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Effect of Age on Resting Blood Pressure in Pregnancy

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Abstract

Pregnancy is a physiological condition associated with profound adaptive changes in the maternal hemodynamics and cardiovascular system. Autonomic nervous system plays a central role in this adaptation to the various needs of pregnancy. Several studies suggest that there are evidences of an age-related increase of cardiovascular sympathetic nervous system activity and a reduction of cardiac parasympathetic nervous system activity. Older age is associated with a gradual loss of vascular compliance, which subsequently leads to a higher afterload. Thus, increased sympathetic activity with maternal age, decreased baroreceptor sensitivity, and loss of vascular compliance all together contributes to increase in blood pressure. The study was conducted among 225 pregnant womenfrom 7 weeks of gestation and they were divided in different age groups (18–23 years, 24–29 years, 30–35 years). Older maternal age was associated with higher blood pressure having the mean systolic blood pressure 102.90 ± 11.95, 103.23 ± 12.58, 113.2 ± 12.53 mm Hg and diastolic blood pressure 63.90 ± 9.20, 65.78, 71.33 and mmHg respectively in different age groups. Women aged 30–35 years had the highest blood pressure, but the steepest increase was observed in those aged 35 years. Thus, changes in sympatho-adrenal function with advancing age may have a number of important physiological and pathophysiological consequences for human health and may lead to gestational hypertensive disorders.

Keywords: Sympathetic nervous system; Vascular compliance; Gestational hypertensive disorders.

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Introduction

Pregnancy is a physiological condition associated with profound adaptive changes in the maternal hemodynamics and cardiovascular system. Autonomic nervous system plays a central role in this adaptation to the various needs of pregnancy.[1]

Over the past three decades the changes in sympathoadrenal function that occur with age in healthy adult humans have been systematically studied using a combination of neurochemical, neurophysiological and haemodynamic experimental approaches. The available experimental evidence indicates that tonic whole-

body sympathetic nervous system (SNS) activity increases with age. The elevations in SNS activity appear to be region specific mainly targeting skeletal muscle and the gut.[2]

Both arterial and cardiopulmonary baroreflexes tonically inhibit central sympathetic nervous system outflow in humans.[3] With advancing age, this tonic inhibition lessens thus allowing progressively greater levels of sympathetic nervous system activity to peripheral tissues.[4]

Reduced neuronal reuptake or systemic plasma clearance of noradrenaline, both of which have been reported to occur with age would result in greaterplasma noradrenaline (PNA) concentrations in response to a particular stress-evoked increase in sympathetic nervous systemactivity.[5] Thus, sympathetic nervous system tone of the heart is increased, although this appears to be due to reduced neuronal reuptake of noradrenaline (norepinephrine).[6]

It was suggested that there is evidence of an age-related increase of cardiovascular sympathetic nervous system activity and a reduction of cardiac parasympathetic nervous system activity. These findings are consistent with the hypothesis that there is sympathetic nervous system and parasympathetic nervous system compensation of cardiovascular function in response to an age-related decrease in baroreceptor sensitivity.[7]

According to some studies the differences in blood pressure levels between younger and older women might be part of the underlying mechanism explaining the association between advanced maternal age and hypertensive complications in pregnancy.[8–11] A different process occurs with ageing. Older age is associated with a gradual loss of vascular compliance, which subsequently leads to a higher afterload.[12]

These changes in sympathoadrenal function with advancing age may have a number of important physiological and pathophysiological consequences for human health and disease. Differences in hemodynamic adaptations related to pregnancy and ageing might be associated with differences in blood pressure levels during pregnancy.[13]

Therefore, we assessed in a population-based prospective cohort study among 225 pregnant women, the associations of maternal age with systolic and diastolic blood pressure in first trimester of pregnancy and may lead to the development of gestational hypertensive disorders.

Material and Methods

The study was conducted in the Department of Physiology, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah, India, in association with Department of Obstetrics and Gynaecology. After clearance from institutional ethical committee, informed written consent from each participant.The pregnant females between age of 18 to 35 years in first trimesters reporting to the Out-Patient Department (OPD) of Obstetrics and Gynaecology were included in the study.

A detailed history was taken from each participant and subjects having multiple pregnancy, history of smoking, subjects taking drugs such as hypnotics or autonomic blockers, and previous history of hypertension, cardiovascular disease, diabetes mellitus, renal disease, obesity, liver diseases, thyrotoxicosis; were excluded from the study'

Patients were divided into three groups. 18–23 years, 24–29 years, and 30 to 35 years. The subjects were requested to sit in peace for 10 minutes. After 10 minutes of rest, baseline systolic and diastolicblood pressure was recorded by auscultatory method using mercurial sphygmomanometer.

Results

In total 225 pregnant women were enrolled during first trimester of pregnancy. For the present study, we included 132 patients in 18–23 years, 78 patients in 24–29 years, 15 patients in 30–35 years of age. Older maternal age was associated with higher blood pressure having the mean systolic blood pressure 102.90, 103.23, 113.2 and diastolic blood pressure 63.90, 65.78, 71.33 and mmHg respectively in different age groups (Table 1).

Table 1: Variation in blood pressure among different age groups.

Trimester	Age(years)	No. of patients	Mean Systolic Blood pressure (mmHg)	Mean Diastolic Blood pressure (mmHg)
1st	18–23	132	102.90 ± 11.95	63.90 ± 9.20
1st	24–29	78	103.23 ± 12.58	65.78 ± 10.92
1st	30–35	15	113.2 ± 12.53	71.33 ± 9.17

Discussion

As observed in the study there is an increase in both resting systolic and diastolic blood pressure in different age groups in first trimesters. In the analyses, we used maternal age as continuous variable and categorized in 3 groups: 132 patients in 18–23 years, 78 patients in 24–29 years and 15 patients in 30–35 years of age. A positive correlation is observed between maternal age and systolic and diastolic blood pressure in first trimester.

According to Romy Gaillard *et al.* (2011), available experimental evidence indicates that tonic whole-body sympathetic nervous system (SNS) activity increases with age.[2] Reduced neuronal reuptake or systemic plasma clearance of noradrenaline, both of which have been reported to occur with age would result in greater plasma noradrenaline (PNA) concentrations in response to a particular stress-evoked increase in sympathetic nervous system activity.[5]

Pfeifer MA *et al*. (1983) also suggested that there was evidence of an age-related increase of cardiovascular sympathetic nervous system activity and a reduction of cardiac parasympathetic nervous system activity. Normal baroreceptor sensitivity leads to increased parasympathetic activity and decreased sympathetic tone in response to increased blood pressure. Decreased baroreceptor sensitivity with age may be contribute to decreased parasympathetic activity and unopposed sympathetic activity (Fig. 1). These findings are consistent with the hypothesis that there is sympathetic nervous system and parasympathetic nervous system compensation of cardiovascular function in response to an age-related decrease in baroreceptor sensitivity.[7]

The mechanisms explaining the differences of age effect on systolic and diastolic blood pressure are not known. It has been suggested that with older age the vascular compliance declines, leading to a higher afterload.[12] This is contradictory to the hemodynamic adaptation during pregnancy, in which the afterload declines. Differences in blood pressure levels between younger and older women might be part of the underlying mechanism explaining the association between advanced maternal age and hypertensive complications in pregnancy.[13]

Conclusion

Study carried out is of interest from an etiological perspective rather than from an individual clinical perspective.Thus,increased sympathetic activity with maternal age, decreased baroreceptor sensitivity and decreased compliance all together contributes to increase in blood pressure. These changes in sympathoadrenal function with advancing age may have a number of important physiological and pathophysiological consequences for human health and disease. Our results suggest the association between maternal age and the rise in blood pressure which may lead to the risk of pregnancy-induced hypertension.

Acknowledgement

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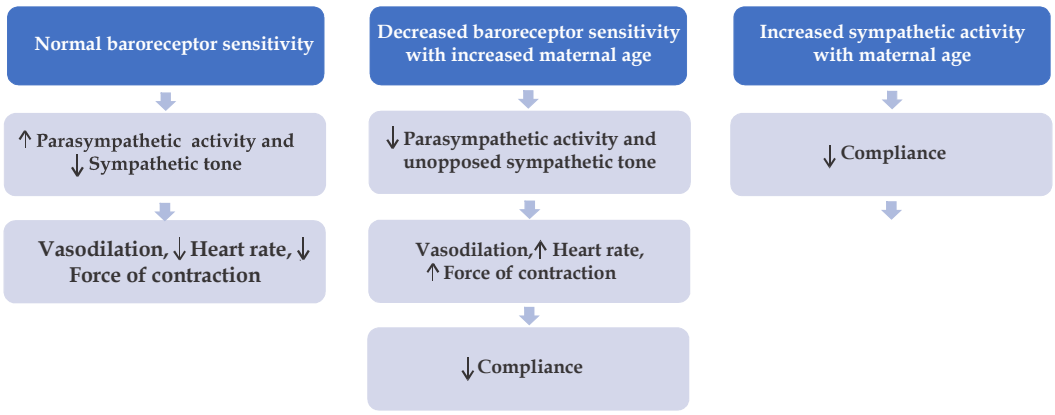

Fig 1: Factors responsible for increased blood pressure in advanced maternal age.

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Correlation Between Rate Pressure Product and Severity of Chronic Obstructive Pulmonary Disease

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Abstract

Objectives: Cardiac co-morbidities add to the overall morbidity and mortality of patients with COPD. Rate Pressure product is the product of systolic blood pressure and heart rate and is indicative of increased myocardial oxygen demand or the cardiac workload. The objective of the study was to assess cardiovascular status of Chronic Obstructive Pulmonary Diseasepatients, by determining rate pressure product (RPP). The study was performed with the hypothesis that RPP would be increased in COPD patients and may be used to detect cardiovascular complications in these patients. *Methods and materials:* Thirty COPD patients of more than 18 years age without frank cardiovascular symptoms were selected. Patients with pulmonary co-morbidities, diabetes mellitus, hypertension, thyroid disorders, any heart disease or other diseases that may affect cardiovascular system were excluded from the study. They were divided into different stages of severity (GOLD classification), based on FEV1. Their RPP was calculated. *Outcomes:* The results showed RPP to be above normal range in all the patients. Spirometry was abnormal (decreased FVC, FEV1, FVC/FEV1 below predicted) in all the patients. A negative correlation was observed between FVC/FEV1 and FEV1 and RPP, however it was not statistically significant. *Conclusion:* The study emphasises the implication of RPP in detecting early and imperceptible cardiovascular morbidity in COPD patients.

Keywords: COPD; Rate pressure product; Cardiovascular morbidity.

How to cite this article:

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Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by chronic obstruction of lung airflow that interferes with normal breathing and is not fully reversible. The systemic involvement in patients with COPD, as well as the interactions between COPD and its comorbidities, better describes COPD as a chronic systemic inflammatory syndrome.[1] The pathogenesis of COPD is closely linked with aging, as well as with cardiovascular, endocrine, renal, and other systemic pathologies, decreasing the quality of life of patients with COPD and, furthermore, complicating the management of the disease.[2,3] Among these, cardiovascular complications are a major cause of morbidity and mortality in COPD patients, which include systemic hypertension, dyslipidaemia, ischemic

heart disease, chronic heart failure, vasculopathies etc.[4,5]

Higher prevalence and incidence of cardiac comorbidities are observed in patients with COPD than in matched controls.[2] Presence of COPD may be an independent risk factor for the development of these cardiovascular diseases above that associated with the most widespread factor these diseases have in common, namely smoking.[6] Autonomic impairment primarily sympathetic over-activity has been implicated as a cause of cardiovascular complications in these patients.[7,8] In addition, recurrent hypoxemia, hypercapnia, increased intrathoracic pressure swings due to airway obstruction, increased respiratory effort, systemic inflammation and the use of beta-sympathomimetics may also lead to associated cardiovascular symptoms in COPD patients.[7]

The efficiency of the myocardium to perform work can be represented by the myocardial oxygen consumption (MVO2), which is the most important indicator of the load on the heart.[8–10] Rate Pressure Product (RPP) is a non-invasive method of estimating MVO2 and can be calculated by multiplying HR by SBP and dividing by 1000 (RPP = [(HR × SBP)/1000]).[8–10] According to Fletcher *et al*. (1979), under resting conditions, safer RPP should range between 7.00 and 9.00,[9] RPP more than 10.00 is a clear indicator of increased risk for heart disease.[9,11] RPP, also referred to as double product, has been recognized as a relevant parameter in evaluating ventricular function and is used as a predictor of cardiovascular morbidity.[12–14]

Keeping in mind the association between COPD and cardiovascular complications, we hypothesised that the rate pressure product may be deranged in COPD patients even before the onset of cardiovascular symptoms. So we have planned the current study to evaluate cardiovascular status in COPD patients by measuring RPP and further to correlate the same with the severity of COPD.

Materials and Methods

This Cross-sectional study was commenced after approval from the Institutional Ethics Committee. It was conducted in the Autonomic Function Laboratory of the institute on thirty COPD patients.

The sample size was calculated with reference to the work by Sembulingam P *et al*., 2015; using Master 2.0 software (CMC, Vellore).[11]

Men and women of more than 18 years attending the outpatient Pulmonary Medicine Clinic and diagnosed of COPD as per GOLD 2015 guidelines were selected for the study.

Patients with pulmonary comorbidities or Patients with diabetes mellitus, hypertension, thyroid disorders, any heart disease or other diseases that may affect cardiovascular system and those who were unwilling to participate, were excluded from the study.

Written informed consent was obtained from the participants after explaining them the importance of the project, their role in the project and the procedural part of the project. Detailed history, including any present medical complaints, duration of disease, past history of any illness pertaining to cardiovascular, respiratory and musculoskeletal system, history of chest pain or breathlessness and history of smoking, alcohol or tobacco intake was also recorded. Clinical examination and other investigations was done between 9:00 am - 12:00 pm to avoid confounding effects of circadian rhythm on spirometry and cardiovascular parameters.

The GOLD staging system was used which classifies people with COPD based on their degree of airflow limitation.[15] Airflow limitation was assessed by Spirometry; which is a simple, non-invasive technique. It was carried out in all the patients by single trained technician following standard protocol to assess the severity of COPD. The spirometric parameters on which diagnosis of COPD is based were forced vital capacity (FVC) and forced expiratory volume in one second (FEV1). The total, forcefully exhaled breath, following deep inspiration is called the forced vital capacity (FVC), measured in liters. The volume of FVC in first second of forced exhalation is called the forced expiratory volume in one second (FEV1), also measured in liters. In patients with FEV1/FVC < 0.70, GOLD classification was used to describe the severity of the obstruction or airflow limitation. The worse a person's airflow limitation is, the lower their FEV1. As COPD progresses, FEV1 tends to decline. GOLD staging uses four categories of severity for COPD, based on the value of FEV1.[16]

Stage I	**Mild COPD**	**FEV1 ≥ 80% of predicted**	
Stage II	Moderate COPD	FEV1	50–79% of predicted
Stage III	Severe COPD	FEV1	30–49% of predicted
Stage IV	Very Severe COPD	FEV1	< 30% of predicted, or < 50% normal with chronic respiratory failure present

The blood pressure (BP) and heart rate (HR) was recorded in all patients using an oscillometric sphygmomanometer. Since oscillometric devices are declaredly unreliable in persons with arrhythmias and those with mid-upper arm circumference >42 cm, such subjects were not included in this study. BP measurements were done in conformity with the updated American Heart Association guidelines for office BP measurement.[17] To stabilize the blood pressure, subjects were made to take rest for 5 min before starting the measurement. Rate pressure product (RPP) was calculated using the formula: RPP = (HR × SBP)/1000).[9]

Statistical analysis was done using SPSS for windows (Version 21; Chicago, IL, USA). The distribution of variables was assessed by means of Kolmogorov-Smirnov normality test. Correlation between two parameters was analyzed using Pearson's correlation test.

Results

The basic characteristics of the patients are given in Table 1.

Table 1: General characteristics of the COPD patients

Parameters	Values
Age (years)	64.75 ± 6.12
Height (cm)	166.8 ± 6.13
Weight (kg)	61.8 ± 14.64
BMI (kg/m^2)	22.29 ± 4.54

All the values are Mean ± SD. BMI: Body mass index.

Cardiovascular (Systolic blood pressure and heart rate) and important spirometric (FVC, FEF1, FEF1/FVC) findings are given in Table 2. The percentage predicted values of the above-mentioned spirometric parameters in all the patients were below normal. The mean RPP was more than the normal range.

Table 2: Cardiovascular and Spirometric parameters

Parameters	Values
FVC (L)	2.6 ± 0.72
FEV1 (L)	1.53 ± 0.61
FEV1/FVC (%)	56.6 ± 13.4
SBP (mmHg)	129 ± 17.9
HR (bpm)	82.35 ± 11.9
RPP (SBP*HR)/1000 (mm Hg• bpm)	10.7± 2.5

All the values are Mean ± SD. BMI: Body mass index. FVC: Forced Vital Capacity; FEV1: Forced Expiratory Flow in 1 second; SBP: Systolic Blood Pressure; HR: Heart Rate; RPP: Rate Pressure Product.

Table 3: Correlation of spirometric parameters with Rate Pressure Product.

Spirometric parameters	*r*	*p* value	
FVC/FEV1		–0.42	0.06
FEV1		–0.12	0.64
FEV1 (Stage I & II)	RPP	-0.25	0.48
FEV1 (Stage III)		-0.26	0.62
FEV1 (Stage IV)		-0.74	0.26

$p < 0.05$ were considered statistically significant. Non-significant negative correlation was observed.

Similarly, non-significant negative correlation was observed between FEV1 and RPP irrespective of the severity of disease (Table 3).

Discussion

COPD and chronic cardiac diseases share common risk factors like old age, smoking, sedentary life style, persistent low-grade pulmonary and systemic inflammation.[1–3] With this background, we proceeded with the hypothesis that the rate pressure product, which is an index of myocardial oxygen consumption and reflects hemodynamic stress, may be deranged in COPD patients even before the onset of cardiovascular symptoms.[8,10,14] In this study, we evaluated the cardiovascular status in COPD patients by measuring RPP and further correlated the same with the severity of COPD.

The rate pressure product was found to be more than the prescribed normal range of 7–9, indicating increased myocardial oxygen consumption and hence increased hemodynamic stress in COPD patients. Similar to our study, many researchers have found RPP to increase in patients of COPD.[18–20] Tzani and co-authors showed that COPD patients with dynamic hyperinflation have a poor cardiovascular response to exercise, supporting the view that in COPD patients, dynamic hyperinflation may affect exercise performance not only by affecting ventilation, but also cardiac function.[18] J. Travers *et al*., 2007 reported improved cardiac as well as pulmonary function with Tiotropium during exercise in COPD. The increased RPP in COPD patients due to exercise was found to decrease with tiotropium.[19] Vengatasubramani M and Vikram M, 2015 observed that the increased RPP in COPD patients decreased with specifically designed physical activity, thus improving the cardiovascular fitness in these patients.[20] As expected, the predicted values of FVC, FEV1 and FEV1/FVC were below normal. We could not detect significant correlation

between spirometric findings and RPP, though a non-significant negative correlation was observed between these parameters, irrespective of the stage of the disease. On literature search, we were not able to retrieve any study correlating these two parameters. Negative correlation is suggestive of increased myocardial workload in patients of COPD, however statistical non-significance makes its clinical importance questionable. We need to extend the study further with increased sample size and consider the duration of disease as well.

Conclusion

Our results were suggestive of increased rate pressure product in all stages of COPD. This indicates increased myocardial workload in these patients. Though a negative correlation was detected between spirometric records and RPP, but was statistically non-significant. Our sample size was small and very few patients were included in each stage of COPD. To confirm the cause, we need to extend the study further, with bigger sample size, taking into consideration duration along with the severity of COPD. We conclude by saying that this simple non-invasive procedure may help in early recognition of the cardiovascular comorbidity in these patients and may help doctors in making better treatment recommendations for people with COPD.

Conflicts of Interest: The authors declare no conflict of interest.

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Relation of Obesity With Ambulatory Arterial Stiffness Index in healthy Young Adult Males

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Abstract

Objectives: 1. To correlate BMI with Ambulatory Arterial Stiffness Index (AASI) 2. To correlate Waist Circumference with AASI 3. To correlate body fat percentage with AASI 4. To determine the best predictor of AASI amongst the obesity parameters *Methodology:* 30 healthy young adults of age between 20 to 35 years were enrolled in the study. Subjects with any H/o hypertension, cardiovascular, renal disorders were excluded. Body mass index (BMI) was calculated as body weight/height^2 (kg/m^2). Waist circumference (WC) was measured midway between lower rib margin and anterior superior iliac spine. Skinfold thickness was measured using Harpendent skinfold calipers at four sites viz triceps, biceps, subscapular and suprailiac. Body-fat percentage was calculated using Durnin-Womersley formula. 24 hours Ambulatory Blood Pressure was measured using Contec Ambulatory Blood Pressure Monitor (AMBP). AASI was calculated by the formula one minus the regression slope of diastolic BP over systolic BP. *Results:* There was a positive correlation between AASI and BMI, WC and fat percentage with correlation coefficients of 0.715 ($p < 0.01$), 0.735 ($p < 0.01$) and 0.646 ($p < 0.01$) respectively. Since the WC had strongest correlation with AASI, WC can be considered as the strongest predictor of AASI. *Conclusion:* AASI is a predictor of arterial stiffness. As the BMI, WC and fat % the AASI increases. Amongst them WC had the strongest relation with AASI. Increase in AASI predispose to peripheral arterial diseases including coronary artery disease, cerebral vascular disease. So, controlling obesity is a must to prevent peripheral arterial diseases.

Keywords: AASI; BMI; Waist circumference; Body fat percentage.

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Introduction

Recently lot of research is going on Arterial stiffness.[1] It is recognized as an important measure of target organ damage and a potent predictor of cardiovascular morbidity and mortality.[2] The ambulatory arterial stiffness index (AASI) as assessed by ambulatory blood pressure monitoring (ABPM) gained importance as an important predictor of future risk of cardiovascular diseases specially stroke.[3]

AASI is defined as 1 minus the regression slope

of diastolic on systolic BP values derived from a 24 h ABPM recording. Thus, AASI indicates that systolic and diastolic BP are related to each other. It can be because of the hemodynamic properties of arteries and arterial stiffness is an important contributor. It is said that if we compare a compliant artery with a stiff artery, the diastolic BP increases more than the systolic BP.[4] A lot of research has been done on the mechanisms by which AASI estimates the cardiovascular risk. Now the AASI is being commonly used in clinical practice.[4]

In the past, many studies suggested that the incidence of certain types of CV diseases, particularly coronary heart disease and stroke, was greater in heavier individuals, but only a few proposed that any obesity index makes an additional contribution to risk once the levels of coexisting risk factors such as dyslipidemia, hypertension, insulin resistance, glucose intolerance, and type 2 diabetes had been taken into account.[5]

In India, there is an increasing prevalence of obesity in urban youth population which has caused them to fall in the category of high risk of cardiovascular diseases. A major factor contributing to obesity and hence cardiovascular risk is the sedentary lifestyle adopted by the children and young adults these days. Both obesity and sedentary lifestyle has caused an increase in the early occurrence of impaired lipid profile & glucose tolerance and arterial stiffness in early adulthood. There are studies suggesting that the process of atherosclerosis is initiated at an early age and which may lead to serious consequences.[6] So, the present study was designed to investigate the relationship of obesity parameters with Ambulatory Arterial stiffness index.

Objectives

1. To correlate BMI with Ambulatory Arterial Stiffness Index (AASI)
2. To correlate Waist Circumference with AASI
3. To correlate body fat percentage with AASI
4. To determine the best predictor of AASI amongst the obesity parameters

Methodology

The present study was conducted in the Department of Physiology of Saraswathi Institute of Medical Sciences, Hapur from the month March 2017 to July 2017. A convenient sample of 30 healthy young adult males who volunteered for the study were enrolled after taking written informed consent from all the subjects. Ethical clearance was obtained from Institutional Ethical Committee. Subjects with any H/o hypertension, cardiovascular, respiratory or renal disorders, smokers and alcoholics were excluded from the study.

The subjects were supposed to report to the Department of Physiology at 10.30 am. Their Weight, Height, WC and Skin fold thickness were measured and measurement of Ambulatory BP recording was started by 11 am. The subjects were supposed to tie the cuff of Ambulatory BP monitor for 24 hours even during their sleep. As disturbed sleep may not decrease the sympathetic activity in the body and hence may not result in decrease in BP during sleep. The subjects who complained of disturbed sleep at night were also excluded from the study

Anthropometry

Body weight was recorded (to nearest 0.5 kg) in all subjects, in erect position without shoes and wearing only light indoor clothes, with a mechanical scale. Height was measured to the nearest 1 cm and body mass index (BMI) was calculated as body weight/ height^2 (kg/m^2). Waist circumference was measured midway between the lower rib cage margin and the anterior superior iliac spine. Skinfold thickness was measured using skinfold calipers to the nearest 1 mm. Triceps and biceps skinfold thicknesses was measured midway between the acromion process of scapula and the olecranon process. Subscapular skinfold thickness was measured at the inferior angle of scapula in midaxillary line and suprailiac skinfold thickness measured just above the highest point of iliac crest. Body fat percentage was calculated using Durnin-Womersley formula.[7]

Ambulatory Arterial Stiffness Index

Subjects were allowed to sit quietly for 15 min prior to assessment of BP; three consecutive measurements were made 5 min apart, and baseline BP taken as mean of the three readings. 24 hours Ambulatory Blood Pressure was measured using Contec Ambulatory Blood Pressure Monitor (AMBP). The cuff of AMBP was tied on non-dominant arm. Subjects morning wake up time and night bed time was noted. AMBP was set to measure BP every 15 min during daytime and every 30 min in night time while sleeping. AASI was calculated by the formula one minus the regression slope of diastolic BP over systolic BP.[8]

Results

There was a positive correlation between AASI and BMI, WC and fat percentage with correlation coefficients of 0.715 ($p < 0.01$), 0.735 ($p < 0.01$) and 0.646 ($p < 0.01$) respectively. Since the WC had strongest correlation with AASI, WC can be considered as the strongest predictor of AASI. (Fig. 1).

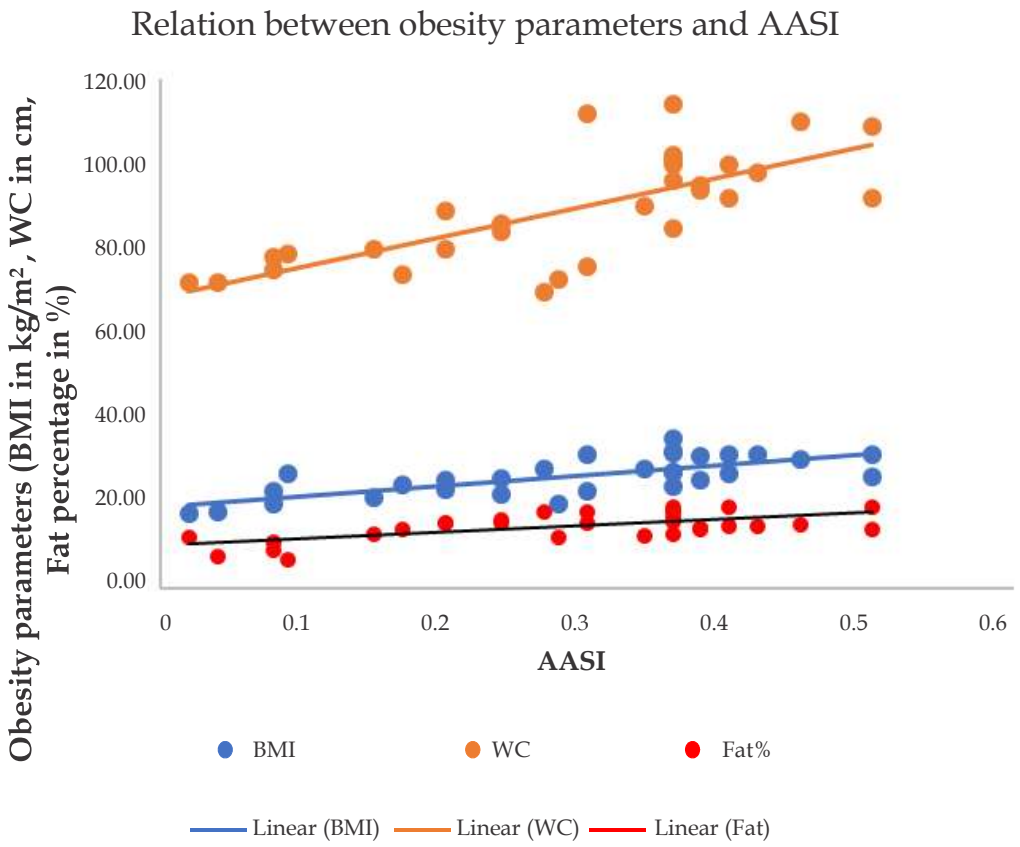

Fig. 1:

Discussion

Our study showed a positive correlation between AASI and obesity parameters like BMI, WC and Body fat percentage which means that as obesity increases the Ambulatory arterial stiffness index increases. As discussed above ambulatory arterial stiffness index is a reliable predictor of arterial stiffness. An increase in AASI means increase in arterial stiffness. Several studies have shown similar results.

There existed a positive association between pulse wave velocity and all adiposity measures. Increased obesity was associated with higher pulse wave velocity, another important index showing arterial stiffening, in adolescent age group. This may increase the CVD risk in obese for future. This association was independent of age and ethnicity.[9] The diameter and stiffness of muscular arteries increased with increased BMI. In elastic arteries, the relationship between arterial stiffness and BMI was more complex and varied with sex and age.[10]

Visceral adipocytes have an elevated lipolytic activity that results in increased free fatty acids release in the portal vein with an accumulation (liver, pancreas, and muscles) that contributes to insulin resistance. Furthermore, other mechanisms could be involved, such as increases in circulating proinflammatory cytokines or leptin. It has been found that obese individuals have high levels of circulating leptin and it has been found to be related with decrease in arterial elasticity. In addition to hypothalamic receptors, receptors for leptin have been observed on the vascular endothelium and on smooth muscle cells. Accordingly, leptin is said to exert influence on vessel tone and growth and, in

cell culture, stimulate proliferation and migration of vascular smooth muscle. In addition, it can induce oxidative stress in endothelial cells, which results in the transcription of oxidant-sensitive genes that participate in atherogenesis. Another mechanism may be due to a complex relation that exists between adiposity, BP, ANS and arterial stiffness. Excess adiposity may modulate sympatho-vagal balance by stimulating sympathetic nervous system which can increase the tone in vessels and hence increase the BP. As a result, this elevation in BP again stiffening of arteries occur that may further augment BP.[11,12]

Our study also showed waist circumference correlated strongest with AASI. A study done in children and adolescents also showed that high obesity parameters (in terms of higher body fat and higher waist circumference) are associated with enhanced arterial stiffening in Indian children and adolescents. Waist circumference was found to be a sensitive predictor of increased stiffness in children.[6]

Another study done in middle aged showed that WC was better associated with arterial stiffness (assessed by PWV) as compared to BMI.[13] Another study showed adiposity was a robust predictor of aortic stiffening in the presence and absence of co-occurring metabolic risk factors and inflammation. General and central obesity and fat mass percent were equally predictive of aortic stiffening.[14]

Conclusion

AASI is a predictor of arterial stiffness. As the BMI, WC and fat % increases, the AASI increases. Amongst them WC had the strongest relation with AASI. Increase in AASI predispose to peripheral arterial diseases including coronary artery disease, cerebral vascular disease. Ambulatory BP monitoring is a novel, cheap and non-invasive method to determine arterial stiffness which is a predictor of future peripheral arterial diseases. It may be used to assess the AASI in obese to know the risk of peripheral arterial diseases in them, so that, the preventive measures can be undertaken.

Key message: Weight management is important to prevent the arterial stiffness and thus peripheral vascular diseases.

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Association of Anemia with Blood Groups

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Abstract

Background: Blood is an unique connective tissue which confers identity to an individual with blood group and type. Blood group has clinical importance in transfusion medicine. One of the major health problems in the world is malnourishment, of which anemia contributes to a vast subset, especially in developing countries. Decreased hemoglobin levels in turn adversely affect functioning of other systems of the human body. Blood group association with diseases like gastric cancer, pernicious anemia are proven. Previously, some studies had varied results analysing association of anemia with different blood groups. So, the present study was done to throw light on Hb levels and blood groups. *Objective:* The objective of this study was to find out the distribution of blood groups, the variation of hemoglobin concentration of the subjects, if there is any association of low Hb levels and blood groups. *Methods:* First MBBS and BDS students of the academic year 2018–2019 who were admitted in Mamata Medical College were taken as subjects and their blood grouping was done using standard antisera method.The hemoglobin content of the subjects was estimated with the help of Sahli's hemoglobinometer. *Results:* The blood group distribution was O (44.87%), B (27.31%), A (23.85%), AB (3.90%). 12.72% males were anemic and 84.66% females were anemic. The distribution of anemia in blood groups was O with 7.31%, A with 4.87%, B of 4.39% and AB with 0.97%. The Chi-square value was 0.76 with p value of 0.85 which is insignificant. *Conclusion:* Anemia was found to be more in subjects with O blood group and less in case of persons belonging to AB group. The blood groups were seen to follow the Asiatic trend (O > B > A > AB). Females were anemic may be due to reduced red blood cell mass influenced by high estrogen levels.

Keywords: Anemia; ABO Blood group; Hemoglobin.

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Introduction

Anemia is a condition where there is a decrease in the oxygen carrying capacity of blood either due to reduced red blood cells or less than the normal quantity of haemoglobin in the blood.[1] The causes of anaemia is multifactorial and may result from blood loss, decreased red blood cell production or increased red blood cell breakdown.[2] Anaemia is a global public health problem affecting nearly a quarter of the world's population.[3] Although its effect is felt in both developing and developed countries, developing countries are the most affected.[4] As per the World Health Organization (WHO) database on anemia globally, anemia affects 1.62 billion people

(95%), which corresponds to 24.8% of the population. WHO also estimates that anemia contributes to about 20% of maternal and perinatal death in developing countries.[5] The impact of anaemia on maternal and child health is well recognised. Severe anaemia has been linked to increased risk of maternal and child mortality.[6,7,8] Anaemia has also been linked to impaired psychological and physical development, behaviour, and work performance of the population.[9] If it would be possible to determine whether any specific population is prone or resistant to anemia, it would rather be easy to suggest specific dietary advice to prevent the occurrence of anemia in such population. Disease like gastric cancer is associated with A blood group.[10,11] Blood group A persons suffer frequently with pernicious anemia[12] are few examples of association of blood group and common diseases. In a population group, so it is therefore imperative to have information on the distribution of these blood groups.[13]

Materials and Methods

The present cross sectional study was conducted in the Department of Physiology, Mamata Medical College, Khammam, between August 2018 and January 2019.

Description of Participants

Students pursuing first year M.B.B.S and first year B.D.S in the academic year 2018–2019 were selected as subjects. Nature of the study was explained and written informed consent was obtained from them. The study was approved by the Ethical and Research Committee of the institution. All the medical and dental students do their blood grouping, hemoglobin estimation during their 1st year of study as a part of their curriculum in hematology practical. The available data reports of ABO blood group and Rh blood type of 205 students was analyzed.

Inclusion Criteria: Age 17–21 years

Exclusion Criteria: Known hemolytic disorders, hereditary anemia, anemic subjects under treatment

Methodology

Blood grouping and typing

The blood grouping and typing was done by standard antisera slide agglutination method. A sterile finger prick was given to the middle or ring finger of the students and few drops of blood were added into a test tube with 0.9% Normal saline. The respective antisera were taken on a slide and separately mixed with the saline suspension of blood and checked for agglutination, presence or absence of clumping determine the blood group. For confirmation, agglutination was taken on a glasss slide and focused by using low-power objective of a compound microscope.[14]

Hemoglobin Estimation

Hemoglobin estimation was done using Sahli's hemoglobinometer based on the principle of formation of acid hematin and colorimetric matching with standard comparators of the apparatus. Three readings were taken, the first reading corresponded to the color of the fluid when it was slightly darker than the comparator. The second reading was noted when the fluid color matched exactly to the comparator. The third recording was that of the fluid color slightly lighter than the standard color. All the three readings were noted in the g/dL taking the scale at lower meniscus values. The average of the three readings was taken as the final hemoglobin value in gm/dL.[14] Anaemia was considered as Hb ≤ 12 g/dL for females and Hb ≤ 13 g/dL for males.

Statastical Analysis

As per the standard protocol, the result was expressed as percentage which is considered as frequency distribution of each ABO blood group and Rh factor. To establish the relationship in between the blood group and anemia, the frequency distribution (observed frequency) of blood group among the entire anemic population (N = 134) was compared with those of general non anemic population (N = 61) by Chi Square test (Mahajon, 2006).[15]

Results

The subjects in this study were 205, out of which were 55 males and 155 females. Table 1 shows the prevalence of different blood groups in males in decreasing frequency (O > A > B > AB). The prevalence in females was observed with a slight difference (O > B > A > AB). O blood group was the most prevalent group in the subjects (44.87%). Table 2 shows 71 subjects were having normal hemoglobin concentration and 134 were found to be anemic. 7 (12.72%) males were anemic

Table 1: Gender wise blood group distribution

	Blood Group			
	A	**AB**	**B**	**O**
Male	14(6.82%)	4(1.95%)	12(5.85%)	25(12.19%)
Female	35(17.03%)	4(1.95%)	44(21.46)	67(32.68%)

and 127 (84.6%) females had low Hb content. The distribution of anemia in blood groups as depicted in Table 3 was O group with 7.31%, A group with 4.87%, B group of 4.39% and AB group with 0.97%. The Chi-square value was 0.76 with p value of 0.85 which is insignificant (>0.05) in all blood groups, showing no association between anemia and blood groups.

Table 2: Distribution Bloodgroups with Rh Typing

	A^+	A^-	AB^+	AB^-	B^+	B^-	O^+	O^-
Male	13(23.63%)	1(1.81)	2(3.63)	2(3.63%)	12(21.81)	0(0%)	23(41.81)	2(3.63%)
Female	34(22.66%)	1(0.66)	3(2%)	1(0.66%)	43(28.66)	1(0.66%)	60(40%)	7(4.66%)

Table 3: Genderwise distribution of hemoglobin levels

	Distribution of HB levels among students (n=205)	
	Normal	**Below normal**
Male	48(87.27%)	7(12.72%)
Female	23(15.33%)	127(84.66%)

Table 4: Assosciaton of blood groups and hemoglobin levels

Blood Group	Total	Normal (%)	Anemic (%)
A	49	39(19.02)	10(4.87)
AB	8	6(2.92)	2(0.97)
B	56	47(22.92)	9(4.39)
O	92	77(37.56)	15(7.31)

The chi-square statistic is 0.7664. The p-value is 0.857497. The result is not significant at $p < .05$.

Discussion

Anemia is a global problem and at its worst in developing countries. Anemia has been effecting various organ systems in the human body, right from childhood to oldage. It has been the cause for poor maternal health, its allied complications like infections, PPH, perinatal death, ill neonates, poor development of physical and mental health of adolescents and so on the vicious cycle goes on. Low levels of hemoglobin is associated with poor performance of students in academics.[16] Blood grouping and typing is a frequently done investigation prior to blood donation, documenting on identity cards, useful in case of any emergency blood transfusion. Hemoglobin estimation is also a common test done in the outpatient departments in nearly all the specialities of medicine. Both the tests are done routinely as practicals under M.B.B.S,[17] B.D.S, MLT curriculum. On the other hand, blood group is one of the important and comparatively known parameter to the large number of present population which exhibits a strong correlation with some common diseases like cardiovascular diseases (WHO, 1993), gastric cancer[10] and even HIV infection. If such relation is found existing between anemia and blood group, then it will become very easy to predict the type of population which is more prone or resistant to anemia and thus help us to recommend such population for taking preventive measure so that ill effects of low Hb levels can be eradicated in such groups.

Our study showed same prevalence of ABO blood group as in Asiatic trend. Many researchers have reported that the prevalence of ABO blood groups were O > B > A > AB.[18–22]

Basak Asim Kuma and Maji Kaushik[23] in their study stated that A blood group is more prone for anemia and O group is reisitant for the same. This observation did not coincide with the outcome of the present study. According to Karl Landsteiner and Weiner, if the specific agglutiongen is present on the RBC surface, and the corresponding agglutinins should be absent in the plasma.[16] As per this law, A blood group has agglutinogen-alpha on the RBC surface and agglutinin–beta in its plasma, both alpha and beta aagglutinins are present in the plasma of blood group O. The individuals with blood group antigen alpha and beta are comparatively more prone to be anemic, due to increased risk of hemolysis, whereas the individuals devoid of these antigens are resistant to anemia. Study done by Tebit, Tayong[24] stated that AB group was prone to be anemic, which contradicts the result of this study. O blood group was found to have more subjects with low Hb level which is similar to the findings of Mukherjee DP, Das MK.[25] Hira Buran *et al*. stated that there was no significant association between the type of blood group and susceptibility to anemia,[26] which is in parallel to the observation of this study.

Conclusion

O blood group was the predominant subset with low Hb levels, there was no significant association of anemia with any blood group. The blood groups seen in decreasing frequency in the study was O > B > A > AB. Gender wise females were prone for anemia.

List of Abbreviations Used

Hb	:	Hemoglobin
Rh	:	Rhesus
WHO	:	World Health Organisation
M.B.B.S.	:	Batchelor of Medicine, Batchelor of Surgery
B.D.S.	:	Batchelor of Dental Surgery
MLT	:	Medical Laboratory Technician
HIV	:	Human Immuno Deficiency Virus
PPH	:	Post Partum Hemmorhage

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Study of Audio – Visual Reaction Time in Rheumatoid Arthritis Patients

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Abstract

Introduction: Rheumatoid arthritis (RA) is a chronic inflammatory disorder which affects the joints and is associated with swelling, stiffness and pain. Advanced disease stages can lead to substantial loss of functioning and mobility. As RA causes functional limitations in the joints, this might affect the movements or the movement patterns of the damaged and inflamed joints. The prevalence of rheumatoid arthritis in India is about 1 to 1.5 %. The primary targets of inflammation are synovial membranes and articular structures but other organs also affected. Reaction time is a time interval between the presentation of stimulus and initiation of muscular response to that stimulus. *Aim:* To study audio-visual reaction time in Rheumatoid Arthritis. *Material and Methods:* 50 Rheumatoid Arthritis patients and 50 controlled subjects were randomly selected from the Medicine & Orthopedics OPD. Age group of the subject from 25 to 75 years and it includes both male & female. Reaction Time Apparatus by Anand Agencies Pune was used to record audio-visual reaction time. Study was carried out in research lab, dept. of Physiology, GMC Mumbai. *Result:* Comparison of the results for the patients with RA and for the healthy controls indicated that the reaction times were longer in the patients with RA than in the controls on both sides. *Conclusion:* Result shows that audiovisual reaction time is longer in RA patients than healthy subject. This could be due to impaired motor functions in RA patients.

Keywords: Rheumatoid arthritis (RA); RT (Reaction Time); Auditory Reaction Time (ART); Visual Reaction Time (VRT); OPD (Out Patient Department).

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Introduction

Rheumatoid Arthritis is a chronic systemic disease of unknown etiology. It is characterized by peripheral symmetrical polyarthritis. It has a progressive course with exacerbation and remissions being part of its natural history. Its onset could be at any age, although it usually starts in the fourth decade of life. Overall, there is a 3:1 female preponderance, but this excess is greater in young people and the age related incidence is approximately equal in elderly people. The prevalence of rheumatoid arthritis in India is about 1 to 1.5 %.[1,2]

It begins with pain, stiffness and swelling of specific joints such as proximal interphalangeal,

metacarpophalangeal, wrist and knee joints. The diagnosis is based routinely on the persistence of arthritic symptoms over a time. Important factors associated with RA are the possibility of infectious triggers, genetic predisposition and autoimmune responses. The primary targets of inflammation are synovial membranes and articular structures but other organs are affected as well.[3]

Rheumatoid arthritis (RA) is a chronic inflammatory disorder which affects the joints and is associated with swelling, stiffness and pain. Advanced disease stages can lead to substantial loss of functioning and mobility.

RA is diagnosed on clinical, serological and radiological grounds. The American Rheumatism Association (ARA) first proposed classification criteria for RA in 1956 and then revised them in 1958.[4,5] Although, these criteria were widely used to diagnose RA for many years, they were heavily criticized for their lack of sensitivity and specificity.

The ARA published revised classification criteria for RA in 1988, based on cross-sectional data from a large group of patients with rheumatoid and other types of inflammatory arthritis.[6]

Rheumatoid arthritis causes reduced functional capacity, which leads to difficulties in activities of daily living. Inflammatory and destructive changes of the joints may cause pain and decrease the range of motion in joints, and inflict periods of immobilization, resulting in muscular atrophy.

Many previous investigators have studied the muscle strength of patients with RA, and the impaired muscle strength and functions of patients with RA compared with those of healthy controls. In one of the motor performance studies dealing with patients with RA, Ginsburg *et al*. studied cognitive functions (including switching attention and hand-eye coordination tasks) in patients with RA and noticed that the patients with RA had poorer motor performance. As RA causes functional limitations in the joints, this might affect the movements or the movement patterns of the damaged and inflamed joints.[7–13]

Audio – Visual Reaction Time

Reaction time is the interval of time between the application of a stimulus and appearance of appropriate voluntary response in subjects. Being voluntary in nature, the response is primarily governed by the ability of an individual to concentrate and to establish a muscular attitude of readiness. The reaction time thus indicates the time lost between the application of stimulus and the appearance of its end effect. Different types of stimulus can be tried to elicit the particular response such as sound, light, pain, heat, etc. it varies with complexity of the reflex and interrelated sensory pathway associated with the course of impulse as it travels to the center. For example factors which facilitate the reaction time are alertness, training, concentration and inhibits the reaction time are advancing age, distraction, muscular weakness etc.[7–10]

Aim: To study audio-visual reaction time in Rheumatoid Arthritis.

Material and Methods

After clinical evaluation and laboratory investigation, those patients satisfying the Modified American Rheumatology Classification Criteria (1987) were included in the study. 50 Rheumatoid Arthritis patients and 50 controlled subjects were randomly selected from the Medicine & Orthopedics OPD, who comes for routine health check up. Age group of the subject from 25 to 75 years and it includes both male & female.

Inclusion Criteria

- Diagnosed Rheumatoid Arthritis Patients

Exclusion Criteria

- Hemoglobin <10 gm/dl
- Pregnant Women
- Suffering from Diseases like diabetes mellitus, Parkinson's disease, cardiovascular diseases likes hypertension, ischaemic heart disease, congestive heart failure, valvular heart disease, cardio-myopathy and cardiac arrhythmia. Neurological diseases like multiple sclerosis, polyneuropathy or Guillain-Barre Syndrome.

Procedure

The subject was instructed to place her/his hand near to the press button of instrument, which was situated on one side of instrument. The test subject then heard a beeps sound, which was the sign to be ready for response. as soon as the subject listen the beep sound ask him to press the button for auditory reaction time, then for visual reaction time as soon as he/she saw the light (red or green) ask him to press the button.

Reaction time was expressed in milliseconds, as the time from initiating a light stimulus or sound stimulus to the time when the subject press the button. The subjects were performed three trials.

Instruments Used: Research Reaction Time Apparatus by Anand Agencies, Pune

Results

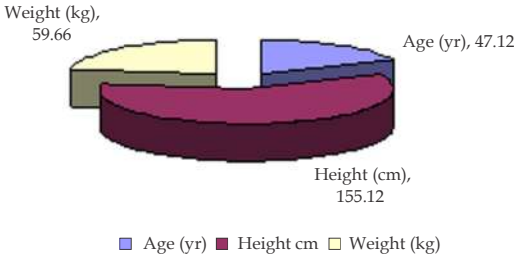
The results indicated that the Mean of ART for RA patients was 207.6 ± 55.40 ms of right hand and 215.26 ± 57.71 ms of left hand.

For controls it was 164.8 ± 25.64 ms of right hand and 173.86 ± 30.05 ms of left hand. It also shows that ART was longer in left hand than right hand for both patients and controls.

Mean of VRT for RA patients was 220.18 ± 60.55 ms of right hand and 236.88 ± 68.25 ms of left hand. For controls it was 177.94 ± 23.22 ms of right hand and 183.16 ± 24.99 ms of left hand. It also shows that VRT was longer in left hand than right hand for both patients and controls. There was high statistically significant difference between the patients and controls ($p = 0.001$). (Tables and Graphs 1–4).

Table 1: RA Patient Details.

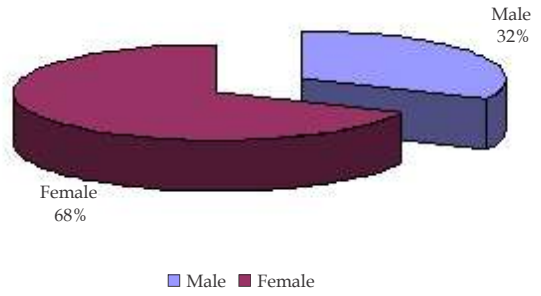
	N	Mean ± SD
Age (yr)	50	47.12 ± 8.62
Height (cm	50	155.12 ± 7.39
Weight (kg)	50	59.66 ± 8.77
Duration of Disease (yrs)	50	3.09 ± 1.70
Hb gm/dl	50	12.44 ± 1.52
ESR	50	15.00 ± 11.95



Graph 1: Age, Height and Weight of RA Patients.

Table2: Gender distribution of RA patients.

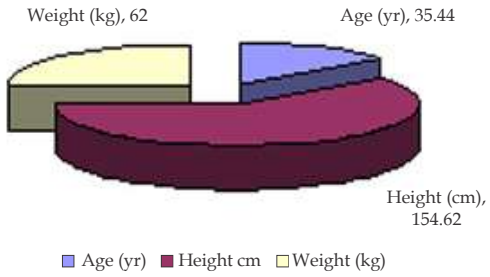
Gender	No	%
Male	16	32
Female	34	68
Total	50	100



Graph 2: Gender Distribution of RA Patients:

Table 3: Control Details:

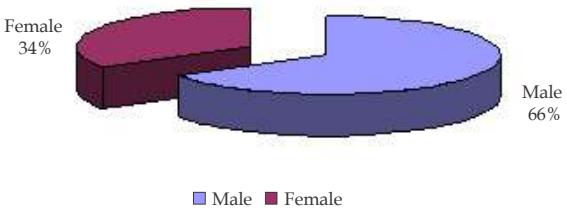
	N	Mean ± SD
Age (yr)	50	35.44 ± 7.62
Height (cm)	50	154.62 ± 6.09
Weight (kg)	50	62 ± 10.70



Graph 3: Age, Height and Weight of Controls:

Table 4: Gender Distribution of Controls:

Gender	No	%
Male	33	66
Female	17	34
Total	50	100



Graph 4: Gender Distribution of Controls

Discussion

In Previous Studies

Motor performance of the hand in patients with rheumatoid arthritis by Kari Kauranen, Pekka Vuotikka, Markku Hakala[71] found that there was

statistically significant differences in the results between the patients with RA and the controls, and hence the groups were comparable and equal in these respects. The results indicated that the reaction times were longer in the group of patients with RA than in the control group on both sides.

In Present Study

The purpose of the study was to examine the motor performance of the hand in a sample of patients with RA and controls. Comparison of the results for the patients with RA and for the healthy controls indicated that the reaction times were longer in the group of patients with RA than in the controls on both sides. The observations of present study were nearly comparable to the study performed by Kari Kauranen, Pekka Vuotikka, Markku Hakala [Table 5].

Table 5: Reaction Time in RA Patient and Control.

	Group	N	Mean	Std. Deviation	T	DF	P- value
Auditory Reaction Time (ART)							
Right Hand	RA	50	207.60	55.406	4.957	98	0.001
	Control	50	164.80	25.647			
Left Hand	RA	50	215.26	57.712	4.499	98	0.001
	Control	50	173.86	30.054			
Visual Reaction Time (VRT)							
Right Hand	RA	50	220.18	60.551	4.606	98	0.001
	Control	50	177.94	23.220			
Left Hand	RA	50	236.88	68.252	5.226	98	0.001
	Control	50	183.16	24.990			

*P < 0.001 statistically highly significant

Conclusion

The motor functions of patients with RA were impaired in both ART and VRT. The reason for these differences may be explained by the neuromuscular problems of the patients with RA. Previous studies have shown an association between RA and nerve functions impairment, and it seems that RA accelerates muscle fiber degeneration, especially in fast-twitch muscle fibers. In addition, one reason for the poorer performance of patients with RA may be that the destructive and inflammatory changes in joints and pain or fear of pain prevent the subjects from performing fast movements as quickly as normal. The pain or fear of pain may delay these movements.

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Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, *et al*. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O,

Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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