters' spine and the significant differences between the groups' body weight and BMI. Future studies should be longitudinal in design, control for the previously listed confounding variables and involve the use of more precise methods of assessing postural alignment.

CONCLUSIONS

No statistically significant difference was found between the prevalence of spinal deformities in professional load porters and control participants. However, spinal deformities were more prevalent among commercial load porters than the control participants and among male porters than female porters. Scoliosis was the most prevalent spinal abnormality among the

load porters. In spite of the absence of a significant difference in the prevalence of spinal deformities in load porters and control participants, the load porters will benefit from the use of such equipment as wheel barrow or push carts which will enhance their capacity to do their work and eliminate the possible deleterious effect of habitual load carrying on the head since a larger percentage of professional load porters than control participants had spinal deformities.

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