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Brachio -Adipo Muscular Ratio (BAMR) in Osteoarthritis (OA) and Rheumatoid Arthritis (RA) Female Patients of Punjab.

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***Abstract*:**

In the present study an attempt has been made to investigate brachio-adipo muscular ratio (BAMR) in the women patients of Rheumatoid arthritis (RA) and Osteoarthritis (OA). Cross-sectional data on 150 samples (50 RA, 50 OA, 50 Control group) ranging in age from 45 to 65 years were collected during the year 2019-2020 for various anthropometric measurements, which included upper arm circumference, triceps skinfold and biceps skinfold. The data were collected following the standard techniques and BAMR is obtained using the equations given by vague *et al.*, 1971. Mean value of brachial-adipo muscular ratio (BAMR) in RA is 1.24, in OA its 1.29 & in control group 1.20, thus indicating more development of adipose tissue mass in the upper region of osteoarthritis women patients followed by rheumatoid arthritis women in contrast to muscle mass whereas least value of BAMR has been found in control group indicating more developed muscle mass tissue in contrast to adipose tissue mass.

***Keywords*:** Arm fat area, Arm muscle area, Brachial adipo-muscular ratio Rheumatoid arthritis, Osteoarthritis, Disability, Female.

INTRODUCTION

Rheumatoid arthritis (RA) and Osteoarthritis (OA) are most common types of arthritis afflicting both joints and connective tissue. Rheumatoid arthritis (RA) is an autoimmune disorder preferably affecting adult population and is categorized by destruction and tenderness of joints **(Alamanos & Drosos, 2005; Begovich *et al*., 2004; Qin *et al*., 2015)**. Osteoarthritis is a common joint disease that results in joint ache, stiffness and impairment of articular cartilage **(Altman *et al*., 1986; Kafil *et al*., 2003)**.

Main influence of RA is on hand and wrist joint. It results in dysfunctioning of hand (Dellhag *et al*., 2001). Many studies have shown direct association between RA and obesity. There is 24% risk for progress in RA in non obese individuals, 31% of risk in obese individuals, however chances for RA advancement were only 15% in normal individuals **(Qin *et al*., 2015)**.

Prior studies have concluded that body composition, obesity and adipose tissue play role in RA pathophysiology. Increase in fat mass, decrease in lean mass and variation in body composition is linked with increased body mass index. This accelerates morbidity and mortality in RA population **(Elkan *et al.*, 2009; Walsmith & Roubenoff, 2002)**. OA knee is positively correlated with fat mass. Body weight in postmenopausal OA females is associated with components constituting body weight and fat mass. Hence, obesity and OA knee is based upon fat mass (**Nur & Tuncer 2018)**. Thus, present study has been conducted with a view to assess brachio-adipo muscular ratio in arthritis women patients.

MATERIAL AND METHODS

The present research included an anthropometric examination of 50 Osteoarthritis (OA) and 50 (RA) Rheumatoid arthritis women patients and 50 control group women ranging in age from 45 to 65 years residing in various urban and rural areas of Punjab. The diagnosis of rheumatoid arthritis was confirmed using the classification criteria of the American College of Rheumatology by **Arnett *et al.*, 1988**. All the subjects both patients and control group women were informed and their consent was taken prior to the inclusion in the study. Women who were pregnant, not ambulant or taking oral corticosteroids, with bilateral shoulder surgery or severe shoulder disease or knee replacement were excluded.

Subjects were measured anthropometrically for upper arm circumference (cm) with steel tape, triceps skinfold (mm) and biceps skinfold (mm) with skinfold calliper using standard techniques given by **Lohman *et al.*, 1988**.
Brachial adipo-muscular ratio is calculated using the formula given by **Vague *et al.*, 1971**.

Radius of upper arm, r = upper arm circumference /2 π

Corrected radius, R = r – ½ average skinfold of upper arm

Cross-sectional area of upper arm, U = πr^2

Cross-sectional area of muscle, M = πR^2

Cross-sectional area of adipose tissue, A = U – M

Brachial Adipo-Muscular Ratio (BAMR)= A/M

During the course of field work all necessary precautions were taken to collect the data.

RESULTS

Analysis of biceps, triceps skin fold, upper arm circumference and body composition in OA, RA and control group has been done using various equations. Results of different components of body composition are framed under estimation of adipose tissue mass.

Mass of total adipocytes i.e. adipose tissue mass in upper limb has been calculated using the equations given by **Vague et al. (1970).** Triceps skinfold and biceps skin fold thickness is same for OA and control subjects i.e. 34.3mm and 33.3mm). Minimum values of all skin fold Triceps Skinfold (28.0mm), Biceps Skinfold (30.5mm) were observed in RA patients.
Higher mean value of arm fat area (46.95 cm^2) and arm muscle area (40.07cm^2) has been observed in control group (**Table 1, Fig 1, 2 & 3)**. Minimum value of arm fat area (35.10 cm^2) and arm muscle area (29.64cm^2) has been observed in RA group. However, maximum value of brachial-adipo muscular ratio (BAMR) has been observed in OA group (1.29), thus showing more adipose tissue developed in upper region in contrast to muscle mass whereas least value of BAMR is present in control group thus indicating developed muscle mass in contrast to adipose tissue.

Table 1 : Mean, SD and SE_m of arm muscle area (AMA), arm fat area (AFA) and brachio-adipo muscular ratio (BAMR) in the subjects of osteoarthritis (OA), rheumatoid arthritis (RA) and control (CNT) groups

Parameter	Group								
	OA			RA			CNT		
	Mean	SD	SE_m	Mean	SD	SE_m	Mean	SD	SE_m
Arm Muscle Area (cm^2)	35.53	8.79	1.24	29.64	9.38	1.32	40.07	8.50	1.20

Arm Fat Area (cm^2)	**45.28**	**14.61**	**2.06**	**35.10**	**10.93**	**1.55**	**46.95**	**10.89**	**1.54**
BAMR	**1.29**	**0.34**	**0.05**	**1.24**	**0.42**	**0.06**	**1.203**	**0.31**	**0.04**

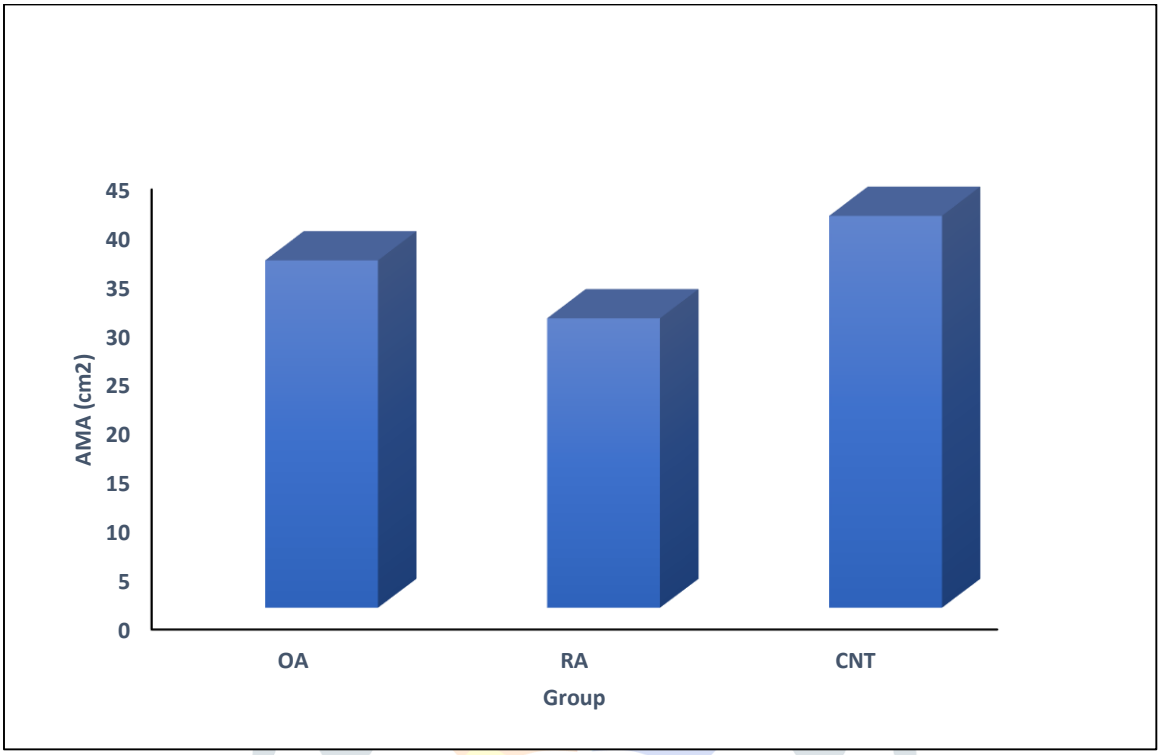

Fig 1. Trend in the values of AMA in the three groups

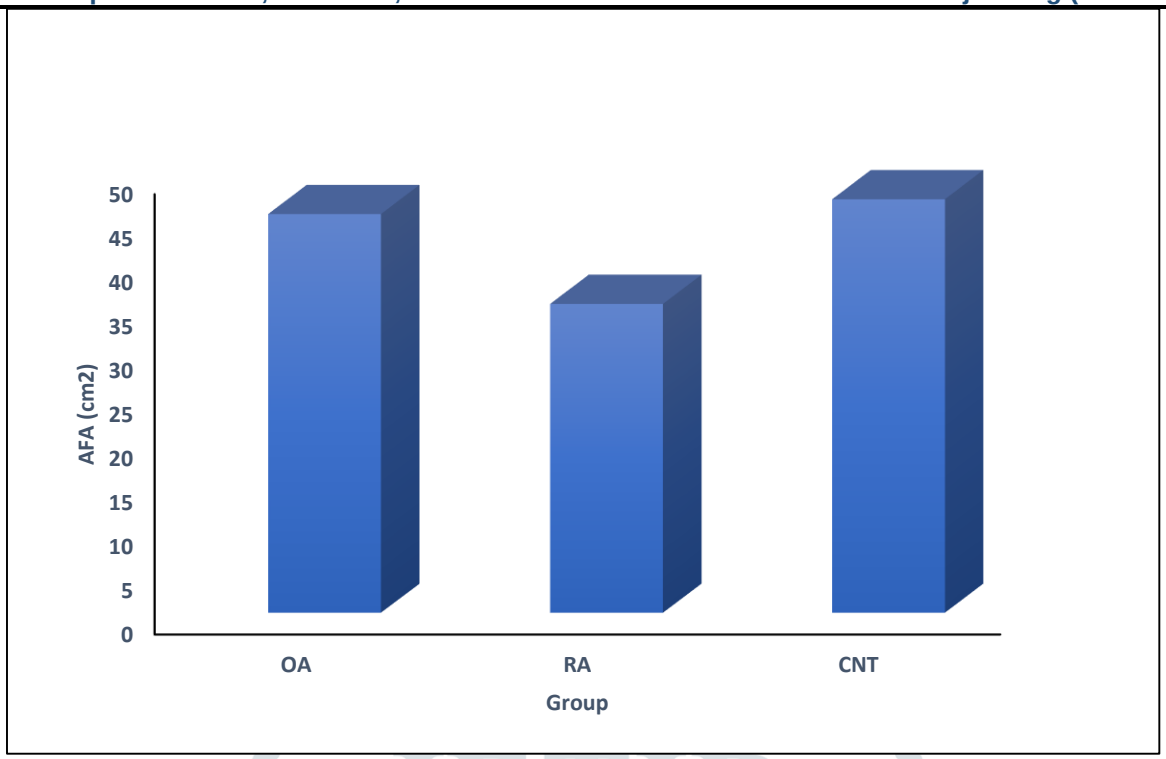

Fig 2. Trend in the values of AFA in the three groups

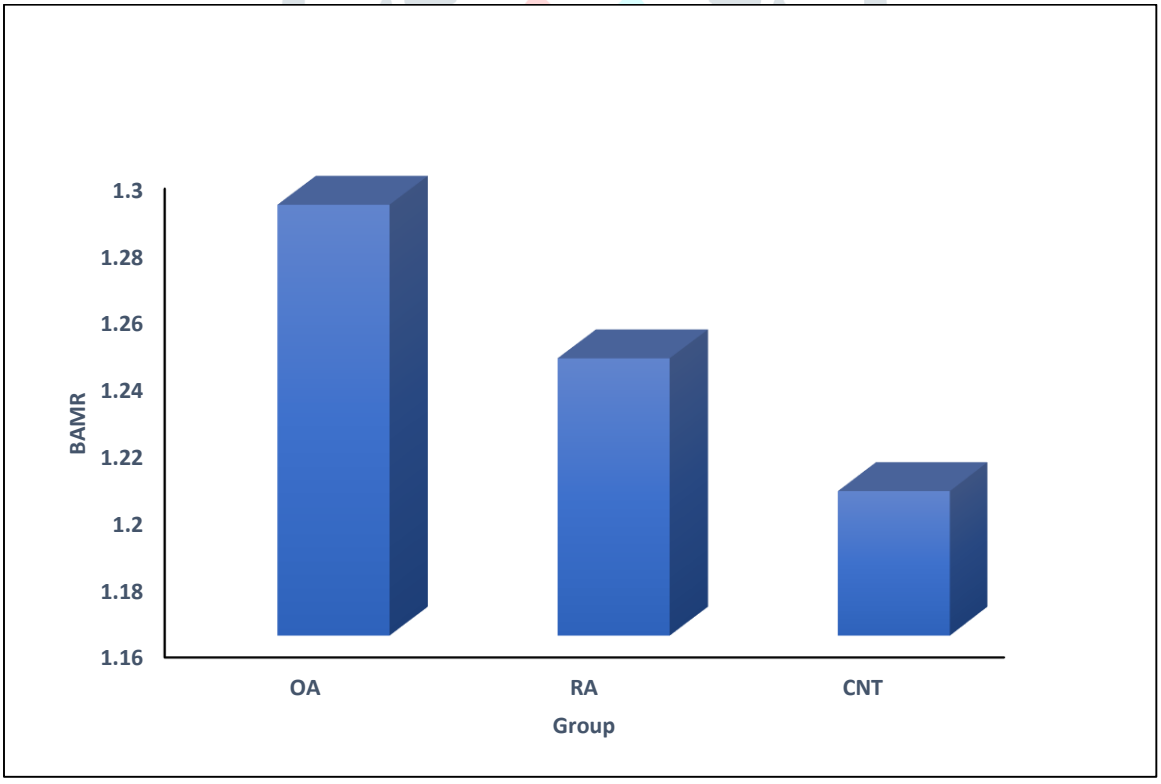

Fig 3. Trend in the values of BAMR in the three groups

In terms of statistics, differences are highly significant among CNT vs RA and significant for CNT vs OA & OA vs RA for arm muscle area.

In case of arm fat area (AFA) differences are statistically highly significant among CNT vs RA & OA vs RA groups and non-significant in CNT vs OA. **(Table 2).**

Table 2. Significant differences for sample mean of arm muscle area (AMA) and arm fat area (AFA) in the three groups

Parameter (cm^2)	Paired Comparisons					
	CNT *vs* OA		CNT *vs* RA		OA *vs* RA	
	t-ratio[$]	p-value	t-ratio	p-value	t-ratio	p-value
Arm Muscle Area	2.624[*]	0.0101	5.826[***]	< 0.0001	3.242[**]	0.0016
Arm Fat Area	0.651[NS]	0.5166	5.432[***]	< 0.0001	3.944[***]	0.0002

[$]**Each t-ratio is associated with 98 *degrees of freedom*;**

[*]**: Significant at 5% probability level;** [**]**: Significant at 1% probability level;**

[***]**: Significant at 0.1% probability level.**

DISCUSSION

In present study in comparison of OA and RA group, maximum arm muscle area and arm fat area is found in OA group and maximum thigh muscle area and thigh fat area is found in OA group. Maximum brachial-adipo muscular ratio (BAMR) has been observed in OA group (1.29) followed by RA (1.24) thus indicate more development of adipose tissue mass in the upper region of the body in comparison to muscle mass whereas control group possess least value of BAMR thus suggesting more developed muscle mass in comparison to adipose tissue mass. Body composition is strongly correlated with RA patient's disability. Brachial-adipo muscular ratio (BAMR) gives the information about relative development of fat mass in relation to muscle mass in the upper region of the body. Mass of total adipocytes i.e. adipose tissue mass has been calculated using the equations given by **Vague et al. (1970).**

Lean body mass is markedly reduced and inversely correlated with disease activity and disability **(Roubenoff et al., 1992)**. Amount of lean and fat mass in upper and lower extremity is strongly linked with deformities in RA patients. Increased disability with increased fat and decreased lean mass, with appendicular fat and lean mass demonstrates effect of greatest magnitude. So, RA patients should be encouraged for fat loss and muscle strengthening by Physicians **(Giles et al., 2008)**.

Adipose tissue is documented as endocrine organ of high metabolic activity and secretes agents involving adipocytokines such as adiponectin and leptin. **(Sowers et al., 2010)** stated Leptin is found in affected joints due to Osteoarthritis. In normal cartilage only few chondrocytes manufacture leptin. Level and pattern of leptin expression was associated with damage of cartilage. So, leptin plays key regulator role and thus signify its important role in OA pathophysiology **(Dumond et al., 2003)**. Decreased lean mass in upper and lower extremity impairs the capability to perform activities such as rising, climbing, lifting, and carrying **(Roubenoff et al., 1992).**

Conclusion

Body composition is strongly associated with Osteoarthritis and disability in RA patients. Maximum adipose tissue is seen in Osteoarthritis patients, thus indicating that adipose tissue is strongly linked with development of Osteoarthritis.

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