# CORRELATION OF MID-UPPER ARM CIRCUMFERENCE WITH BODY MASS INDEX AND WAIST-HIP RATIO IN HAEMODIALYSIS PATIENTS

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## ABSTRACT

### BACKGROUND
Chronic malnutrition is one of the most significant problems in patients on Haemodialysis (HD). The body composition has a complex relation with clinical outcomes in these patients. Many anthropometric indices are available to measure the nutritional status and body composition. Mid-Upper Arm Circumference (MUAC) is a quick assessment anthropometric index of the nutritional status. We correlated MUAC with Height (HT), Weight (WT), Body Mass Index (BMI), Waist Circumference (WC), Hip Circumference (HC) and Waist-Hip ratio (WHR) in haemodialysis patients.

### MATERIALS AND METHODS
Thirty patients undergoing maintenance haemodialysis for stage V chronic kidney disease were recruited. Age, gender, HT, WT, BMI, WC, HC, WHR, MUAC and body fat were recorded during the initial visit. Pearson correlation analysis was performed between MUAC and demographic and anthropometric indices.

### RESULTS
The mean age of the patients was 48.03 ± 11.81 years. There were 21/30 (70%) males and 9/30 (30%) females. The duration of dialysis was 12 ± 4 months. MUAC significantly correlates with weight, body mass index, waist circumference, hip circumference, waist-hip ratio and body fat. It does not significantly correlate with either age or height.

### CONCLUSION
MUAC correlates significantly both with abdominal adiposity (WC or WHR) along with overall adiposity (BMI).

### KEYWORDS
Mid-Upper Arm Circumference, Abdominal Adiposity, Waist Circumference, Waist-Hip Ratio, Haemodialysis, Body Mass Index.

## BACKGROUND
Protein energy malnutrition among dialysis patients and is associated with increased morbidity and mortality in patients on Haemodialysis (HD).[1] Causes of malnutrition in dialysis patients include low calorie or protein intake, stimulation of amino acid and protein degradation and stimulation of protein degradation. Early identification of malnourished patients and intervening at an early stage will improve the overall prognosis of the patients.[2] The simple methods of assessment of nutritional status include measurement of actual body weight, ideal body weight, Mid-Upper Arm Circumference (MUAC), Body Mass Index (BMI), subjective global assessment and bioimpedance.[3],[4] BMI is one of the best indicators of nutritional status in adults.[5] The BMI is a
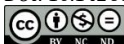
predictor of obesity-related diseases such as cardiac diseases and diabetes. BMI is associated with stable haemodialysis and minimum mortality rates in patients less than 60 years.[6] BMI ≥30 kg/m2 is associated with improved survival among chronic haemodialysis patients.[7] Low Body Mass Index (BMI) predicts poor survival in haemodialysis patients.[8] However, BMI does not demarcate fat and muscle mass.[9] Mid-Upper Arm Circumference (MUAC) is used to assess muscle mass, another anthropometric marker of adult nutritional status. There exists a significant correlation between MAC and the prevalence of malnutrition in patients.[10] MUAC fundamentally becomes a marker of malnutrition in patients for whom weight and height cannot be determined.

There exists a significant correlation between BMI and arm circumference.[11] The midarm circumference reflects the skeletal mass and the mid-arm muscle circumference (MAMC) measures the protein status in the body. A significant correlation exists between MAC and the prevalence of malnutrition in patients.[2] In the general population, waist circumference was noted to be a reliable predictor of visceral fat. Also, increased waist circumference was strongly associated with risk factors for cardiovascular disease.[12] Waist Circumference (WC), a nutritional marker,

| | Mean | SD | N |
|---|---|---|---|
| Hip circumference | 86.83 | 9.97 | 30 |
| Waist-hip ratio | 0.93 | 0.07 | 30 |
| Body fat | 22.27 | 9.00 | 30 |

**Table 1. Descriptive Statistics of Demographic and Anthropometric Indices in Patients Undergoing Dialysis**

| Pearson | r | p | Significance | N |
|---|---|---|---|---|
| Age | -0.001 | 0.994 | No | 30 |
| Sex | 0.165 | 0.385 | No | 30 |
| Height | 0.3 | 0.107 | No | 30 |
| Weight | 0.709** | <0.0001 | Yes | 30 |
| Body mass index | 0.679** | <0.0001 | Yes | 30 |
| Waist circumference | 0.777** | <0.0001 | Yes | 30 |
| Hip circumference | 0.744** | <0.0001 | Yes | 30 |
| Waist-hip ratio | 0.491** | 0.006 | Yes | 30 |
| Body fat | 0.494** | 0.006 | Yes | 30 |

**Table 2. Correlation of MUAC with Demographic and Anthropometric Indices in Patients Undergoing Dialysis**

## DISCUSSION

Poor nutritional status among haemodialysis patients is a primary predictor of shorter survival time.[13] Nutritional assessment is a vital function of healthcare providers given preventing protein-energy malnutrition and provide adequate treatment to malnourished patients.[14] According to the National Kidney Foundation/Dialysis Outcome Quality Initiative Guidelines (National Kidney Foundation, 2002), the assessment of nutritional status in CKD patients on MHD should be made by integrating clinical, biochemical and anthropometric parameters.[15] In patients with maintenance haemodialysis, malnutrition and wasting are not only caused by inadequate nutrient intake, but also by catabolism due to inflammatory and noninflammatory conditions.

This study is meant to assess the nutritional status of haemodialysis patients. In our study, we found a negative correlation of MUAC with age suggesting a decrease in muscle mass with age in general population.[1] The reduction in muscle mass is termed as sarcopenia and it increases with age in haemodialysis patients.[3] Adult MUAC has long been known to reflect changes in adult body weight. We also observed a significant correlation of MUAC with weight. We also noted that MUAC is independent of the sex of the patient. A study reported that MUAC is associated with BMI, a simple measure of body size in hospitalised patients[16] and our study findings were similar to this report. BMI, a simple measure of body size, this measurement does not account for variation in body fat distribution and abdominal fat mass.[4] A study showed that BMI emerges as the leading predictive factor of malnutrition among our patients on dialysis followed by protein intake. Waist circumference, measures both intra-abdominal fat mass and total fat.[15] MUAC correlates significantly both with abdominal adiposity (measured by waist circumference or WHR) along with overall adiposity (as measured by BMI and body fat).[11] An earlier study has shown that waist circumference correlated well with the level of abdominal visceral adipose tissue than is WHR.[2] In our study, we also found that MUAC correlates so closely with BMI, WC, HC and WHR.

## Limitations

This study was cross sectional and could not be generalised due to small sample size, the absence of serum albumin levels, fair assessment of fat mass and lean body mass.

## MATERIALS AND METHODS

This descriptive study was conducted at Gandhi Medical College Hospital, Hyderabad, during the years 2004-2006. Both male and female patients undergoing maintenance haemodialysis for stage V chronic kidney disease were recruited. Patients were excluded if they had any chronic liver disease, significant ischaemic heart disease, congestive cardiac failure, life-threatening arrhythmias, cardiomyopathy, coronary and cerebrovascular disease, chronic obstructive pulmonary disease and active autoimmune disease were excluded.

Demographic and clinical data were recorded from these patients. Height was measured using stature meter and weight using the calibrated weighing machine. BMI was calculated using formula weight (kg)/height (m2) (6). MUAC was measured using non-stretch tapes at the midpoint between the lateral acromion and distal olecranon process when arm flexed to 90 degrees at the elbow. WC was measured with a tape at midway between the lower rib margin and the iliac crest when the patient was standing in an upright position next to the stadiometer. HC was recorded at the maximum point of the buttocks. Body fat was noted by using bioelectrical impedance analysis.

## Statistical Analysis

Data were entered in Microsoft excel spreadsheet 2003 statistical analysis was performed using GraphPad Prism (Version 4). The categorical data were expressed as proportions and percentages, and continuous variables were expressed as a mean and standard deviation. Pearson correlation analysis was performed between MUAC and demographic and anthropometric indices. A probability value of less than 0.05 was considered statistically significant.

## RESULTS

A total of 30 patients undergoing haemodialysis were evaluated. The mean age of the patients was 48.03 ± 11.81 years; there were 21/30 (70%) males and 9/30 (30%) females. The duration of dialysis was 12 ± 4 months. There were 8/30 (27%) were undernourished and remaining 22/30 (73%) were normal body type as per international BMI standards. Data of the anthropometric indices in haemodialysis patients can be seen from Table 1. MUAC significantly correlates with weight, body mass index, waist circumference, hip circumference, waist-hip ratio and body fat. It does not significantly correlate with either age or height (Table 2).

| | Mean | SD | N |
|---|---|---|---|
| Age | 48.03 | 11.81 | 30 |
| Height | 162.00 | 9.79 | 30 |
| Weight | 54.51 | 12.72 | 30 |
| Body mass index | 20.75 | 4.07 | 30 |
| MUAC | 23.08 | 3.80 | 30 |
| Waist circumference | 81.07 | 12.28 | 30 |

## CONCLUSION

MUAC significantly correlates with weight, body mass index, waist circumference, hip circumference, waist-hip ratio and body fat.

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