Impact of Work Performance on Body Proportions in Blacksmiths: a Somatometric Analysis

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Introduction

Using the same muscle groups everyday impacts a person’s physique and development of particular muscle group. Heavy physical work builds muscle mass, leading to a better physique. In modern day, manual work that doesn’t require much physical activity surpasses occupations consisting of manual labor. Therefore, people who perform manual labor as part of their occupation, results in bodies that adapt to it’s external conditions. The adaptations of the physical traits are then passed down genetically to offspring. This leads to differences in body proportion, composition and physique among population, and are significant physical characteristics that can be advantageous in certain fields of work.

Physical efficiency, body movement, and performance in many daily activities and in sport can be determined through the study of human body morphology, body proportions, body composition and physique. These are also increasingly used as primary indicators of healthy growth and development (Tanner et al., 1960; Bubulian, 1984; Slaughter and Lohman, 1976; Dupertius et al., 1951; Bolonchuk et al., 1989 and Bogin, 1999). This study specifically highlights how physical work in a certain occupation impacts body proportions, which in turn, affects level and ranges of bilateral asymmetry in the blacksmith of the Punjab region, India.

Materials and Methods

Measurements were taken in various terms; used to compare and contrast body proportions and bilateral asymmetry of research subjects. Data was collected from April 2002 to January 2004, in various regions of Punjab. There was not a specific method of sampling used to collect data because many of the subjects refused to be a part of the study. Meaning, subjects
had to personally contact the researchers and set up appointments to be measured and studied appropriately during their time off from work.

To measure asymmetry, measurements of size and proportion of the left and right sides of blacksmiths were taken according to appropriate techniques given by Lohman et al., (1988). Those measurements were then adjusted to a standard height or size and compared to specified values and standard deviations calculated from equations given by Ross and Wilson, (1974), which enabled proportion assessments between subjects. Relative Index of Asymmetry (RIA) was calculated according to a formula given by Wolanski (1965). Carter (1980) provided the equations to calculate the three components of physique and finally, body mass index was calculated from equation given by WHO (2002).

**Results**

The results of the measurements applied by these various techniques and methods produced 5 different tables. These tables gave the researchers an array of quantitative information from which, they could produce statistics about the population sample.

Table 1 produced the Mean and Standard deviation values of proportions in specific parts of the body. These included height, weight, skin-fold thickness, circumference, lengths and breadths; of each body part measured. Table 2 produced the mean z-scores of gross body measurement, skin-folds, body circumferences, body breadths, and segmental lengths in Blacksmiths.

Table 3 produced the means of muscle mass difference between right and left sides of subjects’ bodies as well as the RIA in skin-folds, body circumferences, segmental lengths & body breadths. The data found, showed a maximum bilateral difference in skin-fold between the
left and right triceps, with minimum difference in the forearms. Maximum RIA was found in the biceps with minimum RIA found in supriliac skin-fold thickness.

Table 4 data produced a BMI chart that shows in which range subjects were found. 49% of subjects were in the normal range and 42.6 % found in the Grade-1-Overweight range. The last 3% and 5.5% were found in Grade-2-Thinness and Grade-1-Thiness. Table 5 is a chart of the waist to hip ratios (WHR) of the subjects, which served to interpret the risks for cardiovascular disease (CVD) and Coronary Heart Disease (CHD). 78% of subjects had WHR of less than or equal to .95, 15% of group has WHR of 0.96-0.99 with the last 7% with WHR of greater than or equal 1.

Table 6 produced a table interpreting the “somatotype components and it’s dispersion rates in the Blacksmiths and indicates that blacksmiths are found to be more endomorphic followed by mesomorphy and ectomorphy” (Singh et al, 2012 pp. 144). The data collected did not garner any new or unexpected findings, but it serves as quantitative data to support the original hypothesis of the study.

**Discussion**

Data from Table 2 showed that skin-fold thickness is less in subjects’ biceps with most thickness found in the thighs. The most proportional development was found in the waist with thighs as least developed. Meaning, the biceps are the most muscular, as well as their waist. The data in this table was useful because it corresponded to certain points of a normal distribution curve of certain body parts. Most importantly, it shows how the results in Table 1 compare to the z-scores found in Table 2.

The results found in Table 3 verify that subjects’ left and right triceps were fairly symmetrical, but their forearms were similar in muscle mass. Meaning, forearms exert more
energy during physical labor than triceps. In addition, maximum RIA in the biceps compared
the minimum RIA found in the suprailiac shows there is more muscle strength in upper body
compared to lower body. These findings support the conclusions found in Tables 1 and 2.

Findings in Table 4 show that half the sample group was in a normal BMI range with the
other half in an overweight range which can be interpreted as being at risk for CVD and CHD.
But according to the data produced in Table 5, only 7% of the blacksmiths are under the risk of
developing CVH and CHD. This is because the body mass being measured is actually muscle not
fat, which proves that blacksmiths are very muscular and have a certain physique. These results
lead to the findings in Table 6, which shows that most blacksmiths are of a shorter build and
have thick arms and legs. The secondary groups body consisted of large muscles and an athletic
and less than 10% with lean muscle and lean body build.

Therefore, the information and data collected in the study supports the original
hypothesis because the results show how physical labor in an occupation impacts and affects
body proportions, which in turn affect the levels and range of bilateral asymmetry in the body
composition of blacksmiths in Punjab. Although a limitation of this study is data might only be
in correlation to blacksmiths in Punjab. For future studies, it could beneficial to study a different
population or occupation.
References


