


## Research Article

# Influence of Occupational Physical Activity on Anthropometric Profile and Body Composition of Bricklayers in Kwara state, Nigeria

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## ABSTRACT

**Objectives:** Optimal amount of muscle and fat mass has been associated with level of physical activity and are basic determinants of individuals' health, fitness including occupational performance. The study determined the level of occupational physical activity and influence on anthropometrics, body composition and health of bricklayers in Kwara state, Nigeria.

**Methods:** Descriptive correlational design was used. During the study only three bricklaying sites were functional and all the 45 bricklayers who met the inclusion criteria were purposively selected. Standardized instruments: non-elastic anthropometric tape rule, stadiometre and weight scale were used for anthropometric and body composition measurement while Occupational Physical Activity Questionnaire (OPAQ;  $r = .72$ ) was used to assess work-related physical activity. Pilot test was conducted to confirm calibration and functionality of body composition equipment. Informed consent was sought from the participants with ethical approval obtained from the Institutional board. Statistical analysis was performed using SPSS V20.0 with descriptive statistics of mean and standard deviation for analyses of body composition and physical activity while inferential statistics of PPMC and t-test were for analysis of hypotheses at a 0.05 alpha level.

**Results:** Participants performed vigorous intensity occupational physical activity expending an average of 2,699.1 MET-min-wk<sup>-1</sup>. Occupational physical activity negatively correlated with their body mass index ( $N = 45$ ,  $r = -.06$ ,  $r^2 = .36\%$ ,  $p = .05$ ); Waist circumference ( $N = 45$ ,  $r = -.083$ ,  $r^2 = .69\%$ ,  $p = .05$ ) and positively correlated with their bicep circumference ( $N = 45$ ,  $r = .61$ ,  $r^2 = 37.2\%$ ,  $p = .001$ ) and chest circumference ( $N = 45$ ,  $r = .40$ ,  $r^2 = 16\%$ ,  $p = .007$ ).

**Conclusions:** Bricklaying positively influenced body parameters which might induce health and fitness benefits. However, there is need for health promotion intervention for enlightenment and healthy lifestyle practice among bricklayers to improve overall health and fitness.

## INTRODUCTION

The effect of occupation on body shape, size, fat and fat free mass varies based on the level of occupational physical activity involved in the job individuals do. Manual jobs like

bricklaying and other construction works involve vigorous intensity occupational physical activity [1,2]. Although the effects of occupational physical activity on health and fitness has been equivocal [3,4], some studies have associated vigorous intensity occupational physical activity with improved health [2,5-7], while others have reported that vigorous intensity occupational physical activity has negative health consequences [8,9]. This inconsistency might be due to different methods of assessing occupational physical activity

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that was used in these studies.

Body composition and anthropometric assessment have been used for evaluating the impact of physical activity on individuals. Many population studies dealing with health and physical fitness have linked levels of physical activity to body weight, size and levels of body fat [10]. Excessive amount of body fat and distribution causes obesity and increases the risk of diabetes, hypertension and cardiovascular diseases [11,12] especially among sedentary people [13-15].

A few studies have been conducted in Nigeria regarding bricklaying and the health of bricklayers, most of them focusing on the occupational hazards from the work patterns and use of equipment [1] with little consideration for the possible benefits that might result from the high level of physical activity involved in the job [5]. In fact, the findings of these studies are not given priority in public health discussions despite the contribution manual workers make to development of the country. Regarding Ilorin-South Local Government of Kwara State, the relationship and/or implication of bricklaying occupation on health could not be ascertained as no previous study have considered this. This study therefore strategically examined the contribution of occupational physical activity level on the health of bricklayers, to discover the effect of working hours (Metabolic Equivalent of Tasks, METs) on their physical capacity using some specific body composition and anthropometric data. This study provided answers that rated the body composition as low, moderate or high health risk; and quantified physical activity level of the bricklayers based on MET-min per week. It was also hypothesised that bricklayers' physical activity had no correlation with body composition and anthropometric profiles and the group of bricklayers with moderately high intensity (MHI) occupational physical activity were not different from the very high intensity (VHI) occupational physical activity group.

The objective of the study was to determine the body composition and occupational physical activity level and their correlation with fitness and health of bricklayers in Ilorin-South Local Government Area of Kwara State.

## METHODS

This was a descriptive correlational study that examined the relationship between bricklayers' level of occupational physical activity and their anthropometric profile and body composition. The population was all bricklayers in the two districts (Akanbi and Balogun-fulani) in Ilorin-South Local Government Area (LGA) of Kwara State, which had 446 registered bricklayers. Due to inconsistencies in occupational daily recruitment of the bricklayers at the time of this study, all of them could not be reached within the three weeks of data collection at the various bricklaying occupational sites in the LGA. Hence, after excluding those with injury, medical conditions or on medication, only 45 of the 52 bricklayers who were actively engaged in three functional bricklaying sites at the time of this study were purposively recruited. They were all males with an age range of 20-35 years.

For data collection, the Occupational Physical Activity Questionnaire (OPAQ) was adapted from the Global Physical Activity Questionnaire (GPAQ) to measure the nature, duration, frequency and intensity of bricklaying-related physical activity. The questionnaire was validated and had reliability coefficient of  $r = .72$ , from test retest assessment. Rating of physical activity level was in metabolic equivalent of tasks (METs) which was 2.5METs-min, 4METs-min and 8METs-min for light, moderate and high or vigorous intensity physical activities respectively [15]. Participants were also asked to comment about how often they ate, size, class of food that regularly make up their diet and duration of rest at work. Other instruments were non-elastic anthropometric tape rule (Lufkin W606PM) portable stadiometer, and portable weight scale (Harson H89) for measuring girths, height and weight respectively. These instruments have been validated and confirmed to be reliable for this type of study by international standards. However, pilot test was conducted to ascertain calibration and functioning of anthropometric and body composition instruments one week prior to data collection. Four research assistants participated in the study to facilitate data collection, which was conducted at a time conducive for the participants. All measurements were performed following the standardized techniques of the International Society for the Advancement of Kinanthropometry [16]. The technical error of measurement (TEM) was lower than 1% for all measurements, since the instruments were recalibrated prior to use. Anthropometric variables included biceps, chest girth and thigh girth. Height was measured to the nearest 0.1 cm without shoes, and the weight was measured with the participants wearing light clothing to the nearest 0.1 kg. Body composition parameters were body mass index (BMI) was calculated as  $\text{weight/height}^2$  [17], weight was expressed in kilograms (kg) and height in meters ( $\text{m}^2$ ), waist circumference (WC) was measured at the smallest horizontal trunk circumference and hip girth was measured at the largest horizontal circumference around the hip and buttocks, with non-elastic tape to the nearest 0.1 cm. Waist to Hip Ratio (WHR) was then calculated as waist circumference divided by hip circumference [18]. The World Health Organization [18] reference cut-off was used for rating body composition parameters. Ethical approval was obtained from University of Ilorin Ethical Committee (UER/ASN/2016/588). Informed consent was sought from the participants after a letter of introduction was given to the bricklayers' association in the LGA.

## Statistical Analysis

The data collected was analyzed using the descriptive statistics of percentage, mean and standard deviation for the description of age, and body composition parameters. Inferential statistics of Pearson Product Moment Coefficient (PPMC) was used to analyse relationships of anthropometric and body composition with occupational physical activity level. Coefficient of determination was calculated to explain the extent to which bricklaying was associated with change in anthropometric and body composition. After classifying

the participants into two groups (moderately high intensity and very high intensity physical activity) based on their levels of physical activity, t-test analysis was conducted to examine differences between the groups. All the analysis was performed using SPSS version 20.0 and adopting a significant level of 0.05 for testing the hypotheses.

**RESULTS**

Table 1 shows body composition of bricklayers in Ilorin-South Local Government Area of Kwara State. Health risk associated with WC was low for majority of them 77.8% (n=35), 11.1% (n=5) had increased risk and the remaining 11.1% (n=5) had substantially increased risk. For BMI assessment, majority 75.6% (n=34) had normal, 8.9% (n=4) were underweight, 13.3% (n=6) were overweight and 2.2% (n=1) was obese class 1. WHR indicated 60% (n=27) had low health risk and 40% (n=18) had substantially increased health risk. This body composition result indicates that although majority of them have normal parameters, a number of them may be potentially predisposed to high risk of chronic diseases.

In line with previous studies, our study indicated that bricklaying belongs to the category of high intensity physical activity occupation. The bricklayers in Ilorin-South Local Government Area of Kwara State worked for several hours daily and based on their work hours per week, they were grouped into moderately high intensity (MHI) and very

high intensity (VHI) physical activities. Table 2 shows that the participants performed an average of  $2,699.1 \pm 515.2$  METs-min-wk<sup>-1</sup> of physical activity. Majority 62.2% (n=28) performed VHI physical activity with an average of  $1,744.3 \pm 343.3$  METs-min-wk<sup>-1</sup> and 37.8% (n=17) performed MHI physical activity with an average of  $954.8 \pm 171.8$  METs-min-wk<sup>-1</sup>.

Table 3 shows a low negative correlation between physical activity level and BMI of the bricklayers (N = 45, r = -.06, R<sup>2</sup> = .36%, p = .05); and WC (N = 45, r = -.083, R<sup>2</sup> = .69%, p = .05). This implies bricklaying activity influenced little reduction in BMI and WC of the participants. The coefficient of determination (R<sup>2</sup>) shows that physical activity accounts for .36% and .69% reduction in BMI and WC of the participants respectively. There is however no significant correlation between physical activity and WHR (N = 45, r = .096, p = .53).

Table 4 reveals high positive correlation between physical activity and bicep circumference (N = 45, r = .61, R<sup>2</sup> = 37.2%, p = .001) and moderate positive correlation between physical activity and chest circumference (N = 45, r = .40, R<sup>2</sup> = 16%, p = .007). Furthermore, the result revealed physical activity accounts for 37.2% and 16% increase in bicep circumference and chest circumference of the participants respectively. The result also shows that physical activity did not have significant correlation with thigh circumference of the participants (N = 45, r = -.44, p = .77).

The bricklayers were compared based on occupational physical activity ratings. T-test analysis in Table 5, shows no

**Table 1. Description of Body composition of Bricklayers in Ilorin-South Local Government Area of Kwara State**

Variables	Category	N	Percentage
WC	Low risk	35	77.8
	Increased risk	5	11.1
	Substantially increased risk	5	11.1
Total		45	100
BMI	Underweight	4	8.9
	Normal	34	75.6
	Overweight	6	13.3
	Obese class 1	1	2.2
Total		45	100
WHR	Low risk	27	60
	Substantially increased risk	18	40
Total		45	100

**Table 2. Occupational Physical Activity of Bricklayers in Ilorin-South Local Government Area of Kwara State**

Intensity of Physical Activity	N	Percentage	MET minutes per week	
			Mean (SD)	SE
Moderately high	17	37.8	954.8 (171.8)	41.7
Very high	28	62.2	1,744.3 (343.4)	64.9
Total	45	100	2,699.1 (515.2)	106.6

**Table 3. Correlation between Physical Activity and Body Composition of Bricklayers in Ilorin South Local Government Area of Kwara State**

Physical Activity Level	Variables	N	r	R <sup>2</sup>	P-value
2,699.1 METmins-wk <sup>-1</sup>	BMI	45	-.06	.36%	.05
	WHR		.096	-	.53
	WC		-.083	.69%	.05

**Table 4.** Correlation between Physical Activity and Anthropometric Characteristics of Bricklayers in Ilorin-South Local Government Area of Kwara State

Physical Activity Level	Variables	N	r	R <sup>2</sup>	P-value
2,699.1 METs-mins-wk <sup>-1</sup>	Bicep Circumference	45	.61	37.2%	.001
	Thigh Circumference		-.44	-	.77
	Chest Circumference		.40	16%	.007

**Table 5.** Difference of Body Compositions between Participants with Moderately High and Very High Intensities of Physical Activity

Variables	N = 45		M (SD)		MD	t	df	SED	P-value
	MHI	VHI	MHI	VHI					
BMI			23.33 (3.27)	22.06 (2.83)	1.27	1.44	43	.16	.14
WC	17	28	81.49 (12.24)	80.04 (6.69)	1.45	.50	43	.62	.15
WHR			.84 (.07)	.83 (.06)	.01	.71	43	.49	.16

MHI, moderately high intensity; VHI, very high intensity; SD, Standard deviation; MD, Mean difference; SED, Standard error difference

significant difference between body composition variables of bricklayers who performed MHI occupational physical activity and those who performed VHI occupational physical activity. The comparison revealed BMI was, (N = 45, t = 1.44, df = 43, MD = 1.27, SED = .16 p = .14); WC was (N = 45, t = .50, df = 43, MD = 1.45, SED = .62, p = .15) and WHR was (N = 45, t = .71, df = 43, MD = .01, SED = .49, p = .16). High intensity physical activity is known to induce beneficial physical and physiological adaptations, it must be well planned and systematically conducted to avert any negative effects. Although the bricklayers reported high levels of physical activity, excessive hours of vigorous intensity occupational physical activity might not induce any positive improvement in body composition of bricklayers.

## DISCUSSION

The study examined influence of occupational physical activity on anthropometric and body composition parameters of 45 bricklayers in Ilorin-South Local Government Area of Kwara State. It was proved that bricklaying job was associated with reduction in body fat accumulation among the participants. In line with previous studies [2,19,20], physically active occupations might account for decreases in accumulation of body fat and the risk of obesity and/or related diseases. This study revealed that bricklayers' BMI and WC were slightly decreased as occupational physical activity level (in METs) increased. The actual proportion of this decrease could not be ascertained because the study was not longitudinal. However, it is clear that vigorous occupational physical activity (bricklaying) of the participants induced some health and fitness benefits because majority of them had healthy body composition parameters in all the tested variables. Although exercise is confirmed to induced higher improvements in body composition [9,17], studies have indicated that intensity, duration and frequency of exercise, environmental circumstances, diet and physiological status of the individual determine physiological responses to exercise [7,12]. Excessive work duration (largely vigorous intensity physical activity), poor nutrition, inadequate rest and inconsistency in getting recruited for work (a period which

might induce sedentary activity) observed among the bricklayers may have contributed to the little decrease in their body composition parameters.

Vigorous intensity physical activity of bricklaying induced muscle hypertrophy in the upper part of the participants' bodies (chest and bicep circumferences), that were frequently engaged during work. This is similar to adaptations in strength or resistance exercises. This implies bricklaying has positive implication for the participants' strength and resistance to fatigue which are required for optimal occupational performance. This finding upholds the assertion that the functional significance of adaptation from resistance training leads to a greater capacity for strength and power development, high performance and reduction in all-cause mortality [19,21].

We found no significant correlation between occupational physical activity of bricklayers and thigh circumference. This could be due to fewer movement of the lower extremities that is common in bricklaying work. The bulk of bricklayers' depends on loading the arm and trunk muscles which are mostly used for carrying mixing and plastering. It is necessary to have sufficient strength in the legs for balancing, stability since the entire body weight depend on the muscles of the legs [22]. This suggests a need for the participants to engage in lower body resistance exercises to induce a balance in muscular adaptation in this part of their bodies.

Physical activity level categorization indicated that the participants engaged in extensive hours of vigorous intensity occupational physical activity, which was devoid of sufficient rest. There was no difference between body composition of moderately high intensity physical activity bricklayers and very high intensity physical activity bricklayers. Excessive working could increase the risk of muscle overuse disorders such as musculoskeletal pains, excessive fatigue and irritability [2,3,21], which means participants had ergonomic problems common to other type of construction workers.

There is need to develop a healthy work schedule to reduce overworking, and integrate adequate rest. To achieve this, bricklaying associations, employers and exercise and sport scientists should collaborate to educate bricklayers on the importance of being fit as well integrating exercise pro-



grammes as part of work schedule and leisure activities with particular attention to strength exercises for lower limb and flexibility exercises to reduce risk of musculoskeletal pains.

## CONCLUSIONS

Majority of the bricklayers had healthy body composition variables and this showed low risk for chronic diseases. Bricklaying influenced little decrease in BMI and WC but significantly influenced hypertrophy of bicep and chest as indicated by increase in their circumferences. There was no significant difference between body composition of bricklayers who engaged in moderately high intensity occupational physical activity and those who engaged in very high intensity occupational physical activity. However, bricklayers who work for excessively long durations without sufficient rest risk musculoskeletal disorders, reduced physical fitness and related health problems.

## Conflicts of interest

The authors declare no conflict of interest.

## Author's contributions

Dominic OL developed the concept. Etchie AO and Seidina IY collected and analyzed the data. All the authors co-wrote the paper, discussed the results and prepared the final manuscript

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