Physical Activity Patterns and Body Composition in Greater Accra: Validation of the Aggregated Body Composition Score (ABCS)

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ABSTRACT

This study explored the relationship between physical activity participation variables and body composition among members of Keep Fit Clubs in the Greater Accra Region of Ghana. Using a descriptive cross-sectional design, data were collected from 450 recreationally active adults through anthropometric assessments and structured questionnaires. The Aggregated Body Composition Score (ABCS), a novel field-based tool, was employed to assess body composition. Multiple regression analysis showed that exercise frequency ($\beta = 0.26$, $p < 0.01$) and duration ($\beta = 0.31$, $p < 0.01$) were significant predictors of ABCS, while exercise intensity had a moderate effect ($\beta = 0.18$, $p = 0.03$). The type of activity was not a significant predictor. These findings underscore the significance of frequency and duration of physical activity in maintaining a healthy body composition. The study recommends the broader use of the ABCS in community health assessments and calls for further validation of the tool across different populations, as well as its linkage with clinical outcomes.

Keywords: Aggregated Body Composition Score, Physical Activity, Participation Variables, Predictors, Recreational Adults, Body Composition Assessment, Field-Based Measurement

INTRODUCTION

Body composition refers to the relative proportions of fat mass and fat-free mass in the human body (Fahey et al., 2005; Corbin et al., 2005; Hewitt, 2007). It is a critical indicator of health status and physical performance and serves multiple purposes across various settings. These include monitoring changes in fat mass during weight management programmes, helping athletes identify optimal body composition for peak performance, tracking disease-related shifts in body tissue composition, and observing age-related trends in fat and lean mass distribution (Heyward & Wagner, 2004; Heymsfield, 2005).

Aaron (2010) highlighted that maintaining healthy levels of body fat in both males and females is associated with positive health outcomes (National Cancer Institute, 2010). However, Wilmore et al. (1986) emphasized that fat distribution patterns may be more critical than total body fat percentage, particularly regarding cardiovascular disease (CVD) risk. Individuals with android obesity, characterized by central fat accumulation, tend to have higher risks for CVD than those with gynoid obesity. This underscores the need for diverse and accurate methods of assessing body composition (Kravitz & Heyward, 1991; Hewitt, 2007).

In Ghana, recreational physical activity among adults has gained popularity, particularly through Keep Fit Clubs. These clubs offer a valuable context for studying the relationship between physical activity and body composition. Understanding this relationship is increasingly important due to rising rates of obesity and non-communicable diseases in both urban and peri-urban communities. Reliable and field-friendly body composition assessment tools are needed to support early detection and health promotion efforts, especially in low-resource settings.

Existing methods of assessing body composition vary in complexity, accuracy, and applicability. Practical field techniques include skinfold measurements, girth or circumference assessments, hydrostatic weighing, bioelectrical impedance analysis (BIA), and near-infrared interactance. More advanced and resource-intensive techniques such as isotope dilution, magnetic resonance imaging (MRI), meta-analysis, and dual-energy X-ray absorptiometry (DXA) are generally limited to clinical or research institutions (Brodie, 1988). Despite the

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availability of these methods, the search for an accessible and comprehensive tool that can be reliably used in community settings remains a priority.

The widely used Body Mass Index (BMI) has known limitations, particularly in distinguishing between muscle and fat mass. Highly muscular individuals may be misclassified as overweight or obese, while those with low muscle mass may be classified as underweight or healthy despite possessing high body fat levels. Dietz and Bellizzi (1999) noted that the interpretation of BMI should therefore be adjusted with clinical judgment and complemented with other body composition measures. Moreover, the relationship between BMI and disease risk may vary significantly across individuals and populations, limiting its diagnostic accuracy.

Other field-based measures, such as the waist-to-hip ratio, provide a more direct assessment of fat distribution. Waist circumference is typically measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest along the mid-axillary line (Perry, 2012), while hip circumference is taken at the widest point of the buttocks (Hoeger & Hoeger, 2009). This ratio is useful in identifying individuals with higher risk profiles due to central adiposity.

Skinfold measurements, although dependent on technician skill, offer a cost-effective and relatively accurate means of estimating body fat percentage. This method involves using calipers to assess subcutaneous fat thickness at specific anatomical sites. Age, sex, and individual fat distribution influence the accuracy of this technique (Heyward, 1991), but generalized equations developed by Jackson and Pollock (1985) have been widely adopted. For example, a three-site method uses triceps, suprailiac, and abdominal sites for women, and chest, abdominal, and thigh sites for men. These measurements are often used alongside nomograms and predictive equations, such as the Brozek formula, to estimate total body fat percentage. However, extremely obese individuals may not be accurately assessed using skinfold methods alone, and alternate methods like BIA with fat-specific equations (Segal et al., 1985) are recommended.

Given these limitations, there is increasing interest in developing field-based tools that integrate multiple anthropometric indicators into a single, interpretable score. This study introduces the Aggregated Body Composition Score (ABCS), a composite index designed to enhance the practicality and accuracy of body composition assessment in non-clinical environments. The ABCS consolidates various field measurements into one comprehensive score, thereby addressing the limitations of single-indicator approaches like BMI.

Recent literature highlights that physical activity frequency, duration, and intensity are significant predictors of body composition and related health outcomes. Despite their importance, these variables are often underreported in community-based assessments. The present study aims to fill this gap by examining the physical activity profiles of members of Keep Fit Clubs in the Greater Accra Region and investigating the relationship between these variables and their ABCS. Specifically, the study aims to assess the body composition of recreationally active adults using the ABCS and to identify the physical activity factors that significantly predict this composite score.

METHODOLOGY

A descriptive cross-sectional design was adopted to assess physical activity participation and body composition. A total of 450 participants were drawn from 18 registered Keep Fit Clubs in the Greater Accra Region of Ghana using stratified random sampling to ensure representation across gender and age categories. Anthropometric data were collected using portable field tools: Accu-measure body fat calipers, a weight scale and measuring tape, and measuring tape. A structured questionnaire was administered to assess frequency, intensity, duration, and type of physical activity. Descriptive statistics were used to describe the sample, and multiple regression analysis was conducted to test physical activity variables as predictors of ABCS. The research instruments were piloted in the Western Region of Ghana with four (4) registered clubs utilizing fifty-five (55) participants to ascertain the reliability, validity of the instruments. An ‘r’ of 0.80 was obtained during the pilot test to indicate the validity of the questionnaire. It also helped the researcher to check the clarity of the questionnaire items as well as the measurement protocols. Body composition was assessed using three different methods: body mass index (BMI), waist–to–hip ratio (WHR), and Body fat percentage (BFP). The Aggregated Body Composition Score. Each measure was categorized into three levels, with 1, 2, and 3 representing each level. The three measures were aggregated and scored using these cutoff points: 1-3 very healthy, 4-6 somewhat healthy, and 7-9 not healthy.

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RESULTS

The mean age of participants was 38.4 years. Analysis of the Aggregated Body Composition Score (ABCS) indicated that 42% of participants fell within the healthy range. None of the participants were classified as underweight. Based on body mass index (BMI) classifications, 172 individuals (38.2%) were of normal weight, 246 (54.6%) were overweight, and 32 (7.2%) were obese.

Assessment of body fat percentage, measured at the subcutaneous regions of the upper body, core/trunk, and lower body, showed that 156 participants (34.7%) had ideal body fat levels. An additional 250 individuals (55.5%) had average body fat levels, while 44 (9.8%) presented with high body fat levels above the average.

A key finding was that 353 participants (78.4%) exhibited their highest fat accumulation in the abdominal region, indicating a high prevalence of android (central) obesity. Regarding waist-to-hip ratio (WHR), 225 individuals (50.0%) demonstrated moderate levels, 193 (42.9%) were categorized as high, and 32 (7.1%) had very high WHR values.

Multiple linear regression analysis identified exercise frequency ($\beta = 0.26$, $p < .01$) and exercise duration ($\beta = 0.31$, $p < .01$) as significant predictors of ABCS. Exercise intensity was also a significant, though moderate, predictor ($\beta = 0.18$, $p = .03$). Conversely, the type of physical activity was not a statistically significant predictor of ABCS.

DISCUSSION

The results affirm ABCS as a valid and practical tool for body composition assessment. Frequency and duration were the most significant predictors, which supports earlier studies that emphasize consistency and time investment in physical activity as key contributors to favorable body composition. The lack of significance for activity type suggests that the kind of activity is less important than consistency and duration. This has important implications for designing flexible but effective community fitness programs. Despite its relevance, there is a paucity of literature on practical, field-based tools for measuring body composition in Ghana. This study, therefore, presents the Aggregated Body Composition Score (ABCS) as an innovative tool that integrates BMI, waist-to-hip ratio, body fat percentage, and skeletal muscle estimates into a singular, user-friendly metric suitable for use outside clinical settings.

In Ghana, physical inactivity and poor nutritional habits are contributing to an increase in non-communicable diseases such as hypertension, type 2 diabetes, and cardiovascular complications. Members of Keep Fit Clubs represent a unique demographic who are not professional athletes but are physically active. This provides an opportunity to examine body composition in a semi-structured but non-clinical context.

Body composition, as a component of health-related physical fitness, has emerged as a crucial measure of both athletic performance and general well-being. It encompasses the relative proportions of fat mass, lean muscle mass, bone density, and water in the human body. In both clinical and field settings, accurate assessment of body composition is essential in detecting early signs of obesity, sarcopenia, or malnutrition, conditions increasingly prevalent in sub-Saharan Africa.

In studies involving middle-aged populations, the predictors of lean mass retention and fat mass reduction have consistently included exercise duration and frequency (Kim et al., 2015). This positions ABCS as not only a diagnostic tool but also a monitoring framework that aligns with lifestyle-based interventions.

Physical activity has been widely recognized as a primary modifiable factor influencing body composition. The WHO (2020) recommends at least 150 minutes of moderate aerobic physical activity weekly, yet evidence from West Africa suggests less than 30% of adults meet this threshold (Owusu & Gbadamosi, 2021).

Several researchers have argued for more context-specific tools that cater to diverse populations and environments (Heyward & Wagner, 2014). The ABCS aligns with these recommendations by offering a field-based, aggregate model for assessing total body composition without the logistical constraints associated with advanced clinical tools like DEXA scans.

ABCS also proves useful in providing feedback to individuals and fitness facilitators. Unlike traditional metrics like BMI, the ABCS allows users to track improvements across multiple dimensions of body composition. This multi-dimensional feedback may improve adherence to fitness routines and personalize health advice.

The nonsignificant role of the type of activity in this study could reflect a 'volume over mode' hypothesis, which postulates that the quantity of physical engagement may be more influential than its specific form. For practical application, this suggests that fitness programs need not emphasize type, but rather encourage regularity and adequate duration.

The findings support existing literature that identifies physical activity, especially its frequency and duration, as strong predictors of body composition. This is consistent with works by Lee et al. (2018), who found that individuals engaged in physical activity at least four times per week recorded better anthropometric outcomes than their less active counterparts.

CONCLUSION

The ABCS is a valuable field-based tool for assessing body composition among recreational adults. The study confirms that frequency and duration of physical activity are key predictors of healthy body composition. The study recommends: the promotion and the adoption of ABCS in health screening initiatives, regular physical activity through community-based interventions, and the validation the ABCS across diverse populations and its correlation with clinical outcomes.

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