RESEARCH ARTICLE

# Effect of body fat on temporal dispersion of ventricular repolarization duration assessed by QT variability index in healthy females

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## Abstract

**Objective:** To assess the impact of age as well general and central adiposity indices on QT variability index.

**Method:** The cross-sectional study was conducted at the Department of Physiology, College of Medicine, Mustansiriyah University, Baghdad, Iraq, from September 2020 to April 2021, and comprised healthy adult females having regular menstrual cycle. QT variability index and its association with age, body mass index, waist circumference and waist-height ratio were worked out. Data was analysed using SPSS 14.

**Results:** There were 55 women with mean age 37.4±10.5 years. QT variability index correlated significantly and positively with age, body mass index, waist circumference and waist-height ratio ($p<0.05$).

**Conclusion:** Aging and obesity increased QT variability index, and could contribute to ventricular arrhythmia and sudden cardiac death.

**Key Words:** Circumference, Adiposity, Cardiac, Menstrual, Arrhythmias, Aging

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## Introduction

Heart rate variability (HRV) describes spontaneous beat-to-beat shifts in the electrocardiogram (ECG). Compared to normal HRV, reduced HRV results in a greater risk of sudden death, and it is associated with sinus nodal autonomic nervous system (ANS) disregulation[1,2] as well as with many cardiovascular diseases[3]. QT variability (QTV) is the variation in the length of the QT interval as a result of instantaneous temporal changes. Local variations in ventricular repolarisation are thought to cause these fluctuations that show cardiac electrical instability[4]. Using the QT variability index (QTVI) to normalise HRV and QTV variables, studies attempted to assess their predictive value[5], showing that QTVI expresses the temporal dispersion of cardiac repolarisation by representing the relationship between QT and RR variability. Researchers have found that QTVI can predict sudden cardiac death,[6] and it reflects cardiac autonomic dysfunctions[7]. Decreased negativity of QTVI indicates a proclivity for serious arrhythmias[8,9]. Increasing the QT variance and reducing the RR variance, or both, increased QTVI, and patients with dilated cardiomyopathy and elevated QTVI possess a higher risk of congestive heart failure and sudden death[10].

As obesity is related to conditions, such as diabetes mellitus (DM) and hypertension (HTN), it is a major health concern[11]. Autonomic disturbance has been reported in individuals with obesity[12]. Obesity affects the structure of the heart through fat accumulation which disturbs the electrophysiology of the heart.

The current study was planned to assess the impact of age as well general and central adiposity indices on QTVI.

## Subjects and Methods

The cross-sectional study was conducted at the Department of Physiology, College of Medicine, Mustansiriyah University, Baghdad, Iraq, from September 2020 to April 2021, and comprised healthy adult females having regular menstrual cycle who were not consumers of tobacco, alcohol or any medication. Verbal informed consent was taken from all the participants after approval from the institutional ethics committee.

Height and weight were measured, and waist-height ratio (WHtR) was calculated. Waist circumference (WC) was measured as the circumference of the abdomen at the umbilicus with the legs closed using a flexible measuring tape from the midpoint between the top of the iliac crest and the lower margin of the last palpable rib in mid-axillary line. Body mass index (BMI) (kg/m$^2$) was calculated using the standard formula[13], and it was categorisd into normal, overweight and obese groups. [14]

For ECG recording, two electrodes were attached to the right arm and left leg (Lead II), and one electrode was attached to the right leg (as the ground). The RR interval data from the ECG recording were examined for abnormal beats and artifacts.

To calculate the QTVI, P-QRS-T complexes from an epoch

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of 5min ECG recording using the ECG module of the PowerLab analogue-to-digital converter (Data Acquisition Unit 26T). LabChart Pro version 7.2 Software (Kubios HRV Standard software (version 3.3.0, Kuopio, Finland) was purchased from ADInstruments Pty Ltd, New South Wales, Australia.

QTVI was calculated using the formula[13]:

$QTVI = \log10\{[(QTv)/(QTm)^2]/[(RRv)/(RRm)^2]\}$.

Mean QT (QTm) and mean RR (RRm) and QT variance (QTv) and RR variance (RRv) were calculated using Excel. QT intervals below the cutoff value of <300msec were excluded.

Data was calculated using SPSS14. Data was expressed as mean ± standard deviation (SD). Pearson correlation between variables was assessed. Outlier data (abnormal beats and artifacts) was removed using Rosner's Extreme Studentised Deviate test for multiple outliers. [15] $P<0.05$ was considered statistically significant.

## Results

There were 55 women with mean age 37.4±10.5 years. Mean BMI was 32.6±6.9kg/m$^2$, mean WC was 93.3±14.0cm, and mean WHtR was 0.59±0.09.

There was a significant ($p<0.009$) positive relationship between age and QTVI (-0.44±0.46) (Figure). QTVI correlated significantly and positively with with BMI, WC and WHtR (Table). The correlation of age with BMI, WC and WHtR was not significant ($p>0.05$).

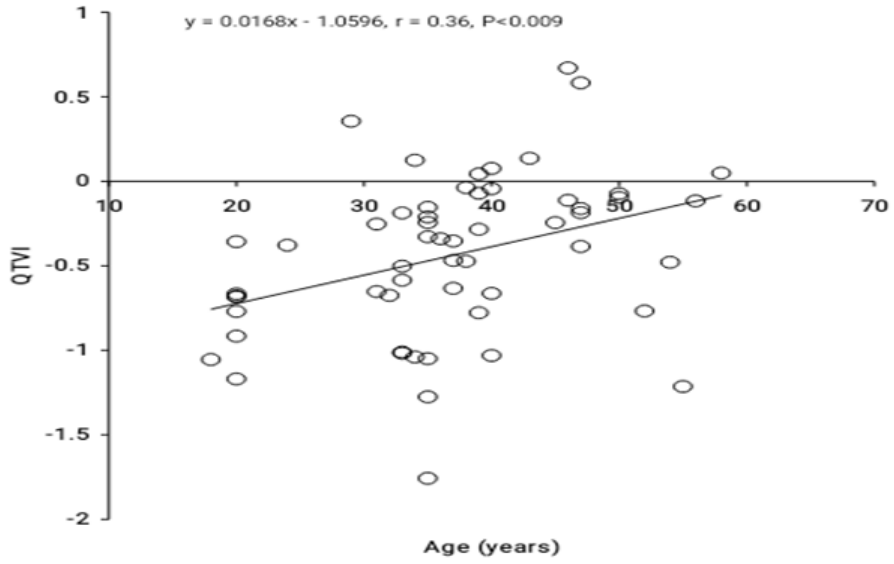


**Figure-1:** The relationship between the age and QT variability index (QTVI), n = 55.

**Table:** Correlation between QT variability index (QTVI) and adiposity indices (n=55)..

| | BMI | WC | WHtR |
|---|---|---|---|
| QTVI | r = 0.34, P<0.02 | r = 0.3, P<0.03 | r = 0.3, P<0.03 |

BMI: Body mass index, WC: Waist circumference, WHtR: Waist-height ratio.

## Discussion

There is an increasing interest among researchers for quantifying QTV. This is due to a potential correlation between a higher QTV and a higher risk of heart disease and overall mortality[16]. The link between increased QTV and high sympathetic activity was demonstrated by using drug-induced beta receptors activation and by postural-induced sympathetic nervous system activation, especially in healthy subjects [17]. Aging is associated with a decline in sympathetic and parasympathetic responses[18]. However, continuous increases in sympathetic activity during rest may contribute to HTN seen in elderly people[19,20]. It is possible that, despite the reduction in overall ANS activity, sympathetic NS activity predominates over parasympathetic NS activity[21].

The present research was planned to discover a potential link between aging and QTVI, because aging is associated with more dominant sympathetic activity and QTVI is increased by sympathetic NS activity. The results showed a clear and highly significant correlation between age and QTVI, which was in agreement with previous results[22]. However, the age-related decrease in overall autonomic control raises the QTVI significantly in stable elderly people because it lengthens the QT interval[23].

To the best of our knowledge, no previous study has demonstrated any relationship between QTVI and obesity as represented by BMI, or central obesity index as represented by WC, in female healthy volunteers. The possible link between these two variables came from the evidence that QTV is increased during sympathetic activation induced by different techniques[17].

The current results are in line with those reported by Arslan et al.[24] who found that obesity in young men without complications of cardiovascular system was associated with QT interval prolongation even if there were no obesity-related disorders, such as

DM, HTN, or coronary artery disease[24]. Finally, the study noted that aging and obesity raised QTVI, which could lead to ventricular arrhythmias and sudden cardiac death.

**Limitation:** The current study has limitations as the sample size was not calculated which could have affected the power of the study.

## Conclusion

Age and obesity increased QTVI, and could contribute to ventricular arrhythmias and sudden cardiac death.

**Disclaimer:** None.

**Conflict of Interest:** None.

**Source of Funding:** None.

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