

Effects of Load-carrying on Children in a Rural Community

IO Abayomi⁺

Summary

Abayomi IO. Effects of Load-carrying on Children in a Rural Community. *Nigerian Journal of Paediatrics* 1995; 22: 86. Fortyone subjects were randomly chosen from an original study group of 200 healthy children whose heights and weights had been monitored every four weeks for two years. All the subjects had authentic recorded dates of birth and were aged between five and seven years at the time of the present study. The 41 subjects were randomly divided into a study group of load-carriers and a control group of non-load carriers. They were boarded and fed thrice a day for two weeks. Height measurements were taken at 7 a.m. and 6 p.m. daily, using standard equipment and call-out technique. The study subjects carried a load on the head for one hour round a school premises between 5 p.m. and 6 p.m. daily, while the controls did not carry any load. Reductions in height measurements during the day and increases in height measurements overnight, were observed in both the load-carrying subjects and in the controls. While non-load-carriers fully recovered their heights during the night, load-carriers not only lost more in height measurement, but also failed to recover fully. The difference between the two groups of subjects was significant ($P < 0.001$).

Introduction

LOAD-CARRYING is a common practice in Nigeria. The loads, usually consisting of farm products or wares for sale, may be carried on the head or shoulder. Among the Yorubas of south-west Nigeria, these loads are usually carried on the head. The impact of carrying loads on the back

Obafemi Awolowo University Teaching Hospital,
Ile-Ife

Department of Community Health

+ Senior Lecturer

Correspondence: I O Abayomi

had been studied by Thomas¹ who suggested that the trunk acted as a counter-balance, altering its inclination according to the position of the load on the back, so that the vertical projection of the centre of gravity remained relatively undisturbed. Beyond a minimum weight, significant adjustment of the body position took place during load carriage on the back in respect of forward displacement of the shoulder and backward displacement of the knees. Thomas,¹ however, did not discuss the effects of load-carrying on the head.

In a study of thoracic curvature among Nigerian adults, Patrick² reported that the cur-

vature in both men and women appeared to be about 20 percent greater than that of Europeans. He concluded that the finding was likely due to genetic differences, but that the Nigerian practice of carrying heavy loads on the head might be a contributory factor. The aim of the present study was to determine the impact of load-carrying on the growth rate of children in Imesi-Ile which is a rural community located in Osun State, south-west Nigeria. The study was conducted as part of a larger project on the seasonal variation in the growth of children in the same community.

Subjects and Methods

Criteria for inclusion in the study consisted of availability of definite records of dates of birth in children of the age between five and seven years. This age range was chosen on the assumption that for the Nigerian child, it is the period in which variations in annual growth rate is minimal. It therefore, provides a period during which the effect of some factors on growth may be investigated.

The subjects were chosen by a two-stage sampling procedure. Five of the 15 wards into which the town was traditionally partitioned were randomly chosen. All the children aged between five and seven years in these wards were enlisted. Virtually all the children in the selected wards, including all those in the present study, had records of their birth and their names could be found in the birth records of the town's three maternity centers (Methodist Maternity Centre, Christ Apostolic Church Maternity Centre and the Government Rural Health Centre).

Healthy subjects, as judged by physical examination carried out by the author, were se-

lected for study. Specifically excluded were children with splenomegaly or hepatomegaly and those with packed cell volume of less than 30 percent and/or total plasma protein of less than 5.6gm percent. Two hundred children (96 males and 104 females) satisfied the selection criteria and the selected subjects were studied for heights and weights every four weeks for two years.

Fortyone of the 200 children were chosen randomly by the use of systematic sampling method and these were randomly separated into a study group and a control group. The study lasted only two weeks - the only school-free period granted to the author by the authority of the Methodist High School, Imesi-Ile, whose premises were used for accommodation of subjects during the study period. The children were boarded and fed thrice daily by special arrangement with certified food vendors as advised by a nutritionist. The study group was made to carry a load for a period of one hour daily between 5.00 pm and 6.00 pm to simulate farm produce that is usually carried home by children of the study age group. The load consisted of a wooden box loaded with sand, the total weight being proportioned to the weight of the subject.

Heights of the children were taken at 7.00 am and 6.00 pm on each day by a locally-trained anthropometrist using Harpenden stadiometer. The two groups of children, the load-carriers and the non-load carriers, were compared for diurnal variation in height which is a normal physiological phenomenon observed in children of about the same age group as the children studied. The weights of the children were noted on the first day as well as on the last day of the two-week study

period. They were measured wearing light underwear. Student's 't' test was performed to determine the significance of differences.

Results

Table 1 tabulates the mean diurnal variation among non-load carriers (13 males and eight females) during the 14 days of the study. The mean values obtained for the am/pm drop in height measurements ranged from 11.3mm to 16.3mm for non-load-carriers (mean = 13.8mm), while the pm/am rise varied from 11.2mm to 16.6mm (mean = 13.9mm).

TABLE I

*Diurnal Variation of Heights among
21 Non-load-carrying Subjects*

Serial Number	Average Drop am/pm (mm)	Average Rise pm/am (mm)
1	16.3	16.6
2	12.6	12.9
3	14.0	15.3
4	15.0	15.5
5	12.9	13.1
6	14.2	14.3
7	14.4	14.0
8	14.8	14.5
9	11.7	11.7
12	13.7	13.7
14	15.0	14.1
15	11.3	11.2
16	12.4	11.9
17	12.7	12.9
18	14.6	15.3
19	13.3	13.8
20	12.3	12.3
21	12.9	13.3
Total	289.1	291.1
Group Mean	13.8mm	13.9mm

Table II shows the mean diurnal variation among load-carriers (13 males and 7 females). The am/pm drop in height varied between 11.3mm and 20.5mm (with a mean of 15.5mm). The pm/am rise or gain in height measurements varied between 10.7mm and 19.3mm (with a mean of 14.9mm).

TABLE II

*Diurnal Variation of Heights among
20 Load-carrying Subjects*

Serial Number	Average Drop am/pm (mm)	Average Rise pm/am (mm)
1	20.5	19.3
2	17.7	16.7
3	17.6	17.4
4	16.1	15.2
5	14.2	14.3
6	12.8	12.6
7	17.4	18.2
8	13.6	13.5
9	17.5	16.3
10	13.8	13.6
11	15.5	14.8
12	12.5	12.4
13	19.0	17.3
14	11.3	10.7
15	13.0	12.3
16	14.8	13.5
17	14.6	14.2
18	16.0	14.0
19	15.6	15.6
20	15.6	14.9
Total	309.4	297.6
Group Mean	15.5mm	14.9mm

Comparison of the two groups of children showed that the load-carriers had greater am/pm drop in height measurements. In addition, whereas the non-load-carriers fully recovered in height during the night (a drop of 13.8mm and a rise of 13.9mm), the load-carriers did not recover the day-time loss in height

during the night (a drop of 15.5mm and a rise of 14.9mm). The difference between the two groups was significant ($P < 0.001$). There were no differences between the mean weights of the load-carriers and non-load-carriers at the beginning and at the end of the two weeks study period.

Discussion

Physiologically, a normal diurnal variation in height of healthy active children due to the resilience of the intervertebral discs had been observed. As such, the loss in height observed between morning and evening measurement of height is made up during sleep. The result is that the height measured the following morning is at least the same as it was the previous morning.³ The same physiological phenomenon was observed among the non-load-carrying subjects in the present study. However, full height recovery was not observed in the case of the load-carriers. Possible explanation of this finding is that the impact of load-carrying on the vertebral column is greater than what is physiologically possible to recover from. It has been shown that load-carrying may cause increased lordosis.² Furthermore, contracture of the neck muscles of significant realignment of the body stature in response to load-carrying may occur.¹ Although the amount of food given to the children was deemed appropriate to their physiological needs, load-carrying may act as a stress-inducing factor which will demand higher nutrient requirement to maintain normal physiological adjustments in heights. Chronic under-

nutrition and famine are known to inhibit the growth of children.^{4,5} However, within the short period of the present study, the nutritional factor was unlikely to play a major part. Load-carrying on the head may therefore be primarily responsible for the observed reduction in height measurement of the subjects.

Acknowledgements

The assistance of late Professor WA Marshall, Loughborough University of Technology, England, Miss Margaret Woodland, Institute of Child Health, London, Dr AO Fatusi, Department of Community Health, Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Prince Debo Ajiboye, anthropometrist and the Imesi-Ile Community during the course of this work, is gratefully acknowledged. The study was sponsored by Obafemi Awolowo University, Ile-Ife.

References

- 1 Thomas DP. The effect of load carriage on normal standing in man. *J Anat* 1959; 93: 75-86.
- 2 Patrick JM. Thoracic and lumbar spinal curvatures in Nigerian adults. *Ann Hum Biol* 1976; 34: 383-6.
- 3 Whitehouse RH Tanner JM and Healy MJR. Diurnal variation in stature and sitting height in 12-13-year old boys. *Ann Hum Biol* 1974; 1:103.
- 4 Howe PE and Schiller M. Growth responses of the school child to changes in diet and environmental factors. *J Appl Physiol* 1952; 5: 51-61.
- 5 Morley DC Bicknell J and Woodland M. Factors influencing the growth and nutritional status of infants and young children in a Nigerian village. *Trans Roy Soc Trop Med Hyg* 1968; 62: 164-9.