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SUPERVISOR: Dr Ngozika Ezinne

NAME - Tamara Persad (816117771) and Denielle Roodal (816019207)

TITLE OF STUDY - Ocular parameters and its association with anthropometry measurements (BMI, weight, and height) in Trinidad and Tobago Adults.

Contents

Abstract

Purpose - This study intends to determine the ocular parameters and its association with anthropometry measurements of Trinidad and Tobago adults.

Method - This study is a clinical, descriptive, cross-sectional study of ocular parameters and anthropometry of patients that visited the UWI optometry clinic in Couva, Trinidad. A total of 33 Trinbagonian adults (66 eyes) were included in this study comprising of East Indian (55.3%), African descent (18.8%), and Mixed (25%). The group consisted of 13 males (39.39%) and 20 females (60.60%) between the ages of 18 – 67 years.

Ocular parameters measurements were found using OCT, IOL Master Biometer, Autorefractor, and Non-Contact Tonometer. Anthropometric measurements of weight, height and BMI were recorded.

Results - Males were found to be taller, heavier and have longer axial lengths whereas females were found to have greater CT values. Age had a negative correlation with CCT LE and RNFLT LE but a positive correlation with LT in both eyes. Education Level was positively correlated with CCT but negatively correlated with LT in both eyes. Weight had a negative correlation with CT in both eyes. Height had a negative correlation with CDR, CCT, and CT in both eyes. Relationships between some ocular parameters and lifestyle factors were observed.

Conclusion – This study determined the average values for ocular parameters among Trinidad and Tobago adults. Weight and height were the only two anthropometry measurements that were associated with the ocular parameters. Weight was negatively associated with CT. Height was negatively associated with CDR, CCT and CT.

Introduction

Ocular parameters (biometry) involve anatomical measurements of various proportions of the eye such as axial length (AL), corneal diameter (CD), central corneal thickness (CCT), corneal refractive power (CRP), lens thickness (LT), intraocular pressure (IOP), retinal nerve fibre layer thickness (RNFLT), optic cup-to-disc ratio (CDR) and macular thickness (MT).1 These ocular parameters may vary according to the individual's age, gender, ethnicity, and socioeconomic status. Multiple studies conducted in various places including China, Australia, Singapore, Nigeria, and Ethiopia showed that there is a variation in distribution of ocular parameters. The variations were described to be associated with age, gender, and race. Few studies showed significant correlation with various diseases including dry eye, diabetes, obesity, and retinal diseases.

Anthropometry may be defined as the physical measurements of the human body, based on muscle, bone and adipose tissue, which are used to evaluate the make-up of the individual's body.2 These measurements which include a person's height, their weight and their calculated body mass index (BMI) are of utmost importance because they are diagnostic principles that can be used to decide whether a person is obese or overweight, underweight or have a normal body weight.2 According to the Center for Disease Control and Prevention (CDC), BMI may be calculated using the formula weight (kg) / [height (m)]^2.3 BMI were categorised as: <18.5kg/m^2 (underweight), 18.5 to 24.9kg/m^2 (normal or healthy weight), 25.0 to 29.9 kg/m^2 (overweight) and ≥ 30.0kg/m^2 (obese) for individuals 20 years and above.3

Several studies have shown that ocular parameters are influenced by anthropometric measurements. A study done in South Africa4 to assess AL, anterior chamber depth (ACD), LT values and their intercorrelations in an African population, concluded that there were significant differences seen in the AL, ACD and LT values between the older and younger age groups and all the ocular parameters directly corresponds with the male gender and height. Another study conducted to determine the associations between ocular biometry and anthropometric measurements in a Nigerian adult population5, found that the body height is independently associated with ocular AL and ACD while the body weight and BMI are not independently associated with any of the ocular biometric indices studied.

Ocular parameters and anthropometry may be correlated and influenced by factors such as age, gender, race and socio-economics status as shown in some studies. However, more

studies are needed to be done to understand this correlation and explore the factors responsible for the association. Although Trinidad and Tobago is geographically different and made up of a heterogeneous ethnic population making it an ideal candidate for such research, there is no record of any study exploring the association between biometry and anthropometry locally or regionally. This study was therefore aimed to investigate the ocular parameters and its correlation with anthropometry (BMI, weight, and height) among Trinidad and Tobago adults.

Background of Study

Globally, a total of 1.9 billion adults (aged 18 and above) were found to be overweight and of these individuals, 650 million were obese.6 Although it remains insufficiently understood, there is enough evidence that exists which suggests that certain ocular diseases such as age-related macular degeneration glaucoma, diabetic retinopathy and cataract may be associated with obesity.7 Furthermore, the underlying structural changes that accompany these ocular diseases may be investigated by observing ocular parameters such as AL, CD, CCT, CRP, LT, IOP, RNFLT, CDR, MT and their association with anthropometry (BMI, weight and height).

A study conducted in Turkey8 compared the anterior segment parameters in obese patients to that of healthy individuals. They found no significant difference in the AL and CCT between obese and non-obese subjects. However, a noteworthy difference in the IOP between obese subjects and non-obese subjects was found. In another report done in Thailand,7 the correlation between BMI and ocular parameters was investigated. They concluded that there was no significant difference in the RNFLT, CCT and CDR values between the overweight and normal weight subjects. However, there was a notable correlation between BMI and IOP as well as MT.

The Singapore Malay Study9 examined the distribution and systemic determinants of ocular biometry in the adult population and concluded that age, sex, and stature were the most consistent predictors of the results of ocular biometry. The study found that AL decreased with increasing age and taller individuals were found to have longer ALs and flatter corneas. Longer ALs were also associated with being male, increasing weight, higher education levels, better housing, professional occupations, greater reading hours and greater hours spent on the

computer. Another study done in Ethiopia10, concluded that age, gender and height were associated with biometric indices among Ethiopian adults.

It is well known that ocular biometrics/parameters and their physiological factors differ significantly amongst ethnicities and populations.9 A study done in Auckland, NZ, concluded that concluded that the ocular biometric parameters varied significantly according to ethnicity.11 They also concluded that this data may help identify those at risk of developing certain ocular diseases known to be associated with these parameters.

Thus, these studies indicate that ocular biometry/parameters are influenced by demographic parameters such as age, gender, ethnicities etc. and may be correlated with anthropometric measurements such as body height, body weight, and body mass index (BMI).

The twin island state of Trinidad and Tobago is known for being ethnically diverse. Its population consists of 35.4% East Indian descent, 35.2% African descent, 22.8% mixed, 0.6% white and 7.0% unspecified/other.12 Besides the varying ethnicities, the population is also made up of various ages, socioeconomic status, height, weight and even BMI. In fact, as of 2021, Trinidad and Tobago was found to have approximately 26.0% of adult women (18 years and above) and 10.8% of adult men (18 years and above) living with obesity.13 Taking into consideration all these factors, this would be the ideal population to investigate ocular biometry, its influences and its correlation to anthropometric measurements (BMI, height and weight). Yet, this study has never been carried out in Trinidad and Tobago before. Thus, this study was aimed to determine the association between ocular parameters and anthropometry measurements of Trinidad and Tobago adult population. The results will be compared with results from other places.

Statement of the Problem

Several studies worldwide have shown that ocular parameters are influenced by demographic parameters such as age, gender, ethnicity etc. and is correlated with anthropometric measurements which includes that of body height, body weight, and body mass index (BMI). Trinidad and Tobago has a very diverse population that is made up of people of various

ethnicities, ages, socioeconomic status, height, weight and even BMI. In fact, as of 2021, Trinidad and Tobago was found to have an estimated 26.0% of adult women and 10.8% of adult men living with obesity.13 It is possible that having a higher BMI is correlated with having serious ocular health complications which may also be observed in the ocular parameters of an individual. In the study done in Auckland, NZ,11 it was found that data may help identify those at risk of developing certain ocular diseases known to be associated with these ocular parameters. Taking all these things into consideration, Trinidad and Tobago presents the ideal population that should be investigated for ocular parameters, its influences and its correlation with anthropometric measurements (BMI, height and weight) yet it has never been done before. Therefore, this study will determine whether there is an association between ocular parameters and anthropometry measurements of Trinidad and Tobago adults. Results of which can be used to compare with results from other countries.

Aim of Study

This study intends to determine the ocular parameters and its association with anthropometry measurements of Trinidad and Tobago adults.

Objectives

1. To assess the demographic distribution of ocular parameters and anthropometric measurements in Trinidad and Tobago adults.

2. To evaluate the correlation between anthropometry and ocular parameters of Trinidad and Tobago adults.

3. To determine correlation of ocular parameters with lifestyle and other factors

Research Questions

1. What is the demographic distribution of ocular parameters and anthropometric measurements in Trinidad and Tobago population?

2. What is the correlation between anthropometric measurements and ocular parameters in Trinidad and Tobago population?

3. What is the correlation between ocular parameters with lifestyle and other factors?

Significance of Study

1. Benefits of the study to participants include the opportunity to gain insight into the ocular parameters and anthropometry measurements (BMI, weight, and height) in Trinidad and Tobago population and understand what factors may influence them as well as whether a correlation exists between the ocular parameters chosen and anthropometry.

2. A benefit to the community and public health would be that the information gathered in this study can aid optometrists as well as fellow optometry students in Trinidad and Tobago to understand the trends, associations and correlations of ocular biometry and anthropometry measurements amongst the current population. The ocular parameters may even be used as a risk indicator for certain ocular diseases.

3. The benefit to research in general is that it will add to the already existing statistical data for this topic since there is a lack of it for Trinidad and Tobago and by extension the Caribbean. It can also serve as a reference point for future studies.

Delimitation of the Study

This study was delimited to patients who visit the University of the West Indies Optometry Clinic at Couva.

Literature Review

1. Demographic distribution of ocular parameters

In a cross-sectional survey carried out in Leipzig, Germany14 to investigate ocular biometry and visual function in healthy eyes across the lifespan of the German population, 218 subjects were included. The subjects were between the ages of 20–69 years old, ametropia between −10 D and +10 D, and without prior ocular surgery, amblyopia, refraction larger than ± 10 D, corneal or retinal pathologies in either eye, or systemic diseases. It was concluded that there was no significant correlation between age and AL, corneal radii, CCT, and corneal power, but ACD appeared to have an inverse relationship with age. It was also noted that AL, ACD, CCT, and corneal radii were bigger in males than females, and it was suggested that this is a result of men being taller than women. Additionally, the study suggested that the difference in AL and gender owed to the use of IOL Master Measurements which they believe to be more repeatable than ultrasound measurements. The corneal power was found to be greater in females than males, but the study couldn't explain why. There was a lack of ethnical diversity in this study, so no comparisons were made.

In another study in an adult population of Shahroud, Iran,15 the distribution of AL, ACD, LT, and vitreous chamber depth (VCD) were analysed. A total of 4869 eyes were examined and the participants were aged 40-64 years old, with 2825 being women. 97.6% were of Persian ethnicity, 2.0% were Turk, and 0.4% were non-Persian and non-Turk all considered Middle Eastern. The results concluded that ACD, AL, and VCD decreased with age. However, LT increased with age and the study suggested that this may be credited to the increase in protein fiber layers forming under the capsule. In this report, it was noted that all the studied biometrics were all higher in men compared to women. The mean AL found in this study was similar to that of a study done in China, but significantly lower than various studies performed in America, Mexico, Australia, Myanmar, Mongolia and Singapore. The mean ACD was observed to be lower in Eastern Asians, and the highest in Los Angeles Latinos. The findings on LT were very similar to that in Americans, but much lower than that in Eastern Asians. Vertical CDR was found to be lower in Mongolia but higher in Myanmar and Singapore.

In a cross-sectional observational study,16 284 normal subjects of European, Chinese, African, and Hispanic descent aged 18-84 years were evaluated at seven sites. Temporal, superior, nasal, and inferior retinal nerve fibre layer thicknesses were measured. The study found that age had

a negative correlation with RNFLT declining by 0.19 μm/y for all subjects. The results also showed that RNFL measurements vary by race among the quadrants. Individuals of European descent had the thinnest RNFLT measurements in all quadrants except in the temporal quadrant. The African descent group had the thinnest temporal quadrant.

The Barbados Eye Studies17 conducted a report to describe the distribution of CCT and evaluate its relationship with IOP in the predominantly black population of Barbados where 1142 participants were involved. The age range was between 40 to 84 years, and 58% were women. The results concluded that CCT decreased significantly among individuals aged 50 to 59 years, to those 70 years and older. There were no significant differences with gender. Of the 1142 participants, 1064 self-reported their race as black, followed by 48 mixed, 25 white, and 5 other participants. Mean IOP was found to be highest among black participants, followed by mixed/other, and white participants reporting the lowest. When compared to white participants, it was noted that the Black participants tended to have thinner corneas.

2. Distribution of anthropometry measurements

In a study performed to investigate the differences in the relationship of weight to height, and BMI, according to age, sex, and birth year cohort. A total of 49,717 individuals born in 1946, 1958, 1970 or 2001, in England, Scotland, and Wales made up the study sample.18 Weight and height were assessed at data collection sweeps at target ages of 11, 15, 20 (self-reported), 26 (self-reported), 36, 43, 53, and 60–64 years. The authors concluded that weight and BMI increased with age and gender, while height was reassuringly stable across adulthood. It was noted that the weight–height correlations generally decreased over age and were lower in females than males. They also appeared to decrease over time, most noticeably in adulthood in males. The BMI-height correlations were positive at age 10/11 years but switched to be negative at age 20 years and were consistently stronger for females than males. The authors found that height is correlated with growth and males tend to be taller than females, thus the more negative BMI-height correlation for females.

In a study done in Korea to analyse anthropometry measurements across sex and race/ethnic groups and its relevance to BMI,19 a total of 26,068 Korean residents participated. The sample consisted of four main race/ethnic groups which were non-Hispanic (NH) whites, NH blacks, Mexican Americans, and Asian Koreans. There were 12,548 men and 13,520 women involved. Notable results concluded that Korean females had the smallest height among the group and

NH white males had the greatest height. Both Korean males and females had the lowest BMI and body fat within their respective sex groupscompared to the other 3 groups. The study found that age can affect height. The study hypothesizes that age may influence the scaling exponent for women but not for men because of the loss of height and the weight gain that frequently accompanies menopause in women. Second, age appeared to skew the scaling exponent in certain race/ethnic groups of females more than others, an effect most apparent for Korean women. One explanation for this finding is that there may be generational differences in nutrition that are greater in Koreans than in the American race/ethnic groups.

A study was done in London to investigate a multi-ethnic population of 2171 primary school children and their body compositions: (47% boys; 34% White, 29% Black African/Caribbean, 25% South Asian, 12% Other).20 A detailed anthropometric measurements were performed and ethnic differences in body size and proportion were assessed. The results showed that children who were Black African/Caribbean and aged less than 11 years old were significantly taller, heavier and had larger body size than children of other ethnicities. They also had larger waist and limb girths and relatively longer legs.

3. Correlation between ocular parameters and anthropometry

In a previously mentioned study done to investigate the relationship between BMI and ocular parameters in Thailand,7 a total of 120 Thai subjects were examined. Fifty-three subjects were of normal weight and the remaining sixty-seven were obese or overweight. The ocular parameters examined were CCT, IOP, anterior corneal curvature, ACD, anterior chamber angle (ACA), MT, ganglion cell thickness (GCT), RNFLT, CDR, and choroidal thickness (CT). The study found that the IOP, GCT, and MT were higher in overweight subjects compared to normal weight subjects. However, the remaining parameters, CCT, ACD, ACA, RNFLT, CDR, and CT, showed no significant difference between both groups.

A pilot study was done in Lithuania21 to evaluate the relationship of CCT of the normal Lithuanian population. A total of 125 men and 134 women, with their height, weight, body mass index, IOP, and refraction ability were included. The study concluded that there was no significant difference in mean CCT found between the right and left eyes or between male and female subjects. CCT was found to significantly correlate with height, weight and IOP; but not BMI or refraction ability in the overall study group.

In rural Central India,22 a study was conducted on 4711 participants aged 30 or more years to investigate the associations between anthropometric parameters and ocular dimensions. It was found that taller participants had larger eyes with a flatter cornea and an increase in body height per 10 cm was associated with anterior chamber depth 1% increase and vitreous cavity length 1% increase. Participants with a higher BMI had flatter, thicker corneas, shorter eyes and thicker lenses. Taller participants and participants with a higher BMI were found to be more hyperopic.

4. Correlation of ocular parameters with lifestyle and other factors

A study was done in Saudi Arabia,23 to assess the tear film in subjects with a high body mass index. Twenty male subjects aged 23–42 years with a mean BMI of 31.8 and an age-matched control group of twenty male subjects aged 22–38 years with a normal BMI were included. The author concluded that in subjects with a high BMI, the quality of tears appears to be lower compared with normal subjects which may lead to dry eyes. However, the tear volume in subjects with a high BMI was just as high and adequate as for normal eye subjects.

In a study to investigate the variation of axial ocular dimensions with age, sex, height, BMI and their relation to refractive status, a total of 152 patients attended the eye out patient department (OPD) in the Regional Institute of Ophthalmology (R.I.O.) Medical College, Kolkata, West Bengal, India were sampled.24 Among the 152 subjects 40 were emmetropic, 57 were myopic and 55 were hypermetropic. Among emmetropic subjects, the number of males and females were 20 each, respectively. Among myopic subjects 33 were male and 24 were female. Among hypermetropic subjects 28 were male and 27 were female. The results showed that in myopic eyes, good positive correlation was found between axial length, vitreous chamber depth and height. In hypermetropic eyes negative correlation was found between axial length, and vitreous chamber depth and height. Negative correlation was also found between BMI and axial length and vitreous chamber depth. It was found that mean BMI was more in hypermetropic than myopic and more in high hypermetropic (26.54) than mild to moderate hypermetropic (21.93). Gender was found not to be significantly associated with emmetropia.

In an empirical study done in Malaysia25 to investigate the determinants of Early Refractive Error on School-Going Chinese Children, a total of 168 Chinese children participated in the study. Myopia was found to be the most common refractive error amongst them followed by

astigmatism. The study found that playing video games, watching TV, and participating more in activities put a strain on Chinese children's eyes resulting in these refractive errors. Considering the role of gender, male children were found to be more dependent on machine-oriented activities than female children. Concerning eating habits, because the Chinese are well adapted to a variety of foods, eating habits were not found to be a significant factor in the development of refractive error. Also, genetic traits were found not to influence refractive error.

A study was done recently in Saudi Arabia26 to determine the role of diet in glaucoma. Consumption of alcohol, coffee, tea, Ginkgo biloba Extract, fruits and vegetables, chocolate, saffron, and dietary supplements were investigated. Diet was found to have an impact on IOP, incidence, and progression of glaucoma. It was concluded that a healthy diet, normal weight, decrease in coffee intake and increased consumption of fruits and vegetables, together with any conventional glaucoma treatment could help in the management of glaucoma by decreasing the IOP levels, risks and progression of glaucoma.

Methodology

Ethical Considerations

- Ethical approval was granted by the Ethics Committee of the University of the West Indies, St Augustine Campus.
- Permission was obtained from the Head of Department of the Optometry Unit to conduct research at the UWI Optometry Clinic in Couva.
- Consent to participate in the study was obtained first from each participant prior to administering the questionnaires and carrying out the tests.
- The data collected from the participants was stored on a password protected computer only accessible to the co-investigators and principal investigator. This computer was stored in a secure place and the data is to be destroyed in 5 years after the study has come to pass.
- The study complied with the tenets of the Declaration of Helsinki (1964).

Research Design

This study was a clinical, descriptive, cross-sectional study of ocular parameters and anthropometry of patients that visited the UWI optometry clinic in Couva.

Study Setting

The study area was Trinidad and was not limited to any specific city or town within Trinidad. Trinidad and Tobago has an estimated population of 1.4 million people and consists of a multi-ethnic society comprised of African descent (35.2%), East Indian descent (35.4%), Mixed (22.8%), White (0.6%) and Unspecified/Other (7.0%).[12] The population has a varied age structure with the majority age group being 25-54 years and the life expectancy is estimated to be 73.9 years.[27] The public health sector consists of clinics and hospitals distributed throughout the islands where treatment is free or low cost.[12] Trinidad and Tobago has one optometry training programme which is hosted by the University of the West Indies St Augustine Campus and they have one associated clinic which is the University of the West Indies Optometry Clinic located in Couva.[28] The clinic is fully equipped, has qualified optometrists and offers comprehensive eye exams including ophthalmic diagnosis, ocular imaging, contact lens fitting, binocular vision and low vision assessment.[28]

Study Population

This study population included individuals 18 years and above that visited the UWI Optometry Clinic in Couva regardless of their gender, race, weight and socio-economic status.

Inclusion Criteria

- All patients 18 years and above that visited the University of the West Indies Optometry Clinic within the study period (October to February 2022) and were willing to participate in the study were included.

Exclusion Criteria

- Persons with a history of ocular trauma or surgery, current eye diseases, limb or spinal deformity, pregnancy and recent weight loss were excluded.
- Persons with any optic neuropathy (glaucomatous, traumatic, ischemic), a history of intraocular surgery, corneal pathology, pseudophakia or aphakia were excluded.
- Persons with significant cataract blocking the view of the fundus were excluded from this study.

Study Sample

Sample Size

The sample size was determined using the RAOSOFT sample size calculator. With the population size of Trinidad and Tobago at 1,403,375, a confidence interval of 90% and a margin of error of 5%, the sample size was calculated to be 135 (271 eyes). In order to compensate for those who might not be willing to participate in the study the sample size was increased by 10% giving approximately 150 (300 eyes). Therefore, a total of 150 participants were intended to be included in the study. However, due to the COVID-19 pandemic, which prevented a lot of patients from visiting the clinic, only 33 participants (66 eyes) were included.

Sampling Technique

This study used convenience sampling techniques due to the reduction in number of patients that came to the optometry clinic since the COVID-19 pandemic. The patients were

selected based on the major ethnic groups in Trinidad and Tobago which included Indo-Trinidad, Afro-Trinidad, Mixed and others (Syria, Chinese, White, etc.).

Tests and Equipment

The data was collected using a structured questionnaire, IOL Master Biometry machine, Optical Coherence Tomography (OCT) machine, Non-Contact Tonometer (NCT) machine, Auto-refractor machine, standard weighing scale in kilograms (kg), measuring tape and Schirmer's test strip.

Data Collection Procedure

Permission to conduct the study at UWI Optometry clinic in Couva was sought and obtained from the head of the Optometry unit. Ethics approval was sought and obtained from UWI Research and Ethics Committee. Participants were recruited weekly from patients attending the UWI Clinic, who suit the inclusion criteria. All selected patients were given a brief introduction of the study, what the study entails, the purpose of the study, and why they should participate in the study. Those that gave their consent to participate were included in the study. A short questionnaire was then given in order to gather demographic information including age, gender, ethnicity, socio-economic status, medical history, and ocular history.

Clinical examination and procedures

A comprehensive clinical history and eye examination was performed including visual acuity measurement using logMAR chart and slit lamp examination with schirmer's test. The following ocular parameters were measured for each eye of the participants using the following equipment:

- Optical Coherence Tomography (OCT) – for CDR, MT and RNFLT measurements

- IOL Master Biometry Machine – for AL, CCT, LT, Corneal Refractive Power and CD measurements
- Autorefractor – for refractive power
- Non-Contact Tonometer – for IOP measurement

The anthropometric measurements were recorded in the following way:

- Weight- measured in kg by using a weighing scale available at the UWI clinic
- Height- measured in m by using a tape measure
- BMI- calculated by using the formula weight (kg) / [height (m)]^2

All the clinical examinations occurred during the period of October 2021 to February 2022.

Data Analysis

The raw data was entered into Microsoft Excel, then transferred to and analyzed utilizing SPSS version 24. Frequency was calculated for socio-demographic variables such as age and gender. Pearson correlation analysis was performed to determine the relationship between ocular parameters and anthropometric measurements. Univariate and bivariate linear regression were utilized to determine the association of socio-demographic variables (age, gender and ethnic group) and anthropometric parameters (height, weight, and BMI) with ocular parameter indices. Statistical significance was maintained at a p-value less than 0.05.

Data Protection

Study data was de-identified and kept confidential on a password-controlled computer that only the principal investigator and co-investigators had access to. This password-controlled computer was stored in a secure place and the data is to be destroyed after 5 years.

Results

Demographic profile of the participants

This study included 33 subjects giving a total of 66 eyes. Their ages ranged from 18 to 67 years with a mean age (± SD) of 33.12 ± 15.39 years. Majority of the participants were females (n= 20, 60.6%) and 18-28 years old (n= 20, 60.6%). More than half 19 (57.6%) of the study participants were of East Indian descent and 6 (18.2%) of them had diabetes mellitus and/or high cholesterol or hypertension.

Table 1.0: Demographic profile of the participants

Variable	Frequency (N= 33)	Percentage (N= 100%)
Gender		
Male	13	39.4%
Female	20	60.6%
Age (years)		
18-28 years old	20	60.6%
29-38 years old	4	12.1%
39-48 years old	2	6.1%
49-58 years old	3	9.1%
59-68 years old	4	12.1%
Ethnicity		
Indo-Trinidadian	19	57.6%
Afro-Trinidadian	6	18.2%
Mixed	8	24.2%
Location in which the participant resides		
Central	9	27.3%
Northeast	5	15.1%

Northwest	7	21.2%
Southeast	0	0%
Southwest	12	36.4%
Highest Education Level		
No formal education	1	3.0%
Primary School (SEA)	0	0%
Secondary School	10	30.3%
University/Tertiary	22	66.7%

Objective 1: Demographic distribution of ocular parameters and anthropometric measurements of the participants

With regards to gender, the difference in weight and height were significantly observed with a p-value less than 0.05. AL both eyes, corneal topography both eyes, and WTW corneal diameter LE were significantly different between males and females with a p-value less than 0.05. Males were found to be taller, heavier and have longer ALs than females. Females had steeper cornea than males. Females also had shorter WTW corneal diameter in LE than males. There were no other statistically significant correlations between gender and the variables seen in Table 2.0.

Table 2.0: Gender distribution of ocular parameters and anthropometric measurements of the participants.

Variable	Total (n=66) Mean (SD)	Male (n=26) Mean (SD)	Female (n=40) Mean (SD)	p-value
Weight in kg	66.87 (16.06)	73.60 (17.10)	62.47 (13.16)	0.049
Height in m	1.68 (0.09)	1.76 (0.06)	1.62 (0.06)	0.004
BMI in kg/m^2	23.56 (4.83)	23.37 (4.96)	23.69 (4.75)	0.858
Tear Break-Up Time	9.94 (4.84)	11.23 (4.76)	9.10 (4.70)	---
Cup-to-disc ratio RE	0.29 (0.16)	0.27 (0.15)	0.31 (0.16)	0.535
Cup-to-disc ratio LE	0.29 (0.15)	0.29 (0.14)	0.29 (0.16)	0.978
Macular Thickness RE	266.74 (19.21)	270.35 (11.15)	264.40 (22.67)	0.400
Macular Thickness LE	263.59 (15.84)	269.78 (10.51)	259.56 (17.34)	0.074
Axial Length RE	23.66 (1.00)	24.12 (0.89)	23.35 (0.95)	0.032
Axial Length LE	23.61 (0.98)	24.07 (0.96)	23.30 (0.87)	0.028
Central Corneal Thickness RE	533.09 (28.99)	528.46 (30.50)	536.10 (27.55)	0.475
Central Corneal Thickness LE	533.45 (27.93)	528.31 (26.14)	536.80 (28.54)	0.409
Lens Thickness RE	3.88 (0.54)	3.77 (0.40)	3.95 (0.60)	0.353

Lens Thickness LE	3.81 (0.42)	3.73 (0.30)	3.86 (0.48)	0.420
Retinal Nerve Fibre Layer Thickness RE	101.03 (8.25)	100.31 (8.35)	101.50 (8.15)	0.696
Retinal Nerve Fibre Layer Thickness LE	100.42 (8.80)	99.23 (8.64)	101.20 (8.81)	0.545
Refractive Power RE	-1.17 (2.59)	-1.37 (2.44)	-1.05 (2.67)	---
Refractive Power LE	-1.17 (2.59)	-1.42 (2.36)	-1.01 (2.71)	---
Corneal Topography RE	43.97 (1.46)	43.19 (1.15)	44.48 (1.41)	0.012
Corneal Topography LE	43.99 (1.36)	43.26 (1.07)	44.47 (1.32)	0.011
WTW Corneal Diameter RE	11.99 (0.35)	12.09 (0.38)	11.94 (0.31)	0.228
WTW Corneal Diameter LE	12.02 (0.36)	12.18 (0.37)	11.92 (0.30)	0.041
Intraocular Pressure RE	14.62 (2.86)	13.68 (1.09)	15.23 (3.43)	0.138
Intraocular Pressure LE	14.38 (2.79)	13.75 (2.16)	14.80 (3.06)	0.304

A Pearson correlation coefficient was computed to determine the relationship between Demographic data and Ocular Parameters. It was found that age had a negative correlation with CCT LE (r= -0.353, p= 0.044) and RNFLT LE (r= -0.348, p= 0.047). As age increased, CCT LE and RNFLT LE decreased. Age also had a positive correlation with LT RE (r= 0.881, p= <0.001) and LT LE (r= 0.829, p= <0.001). As age increased, LT also increased. Education level had a positive correlation with CCT RE (r= 0.418, p= 0.015) and CCT LE (r= 0.408, p= 0.018). As education level increased, CCT also increased. Education Level also had a negative correlation with LT RE (r= -0.606, p= <0.001) and LT LE (r= -0.521, p= 0.002). As education level increased, LT decreased. There was no statistically significant relationship between ethnicity and biometric indices (Table 2.1).

Table 2.1: Correlations of Socio-Demographic Variables with Ocular Parameters of Study Participants.

Socio-Demographic Variables / Ocular Parameters	Age r (p)	Ethnicity r (p)	Education Level r (p)
CD ratio RE	0.153 (0.396)	0.320 (0.070)	-0.262 (0.141)
CD ratio LE	0.008 (0.964)	0.226 (0.206)	-0.288 (0.104)
MT RE	0.112 (0.533)	0.034 (0.851)	0.235 (0.188)
MT LE	-0.226 (0.206)	-0.019 (0.915)	0.295 (0.096)
Axial Length RE	-0.196 (0.273)	0.088 (0.625)	0.305 (0.084)
Axial Length LE	-0.176 (0.328)	0.093 (0.607)	0.342 (0.051)
CCT RE	-0.294 (0.097)	0.192 (0.284)	0.418 (0.015)
CCT LE	-0.353 (0.044)	0.175 (0.330)	0.408 (0.018)
Lens Thickness RE	0.881 (0.000)	-0.077 (0.671)	-0.606 (0.000)
Lens Thickness LE	0.829 (0.000)	-0.067 (0.713)	-0.521 (0.002)

RNFLT RE	-0.145 (0.422)	-0.209 (0.243)	-0.086 (0.636)
RNFLT LE	-0.348 (0.047)	-0.206 (0.249)	-0.008 (0.936)
Corneal Topography RE	-0.058 (0.748)	0.046 (0.800)	-0.127 (0.480)
Corneal Topography LE	-0.057 (0.754)	0.037 (0.839)	-0.214 (0.232)
WTW Corneal Diameter RE	-0.280 (0.115)	-0.175 (0.329)	0.241 (0.176)
WTW Corneal Diameter LE	-0.190 (0.290)	-0.290 (0.101)	0.004 (0.982)
IOP RE	0.262 (0.140)	0.260 (0.145)	-0.219 (0.221)
IOP LE	0.105 (0.560)	0.160 (0.375)	-0.030 (0.868)

Objective 2: To evaluate correlation between ocular parameters and anthropometry of the participants

A Pearson correlation coefficient was computed to determine the relationship between ocular parameters and anthropometry. Weight had a negative correlation with Corneal Topography of the RE (r= -0.427, p= 0.013) and LE (r= -0.386, p= 0.026). Height had a negative correlation with CDR of RE (r= -0.373, p= 0.033), CDR LE (r= -0.410, p= 0.018), CCT RE (r= -0.382, p= 0.028), CCT LE (r= -0.410, p= 0.018), Corneal Topography RE (r= -0.453, p= 0.008) and Corneal Topography LE (r= -0.468, p= 0.006). There was no statistically significant relationship between BMI and biometric indices (Table 3).

Table 3.0: Correlation between anthropometry and ocular parameters.

Anthropometric Measurements / Ocular Parameters	Weight r (p)	Height r (p)	BMI r (p)
CD ratio RE	-0.143 (0.426)	-0.373 (0.033)	0.020 (0.913)
CD ratio LE	-0.122 (0.497)	-0.410 (0.018)	0.019 (0.915)
MT RE	0.057 (0.753)	0.250 (0.160)	0.016 (0.930)
MT LE	-0.129 (0.475)	0.191 (0.288)	-0.238 (0.183)
Axial Length RE	0.126 (0.486)	0.146 (0.419)	-0.075 (0.678)
Axial Length LE	0.156 (0.385)	0.152 (0.398)	-0.066 (0.715)
CCT RE	-0.066 (0.716)	-0.382 (0.028)	0.048 (0.791)
CCT LE	-0.076 (0.673)	-0.410 (0.018)	0.066 (0.714)
Lens Thickness RE	0.111 (0.540)	0.160 (0.374)	0.177 (0.323)
Lens Thickness LE	0.119 (0.508)	0.151 (0.403)	0.205 (0.253)
RNFLT RE	0.148 (0.412)	0.128 (0.478)	0.077 (0.670)
RNFLT LE	-0.139 (0.441)	-0.104 (0.563)	-0.204 (0.255)
Corneal Topography RE	-0.427 (0.013)	-0.453 (0.008)	-0.242 (0.175)

Corneal Topography LE	-0.386 (0.026)	-0.468 (0.006)	-0.189 (0.292)
WTW Corneal Diameter RE	0.016 (0.929)	0.137 (0.447)	-0.060 (0.740)
WTW Corneal Diameter LE	0.068 (0.705)	0.295 (0.096)	-0.073 (0.688)
IOP RE	-0.066 (0.716)	-0.304 (0.085)	0.042 (0.817)
IOP LE	-0.074 (0.681)	-0.277 (0.118)	0.038 (0.833)

Objective 3: To determine the correlation of ocular parameters with lifestyle and other factors

Correlational analyses indicated that there was a positive relationship between hours spent on the computer and RE (r= 0.633, p= <0.001) and LE refractive power (r= 0.553, p= 0.001). There was a positive relationship between persons with diabetes mellitus and/or high cholesterol or hypertension and IOP RE (r= 0.345, p= 0.039) as well as IOP LE (r= 0.364, p= 0.037). There was a positive relationship between persons who smoke and IOP RE (r= 0.346, p= 0.048) as well as IOP LE (r= 0.374, p= 0.044) (Table 4). There was no statistically significant relationship between persons who drink alcohol and biometric indices (Table 4). There was also no statistically significant relationship between persons who exercise, persons who eat fast food, persons who wear spectacles and the biometric indices.

Table 4: Association/correlation of ocular parameters with life style and other factors

Lifestyle Variables / Ocular Parameters	Hours spent on computer r (p)	DM and or/ high CHOL or HTN r (p)	Smoking r (p)	Drinking alcohol r (p)
CD ratio RE	-0.253 (0.155)	0.021 (0.906)	-0.187 (0.297)	-0.678 (0.322)
CD ratio LE	-0.017 (0.923)	0.262 (0.141)	-0.153 (0.395)	-0.552 (0.448)
MT RE	-0.295 (0.096)	-0.270 (0.128)	0.015 (0.935)	-0.258 (0.742)
MT LE	-0.005 (0.980)	-0.137 (0.445)	0.110 (0.542)	-0.351 (0.649)
CCT RE	0.260 (0.144)	0.188 (0.295)	-0.158 (0.379)	-0.215 (0.785)
CCT LE	0.223 (0.212)	0.162 (0.367)	-0.178 (0.321)	-0.688 (0.312)
LT RE	0.228 (0.201)	0.000 (0.998)	0.443 (0.010)-	0.701 (0.299)
LT LE	0.273 (0.124)	-0.008 (0.965)	0.478 (0.005)-	0.704 (0.296)
Refractive Power RE	0.633 (0.000)	0.396 (0.052)	-0.197 (0.273)	-0.017 (0.983)
Refractive Power LE	0.553 (0.001)	0.308 (0.081)	-0.206 (0.251)	-0.008 (0.992)
IOP RE	0.259 (0.166)	0.345 (0.039)	0.346 (0.048)	0.706 (0.294)
IOP LE	0.203 (0.256)	0.364 (0.037)	0.374 (0.044)	0.703 (0.297)

Discussion

Objective 1: Demographic distribution of ocular parameters and anthropometric measurements of the participants

In this study, AL, corneal topography, and WTW corneal diameter LE were significantly different between males and females. Males were found to have longer axial lengths than females. This finding is similar to a cross-sectional survey carried out in Leipzig, Germany,[14] to investigate ocular biometry and visual function in healthy eyes across the lifespan of the German population where 218 subjects were included. This study suggested that this finding can be attributed to men being generally taller than women. However, in a study done on sex-related differences in Japanese population,[29] it was found that there was no significant difference in axial length between men and women.

In the present study, females were found to have steeper corneal curvatures. This may be due to females having shorter axial lengths than males which was a suggested reason for similar results in a study of the ocular biometric values of the black African patient in Ivory Coast.[30] This research also found that females had smaller white-to-white corneal diameters in the left eye compared to males. A possible reason may be because of their steeper corneas.

A Pearson correlation coefficient was computed to determine the relationship between Demographic data and Ocular Parameters. It was found that age had a negative correlation with CCT LE ($r= -0.353$, $p= 0.044$) and RNFLT LE ($r= -0.348$, $p= 0.047$). As age increased, CCT LE and RNFLT LE decreased. The decrease in RNFLT may be a result of loss of axons as a person gets older. Similar findings were reported in Turkey[31] in a cross-sectional study to investigate age-related change in peripapillary RNFLT. CCT decreased with age may be due to histologic evidence that older individuals have thinner central corneas because of a decline in the density of keratocytes and a probable breakdown in the collagen fibers in the ageing cornea.[32] Similar findings were recorded in the Barbados Eye Studies[71] to describe the distribution of CCT and evaluate its relationship with IOP in the predominantly black population of the Barbados, where 1142 participants were involved with an age range of 40 – 84 years. However, in the Reykjavik Eye Study,[33] no correlation between corneal thickness and age was found.

Age also had a positive correlation with LT in both eyes. As age increased, LT also increased. This can be as a result of an increase in protein fibre layers which forms under the

capsule as a person age. Similar findings were found in a previously mentioned study of an adult population in Shahroud, Iran[15] where a total of 4869 eyes were examined and the participants were between the ages of 40 to 64 years old.

Education Level had a positive correlation with CCT of both eyes (r= 0.408, p= 0.018). As education level increased, CCT also increased. Related results were found in a study done to assess CCT and its associations in a Russian population in the Ural eye and Medical Study.[34]

Education Level also had a negative correlation with LT RE (r= -0.606, p= <0.001) and LT LE (r= -0.521, p= 0.002). As education level increased, LT decreased. In the study to determine the normal range of AL, ACD, LT, and VCD in the population of Shahroud in the north of Iran, parallel results were also seen.[15]

There was no statistically significant relationship between ethnicity and biometric indices in this study. However, several studies found relationships between race and ocular parameters. The Shahroud Eye Cohort Study,[15] found that LT was very similar to that in Americans, and considerably lower than that in Eastern Asians, especially the Chinese. Vertical cup to disc ratio was found to be lower in Mongolia but higher in Myanmar and Singapore. In a cross-sectional observational study[16] which involved 284 subjects where they self-identified as being of European (122), Chinese (63), African (51), or Hispanic (35) descent. Individuals of European descent were found to have the thinnest RNFL measures except in the temporal quadrant, corresponding to the papillomacular bundle, which was the thinnest in the African descent group. In the Barbados Eye Studies, black participants were found to have thinner corneas than white participants.[17]

Objective 2: To evaluate correlation between anthropometry and ocular parameters of the participants

A Pearson correlation coefficient was computed to determine the relationship between Anthropometric data and Ocular Parameters. Weight had a negative correlation with CT RE (r= -0.427, p= 0.013) and CT LE (r= -0.386, p= 0.026). Therefore, as body weight increased, corneal steepness decreased. Similar results were found in a study to investigate anthropometric measures and their relationship to corneal refractive power in the United States population.[35] They found that the highest category of weight (200.1 lbs+) showed a statistically significant

inverse relationship with steep cornea compared to the reference category (≤140 lbs). However, in research about the prevalence and associations of steep cornea in Beijing,[36] contrasting results were found. Body weight did not affect CT.

Height had a negative correlation with CDR, CCT, and CT of both eyes Therefore, as height increased, CDR, CCT and CT decreased. Our findings are not consistent with findings in other groups. The Singapore Malay Eye Study[37] found that as height increases, CDR increases. In the Central India Eye and Medical Study,[38] a lower body height was associated with steep cornea and thinner CCT.

There was no statistically significant relationship between BMI and biometric indices in this study. Similar findings were observed in a pilot study of normal Lithuanian population[21] where BMI was not correlated with CCT. Another study to assess the tear film for subjects in Saudi Arabia with high BMI [23] found that the tear volume in subjects with a high BMI was just as high and adequate as for normal eye subjects. However, in a cross-observational study in West Bengal, India,[24] it was found that there was a negative correlation between BMI and AL. In the Singapore Malay Eye Study,[39] a lower BMI was correlated to a greater VCD and a higher IOP.

Objective 3: To determine the correlation between ocular parameters with life style and other factors

A positive relationship was found between hours spent on the computer and RP in both eyes (r= 0.553, p= 0.001). Similar findings were seen in a research paper entitled "The association between digital screen time and myopia: A systematic review"[40] which analyzed data from 15 studies with participants ranging between 3 and 19 years old in order to explore this association. Seven of the studies found that there is an association between increased screen time and the progression of myopia due to greater peripheral defocus at closer working distance whilst the others do not.

There was a positive relationship between persons with diabetes mellitus and/or high cholesterol or hypertension and IOP RE (r= 0.345, p= 0.039) as well as IOP LE (r= 0.364, p= 0.037). This finding is similar to a study carried out in non-glaucomatous Japanese adults living in Chikusei City,[41] to investigate the relationships of diabetes and hyperglycemia with

intraocular pressure. They found that participants with diabetes were significantly related to higher IOP values than participants without diabetes.

There was a positive relationship between persons who smoke and IOP RE (r= 0.346, p= 0.048) as well as IOP LE (r= 0.374, p= 0.044). This finding is similar to research carried out in an area west of Sydney, Australia from the years 1992-1994 on 3,654 residents to assess the relationship between smoking and IOP.[42] They found that current smokers had higher IOP pressures than non-smokers.

There was no statistically significant relationship between persons who drink alcohol and biometric indices. Our findings were not consistent with findings in another study which investigated the relationships between alcohol consumption and IOP in a South Korean population and found that significant alcohol intake was associated with higher IOP levels in both men and women.[43]

There was also no statistically significant relationship between persons who exercise, persons who eat fast food, persons who wear spectacles and biometric indices.

Limitations

1.) Findings from this study cannot be generalized since only patients that visited the UWI Optometry clinic were used.

2.) The Covid-19 pandemic affected the usual number of patients visiting the UWI Optometry Clinic and it also affected patients' willingness to participate in the study due to social distancing.

3.) This study was susceptible to participants' honesty and responsiveness to the questionnaires.

4.) This study obtained the IOP via use of the non-contact tonometer, which is considered less accurate than the Goldmann applanation tonometer.

Recommendations

1.) Future studies should be done to include patients from other optometric practices around Trinidad and Tobago so results can be more generalised.

2.) Similar studies should be done in other Caribbean countries.

3.) Future studies should be done with a longer time in order to get a larger sample size to analyze.

4.) Use the Goldmann Applanation Tonometer to measure IOP values in future studies.

Conclusion

This study is the first of its kind to be carried out in Trinidad and Tobago and by extension the Caribbean. Males were found to be taller, heavier and have longer axial lengths whereas females were found to have steeper corneal curvatures. While there was a positive association between Age and LT, there was a negative association between Age and both CCT and RNFLT. Education Level had a positive correlation with CCT but had a negative correlation with LT. Weight had a negative correlation with Corneal Topography. Height had a negative correlation with CDR, CCT, and Corneal Topography. BMI had no associations with any ocular parameters. Correlational analyses indicated that there was a positive relationship between hours spent on the computer and Refractive Power. IOP was found to be positively associated with diabetes mellitus and/or high cholesterol or hypertension as well as persons who smoke. This study may provide baseline clinical information on ocular biometric measures and its associations for future research done locally, regionally or internationally.

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Appendix

1. Approval Letter

THE UNIVERSITY OF THE WEST INDIES
ST. AUGUSTINE, TRINIDAD AND TOBAGO, WEST INDIES
CAMPUS RESEARCH ETHICS COMMITTEE
TELEPHONE: (1-868) 662-2002 ext. 82755 E-mail: campusethics@sta.uwi.edu

September, 29 2021

Dr Ngozika Ezinne, Denielle Roodal, Tamara Persad,
Optometry unit, Department of Clinical Surgical Sciences,
Faculty of Medical Sciences
Email: Ngozika.ezinne@sta.uwi.edu

Dear Dr Ngozika Ezinne,

Ref: CREC-SA.1180/09/2021

Title: Ocular parameters and its association with anthropometry measurements (BMI, weight, and height) in Trinidad and Tobago Adults.

I am pleased to advise that your application for research on the above captioned topic has been approved on behalf of Campus Research Ethics Committee, St. Augustine.

Approval is valid for one (1) year.

Sincerely,

Professor Jerome De Lisle
Chair
Campus Research Ethics Committee

2. Consent Form

THE UNIVERSITY OF THE WEST INDIES

ST. AUGUSTINE, TRINIDAD AND TOBAGO, WEST INDIES

CAMPUS RESEARCH ETHICS COMMITTEE

TELEPHONE: (1-868) 662-2002 ext. 82755 E-mail: campusethics@sta.uwi.edu

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CONSENT TO PARTICIPATE IN RESEARCH

Complete Protocol Title: Ocular parameters and its association with anthropometry measurements (BMI, weight, and height) in Trinidad and Tobago Adults.

Principal Investigator: Dr Ngozika Ezinne

Co Investigator(s): Denielle Roodal, Tamara Persad, ...

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1. Identification of project

a. What is the purpose of this research?
This research project entitled "Ocular parameters and its association with anthropometry measurements (BMI, weight, and height) in Trinidad and Tobago Adults", involves research that requires voluntary participants. The research is necessary in order to determine the ocular parameters and its association with anthropometry measurements of Trinidad and Tobago adults, and by extension, analyze the data to determine the demographic distribution of ocular biometry in Trinidad and Tobago adults, the demographic distribution of anthropometric measurements of Trinidad and Tobago adults, and the factors responsible for the correlation. This research is necessary to conduct as it has never been done in Trinidad and Tobago before, and by extension the Caribbean, yet our rich, diverse make-up of people makes this the perfect population that should be investigated for ocular biometry, its influences and its correlation to anthropometric measurements (BMI, height and weight). Thus, we formally invite you to voluntarily participate in our research project so that this study will finally be performed in Trinidad and Tobago.

b. How long it will take to complete this project?
The purpose of this research project is to determine the ocular parameters and its association with anthropometry measurements of Trinidad and Tobago adults since this particular study has never been carried out in Trinidad and Tobago before, and by extension the Caribbean, and thus there is a great need for the study to occur. This research project will take place over the period of October 2021 to February 2022.

c. Why am I selected for this research?
The reason you are selected for this research is because you fit our inclusion criteria which includes all patients 18 years and above that visit the University of the West Indies Optometry Clinic within the study period (October to February 2022) and are willing to participate in the research.

d. Why is this document for obtaining informed consent important?
This document for obtaining informed consent is important because it is a critical aspect in participating in research as it provides the potential participant with all the necessary information they require to understand what they are volunteering for. It essentially protects the human participants of research, giving them the option to enter research freely and voluntarily or decline.

2. Description of Procedures

a. What am I expected to do in this study?
In this study we will expect you to fill out a brief questionnaire about your demographic and lifestyle information. Afterwards, we will expect you to participate in few tests such as a comprehensive routine eye exam, Optical Coherence Tomography, Autorefractokeratometry, Topography and Tonometry in order to record the following measurements: VA, axial length, corneal diameter, corneal thickness, corneal power, anterior chamber depth, intraocular power, retinal nerve fiber layer thickness and choroidal thickness. Then we will expect you to allow us to measure your height and weight and calculate your BMI measurement.

b. Which procedures are investigational, which are routine? What is the expected duration, how frequently I have to participate and where will the activities take place?
The procedure to be followed includes: 1.) A short questionnaire is to be filled out, by you, the participant in order to gather information about your demographic and lifestyle. 2.) A comprehensive clinical history and eye examination will be performed including visual acuity measurement using log MAR chart and slit lamp examination. The following ocular parameters will be measured for each eye of the participants using the following equipment: Optical Coherence Tomography (OCT) – for AL, CCT, ACD, RNFLT and CT measurements Autorefractokeratometer – for refractive power, and cornea power Topographer – for corneal topography and diameter Tonometer – for IOP measurement 3.) The anthropometric measurements will then be recorded in the following way: Weight- measured by using a weighing scale available at the UWI clinic Height- measured by using a tape measure BMI- calculated by using the formula weight (kg) / [height (m)]^2 4.) Height will be measured with a tape measure with the subject standing up without shoes and recorded in centimeters (cm). All examinations will be performed three times each, and the mean values taken. All the clinical examination will occur during the period of October 2021 to February 2022. The expected duration of this procedure is approximately 2 hours long. You only have to participate in this procedure once and it will occur right here at the

UWI Optometry Clinic.

c. How many participants are involved in the study approximately?
The approximate number of participants is a total of 150 participants.

3. Risks and Discomforts

a. What are the risks or discomforts that may result from my participation in the study?
There is the risk of being identified through your participation in this research, however in order to mitigate this risk the researchers will not be collecting identifiable information. There will be no physical harm/pain involved in any of the eye examinations.

b. What help and treatments are available if any adverse reactions occur? How can I access them? Is there any compensation available if serious adverse effects occur?
There are no adverse reactions that can occur during this research.

c. Are there any potentially beneficial treatments or procedures that are withheld for the purpose of the study?
There are no potentially beneficial treatments or procedures that may be withheld for the purpose of the study.

4. Termination of Research

a. Are there any anticipated circumstances under which the study/participation may be terminated by the researchers without regard my consent?
There is no anticipated circumstances under which the study/participation may be terminated by the researchers without regard to your consent. However if there is any circumstance that will make University of the West Indies Research and Ethics committee to stop the research, you will be duly notified.

5. Benefits

a. What are the benefits to me (and the wider society) by this study?
The benefit you could get as a participant could be knowing your status with regards to the study objectives. A benefit to the community and public health would be that the information gathered in this study can aid optometrists as well as fellow optometry students in Trinidad and Tobago to understand the trends, associations and correlations of ocular biometry and anthropometry measurements amongst the current population. The ocular parameters may even be used as a risk indicator for certain ocular diseases. Findings from this study could add to exsting literature in this field of study.

6. Alternatives

a. Does this study involve more than minimal risk? Are there any appropriate alternative procedures or courses of treatment that might be advantageous to me?
No, this study does not involve more than minimal risk.

b. Do I have the right to pursue the alternatives?

7. Confidentiality

a. How will confidentiality be maintained regarding my data? Who will have access to the data, how the data will be reported and /or published?
Study data will not include personal identifying information and will be kept confidential on a password controlled computer that only the principal investigator and co-investigators will have access to. This password controlled computer will be stored in a secure place and the data will be destroyed after 5 years. The data will be published on UWI Scholar and without any identifiers.

8. Cost and Payments

a. Are there any costs involved and are there any compensations provided?
There are no additional costs involved in participating in this study. The participants will be thanked for their participation and no financial compensation will be given.

9. Freedom to Withdraw

a. Do I have the freedom to withdraw from the study anytime?
Yes, participation is completely voluntary and you are free to withdraw at any time even if you changed your mind. Should you decide to withdraw, any information collected from your participation will be excluded from this study and destroyed

b. Will withdrawing from the study have any impact on my treatment?
If you do refuse to participate or withdraw from this study, it will not impact your relationship with any of the investigators, nor will it affect any treatment or services available to you at the University of the West Indies or its affiliated institutions.

10. Opportunity to ask questions

a. Do I have to right to ask questions anytime during the study? Whom should I contact?
You have the right to ask any question that you feel is necessary with regards to this study and your understanding of this study. We will answer all your questions before the start of this study and if you have any questions throughout the duration of this study then you reserve the right to ask it at anytime. If you have any further questions/concerns or queries related to the study then you may contact the principal investigator at Ngozika.ezinne@sta.uwi.edu or co-investigators at tamara.persad@my.uwi.edu or danielle.roodal@my.uwi.edu If you have any questions or queries about your rights as a study participant, or if you are concerned about an aspect of the study or the researcher then you may contact: The UWI Research and Ethic Committee on campusethics@sta.uwi.edu

CONSENT

I have read and understood this explanation. The researcher has also explained the study to me. I have had a chance to ask questions and have them answered to my satisfaction. I agree to take part in this study. I have not been forced or made to feel like I had to take part.

By signing this document, I agree that I have read and received a copy of this document.

I must sign this Consent Form. I will be given a signed copy of the form to keep.

Print Name of Subject

_____

Signature of Subject Date

_____

INVESTIGATOR'S STATEMENT AND SIGNATURE
I have explained the purpose of the research, the study procedures, including those that are investigational, the possible risks and discomforts, and the potential benefits, and have answered all questions regarding the study to the best of my ability. In my opinion, the participant understands these issues and has voluntarily agreed to participate in the study.

Signature of Person conducting the informed consent discussion Date

_____

Role of person named above in the research project

_____

Signature of Second Witness Date

_____

This document was approved by Campus Ethics Committee on:
September, 29 2021
This document expires on:
September, 29 2022

By Chairman:

3. Questionnaire

Dear Participants,

We are 3rd Year students currently pursuing a BSc of Optometry degree at the University of the West Indies St. Augustine. We are conducting research on the topic "Ocular parameters/biometry and Anthropometry measurements (BMI, weight, and height) in Trinidad and Tobago Population". This questionnaire will be used to aid in any necessary information relevant to our study. Please answer each question by placing a tick in the box where appropriate and any open ended questions. This questionnaire also remains anonymous and will be kept confidential. Thank You for your participation and time.

Regards,

Denielle Roodal and Tamara Persad

Please answer the following questions by either placing a tick in the appropriate box of your choice or by filling in the open-ended questions.

Part 1: Demographics

1.) Age: _____

2.) Town/City/Area of residence: _____

3.) Gender: Male ☐ Female ☐

4.) Ethnicity: East Indian ☐ African Descent ☐ Mixed ☐ White ☐ Unspecified/Other ☐

5.) Highest educational level:

No formal education ☐

Primary School (SEA) ☐

CSEC / O Levels ☐

CAPE / A Levels ☐

College / University (Undergraduate) ☐

University (Postgraduate) ☐

6.) Occupation/Job: _____

7.) How often do you read?

Everyday ☐

Once or twice a week ☐

A few times a month ☐

Rarely ☐

Never ☐

8.) When you do read, how much hours do you spend reading?

Less than 30 minutes ☐

30 minutes to 1 hour ☐

1 to 2 hours ☐

2 to 3 hours ☐

3 to 4 hours ☐

Greater than 4 hours ☐

9.) How often do you use the computer?

Everyday ☐

Once or twice a week ☐

A few times a month ☐

Rarely ☐

Never ☐

10,) When you do use the computer, how much hours do you spend on the computer?

Less than 30 minutes ☐

30 minutes to 1 hour ☐

1 to 2 hours ☐

2 to 3 hours ☐

3 to 4 hours ☐

Greater than 4 hours ☐

Part 2: Lifestyle

11.) Have you ever been diagnosed with any of the following diseases? (If yes, tick all that you have)

Diabetes ☐ Hypertension ☐ Stroke ☐ Cardiovascular disease ☐

High cholesterol ☐

12.) Are you a past or current smoker?

Yes ☐ No ☐

If yes, then answer question 13. If No then skip to question 14.

13.) When you smoke, how often do you smoke?

Everyday ☐

Every week ☐

Every month ☐

On occasions ☐

14.) Do you drink alcohol currently or in the past?

Yes ☐ No ☐

If yes, then answer question 15. If No then skip to question 16.

15.) How often do you drink alcohol?

Everyday ☐

Every week ☐

Every month ☐

On occasions ☐

16.) How often do you work out?

Everyday ☐

Once or twice a week ☐

A few times a month ☐

Rarely ☐

Never ☐

17.) Do you eat fast foods (KFC, McDonalds, Pizza Hut, etc.), fried foods, and/or sweets/chocolates?

Yes ☐ No ☐

If yes, answer the next question

18.) How often do you eat fast foods, fried foods and/or sweets/chocolates?

Everyday ☐

Once or twice a week ☐

A few times a month ☐

Rarely ☐

Never ☐

4. Calculation

BMI may be calculated using the formula weight (kg) / [height (m)]^2.

BMI were categorised as: <18.5kg/m^2 (underweight), 18.5 to 24.9kg/m^2 (normal or healthy weight), 25.0 to 29.9 kg/m^2 (overweight) and ≥ 30.0kg/m^2 (obese) for individuals 18 years and above.

5. Results Spreadsheet

1	Timestamp	1.) Age:	2.)Town/City/Area of	3.) Gender	4.) Ethnicity	5.) Highest education	6.) Occupation/Job:
2	2/16/2022 10:32:57	65	Port of Spain	Male	African Descent	CSEC / O Levels	Part time security offi
3	2/16/2022 10:46:50	66	D'Abadie	Female	African Descent	No formal education	Retired
4	3/17/2022 9:58:58	28	Port of Spain	Male	African Descent	College / University (U	Student
5	3/17/2022 10:24:09	23	St. Augustine	Female	Mixed	College / University (U	Student
6	3/17/2022 13:26:30	21	San Fernando	Female	Mixed	College / University (U	Student
7	3/17/2022 13:43:13	30	Chaguanas	Male	African Descent	College / University (U	Student
8	4/21/2022 14:48:17	24	San Fernando	Female	Mixed	College / University (U	Student
9	4/21/2022 15:06:58	28	San Fernando	Female	East Indian	College / University (U	Radiographer
10	4/21/2022 15:26:36	23	Chaguanas	Female	East Indian	College / University (U	Student
11	4/21/2022 16:12:04	23	San Fernando	Female	East Indian	College / University (U	Unemployed
12	4/21/2022 16:24:57	18	Chaguanas	Male	East Indian	CSEC / O Levels	Student
13	4/21/2022 16:37:51	23	Port of Spain	Male	African Descent	CAPE / A Levels	Student
14	4/21/2022 17:12:40	23	San Fernando	Male	East Indian	College / University (U	Student
15	4/21/2022 19:50:29	21	Chaguanas	Male	Mixed	College / University (U	Student
16	4/21/2022 20:03:34	40	Trincity	Male	East Indian	University (Postgradu	Lab Technician
17	4/21/2022 20:15:45	19	San Juan	Male	East Indian	CSEC / O Levels	Accountant
18	4/21/2022 23:07:01	21	San Fernando	Male	East Indian	College / University (U	Student
19	4/21/2022 23:17:43	67	Couva	Female	East Indian	CSEC / O Levels	Retired
20	5/22/2022 13:11:10	57	Londonville	Female	East Indian	CAPE / A Levels	Unemployed
21	5/22/2022 13:28:37	28	Diego Martin	Female	African Descent	College / University (U	Student
22	5/22/2022 13:44:57	24	Arima	Male	Mixed	College / University (U	Student
23	5/22/2022 14:03:47	61	El Dorado	Female	East Indian	CSEC / O Levels	Sales Clerk
24	5/22/2022 14:26:02	49	San Fernando	Female	Mixed	CSEC / O Levels	Unemployed
25	5/22/2022 14:39:06	56	Cunupia	Female	East Indian	CSEC / O Levels	Unemployed
26	5/22/2022 15:10:28	23	Cunupia	Female	Mixed	College / University (U	Student
27	5/22/2022 15:28:28	21	Cunupia	Female	East Indian	College / University (U	Student
28	5/22/2022 15:37:18	20	Sangre Grande	Female	Mixed	College / University (U	Tutor
29	5/22/2022 15:47:14	30	Sand Fernando	Female	East Indian	College / University (U	Unemployed
30	5/22/2022 16:01:39	34	San Fernando	Male	East Indian	College / University (U	Unemployed
31	5/22/2022 16:11:51	25	Sangre Grande	Male	East Indian	College / University (U	Unemployed
32	5/22/2022 16:24:10	30	San Fernando	Female	East Indian	College / University (U	Unemployed
33	5/22/2022 16:34:50	47	San Fernando	Female	East Indian	CSEC / O Levels	Unemployed
34	5/22/2022 17:43:02	25	San Fernando	Female	East Indian	College / University (U	Unemployed

7.) How often do you	8.) When you do reac	9.) How often do you	10.) When you do use	11.) Have you ever b
Everyday	30 minutes to 1 hour	Never		None
Everyday	1 to 2 hours	Everyday	1 to 2 hours, Greater	High cholesterol, Hyp
Everyday	2 to 3 hours	Everyday	2 to 3 hours	None
Everyday	2 to 3 hours	Everyday	2 to 3 hours	None
Everyday	3 to 4 hours	Everyday	3 to 4 hours	None
Everyday	2 to 3 hours	Everyday	Greater than 4 hours	None
Once or twice a wee	1 to 2 hours	Everyday	Greater than 4 hours	None
Everyday	Greater than 4 hours	Rarely	2 to 3 hours	None
Everyday	1 to 2 hours	Everyday	1 to 2 hours	None
A few times a month	1 to 2 hours	Everyday	3 to 4 hours	Diabetes, High chole
Everyday	3 to 4 hours	Everyday	3 to 4 hours	None
A few times a month	2 to 3 hours	Everyday	3 to 4 hours	None
Everyday	Less than 30 minutes	Rarely	2 to 3 hours	None
Everyday	3 to 4 hours	Everyday	3 to 4 hours	None
Everyday	30 minutes to 1 hour	Everyday	Greater than 4 hours	None
Everyday	Greater than 4 hours	Everyday	Greater than 4 hours	None
Everyday	1 to 2 hours	Once or twice a wee	2 to 3 hours	None
Everyday	30 minutes to 1 hour	Everyday	Less than 30 minutes	Diabetes
Everyday	30 minutes to 1 hour	Rarely	Less than 30 minutes	Diabetes
Everyday	2 to 3 hours	Everyday	Greater than 4 hours	None
Everyday	2 to 3 hours	Everyday	Greater than 4 hours	None
Everyday	1 to 2 hours	Everyday	Less than 30 minutes	Diabetes
Everyday	30 minutes to 1 hour	Never		None
Everyday	30 minutes to 1 hour	Never		Diabetes
Everyday	3 to 4 hours	Everyday	3 to 4 hours	None
Everyday	Greater than 4 hours	Everyday	3 to 4 hours	None
Everyday	Greater than 4 hours	Everyday	Greater than 4 hours	None
Everyday	3 to 4 hours	Everyday	3 to 4 hours	None
Everyday	3 to 4 hours	Everyday	3 to 4 hours	None
Everyday	3 to 4 hours	Everyday	3 to 4 hours	None
Everyday	3 to 4 hours	Everyday	Greater than 4 hours	None
Everyday	30 minutes to 1 hour	Never		None
Everyday	3 to 4 hours	Everyday	Greater than 4 hours	None

12.) Are you a past o	13.) When you smoke	14.) Do you drink alcc	15.) How often do yo	16.) How often do yo	17.) Do you eat fast f
Yes	Everyday	Yes	On occasions	A few times a month	Yes
Yes	Everyday	Yes	On occasions	A few times a month	Yes
No		Yes	On occasions	A few times a month	No
No		Yes	On occasions	A few times a month	Yes
No		Yes	On occasions	Never	Yes
No		No		Rarely	Yes
No		No		Rarely	No
No		Yes	On occasions	A few times a month	Yes
No		Yes	On occasions	Rarely	Yes
No		Yes	On occasions	Once or twice a wee	Yes
No		Yes	On occasions	Once or twice a wee	Yes
Yes	On occasions	Yes	On occasions	Once or twice a wee	Yes
No		Yes	On occasions	Everyday	Yes
Yes	On occasions	Yes	Every week	Once or twice a wee	Yes
No		Yes	On occasions	Rarely	Yes
No		No		Everyday	Yes
No		Yes	Every week	Rarely	Yes
No		No		Once or twice a wee	No
No		Yes	On occasions	Rarely	Yes
No		Yes	On occasions	Everyday	Yes
No		Yes	On occasions	Once or twice a wee	Yes
No		No		Never	No
No		No		Rarely	Yes
No		No		Everyday	Yes
No		No		Rarely	Yes
No		Yes	Every month	Rarely	Yes
No		Yes	On occasions	Everyday	Yes
No		Yes	On occasions	Rarely	Yes
No		Yes	Every month	Rarely	Yes
No		No		Once or twice a wee	Yes
No		No		Never	Yes
No		Yes	On occasions	Rarely	Yes
No		Yes	On occasions	Everyday	Yes

Do you eat fast f	18.) How often do yo	19.) Do you wear gla	Patient no.	Tear Break-Up Time	Cup-to-disc ratio RE	Cup-to-disc ratio LE
	A few times a month	Yes	002	13mm	0.38	0.39
	A few times a month	Yes	001	12mm	0.26	0.28
		No	003	10mm	0.23	0.29
	A few times a month	No	004	8mm	0.13	0.19
	Once or twice a wee	Yes	005	16mm	0.01	0.01
	Everyday	No	006	6mm	0.09	0.23
	Never	No	007	5mm	0.21	0.11
	A few times a month	No	008	8mm	0.51	0.51
	A few times a month	Yes	009	15mm	0.44	0.39
	A few times a month	Yes	010	6mm	0.61	0.64
	Once or twice a wee	Yes	011	5mm	0.43	0.46
	Rarely	No	012	13mm	0.24	0.14
	Rarely	Yes	013	19mm	0.13	0.13
	Once or twice a wee	Yes	014	4mm	0.61	0.6
	Once or twice a wee	Yes	015	14mm	0.14	0.15
	Rarely	Yes	016	15mm	0.36	0.28
	Once or twice a wee	No	017	13mm	0.26	0.23
		Yes	018	6mm	0.21	0.15
	Rarely	Yes	019	11mm	0.47	0.14
	A few times a month	Yes	020	4mm	0.24	0.29
	A few times a month	Yes	021	4mm	0.04	0.14
		Yes	022	3mm	0.35	0.3
	Rarely	No	023	14mm	0.32	0.28
	Rarely	Yes	024	3mm	0.38	0.35
	A few times a month	Yes	025	3mm	0.1	0.1
	Once or twice a wee	Yes	026	12mm	0.08	0.16
	Rarely	Yes	027	11mm	0.28	0.23
	A few times a month	Yes	028	13mm	0.21	0.25
	Once or twice a wee	No	029	14mm	0.27	0.3
	Once or twice a wee	No	030	16mm	0.35	0.41
	A few times a month	Yes	031	15mm	0.47	0.5
	Once or twice a wee	No	032	15mm	0.53	0.56
	A few times a month	Yes	033	2mm	0.34	0.36

Macular Thickness RE	Macular Thickness LE	Axial length RE	Axial length LE	Central Corneal Thick	Central Corneal Thick
261	261.6	23.78	23.94	461	472
263.7	232.6	24.01	23.83	485	475
284.1	286.1	23.01	22.94	536	531
272.7	277.6	24.15	23.57	507	516
252.3	251.2	25.19	25.13	595	595
256.6	258.7	23.63	23.53	535	541
262.5	266.8	23.31	23.28	555	550
258.1	256.9	22.07	22.36	551	551
256.5	262.4	23.9	23.98	565	574
257.5	260.4	22.67	22.67	567	557
262.5	263.9	22.86	22.78	493	495
270.6	271.5	24.95	24.96	537	536
266.7	259	25.04	25.62	537	536
268.6	269.9	23.59	23.58	511	507
259.4	261.5	25.55	25.65	587	578
281.7	280.9	25.76	25.43	536	540
289.1	285.4	23.71	23.54	533	531
252.5	251.7	23.05	23.07	517	506
355.5	305.9	23.37	23.53	543	543
263.1	264.8	22.35	22.37	557	566
262.3	264.3	23.67	23.43	568	559
274	271.1	23.34	23.27	510	503
271.9	271.4	22.62	22.64	554	557
245	221.8	21.61	21.62	548	550
256.2	253.6	22.68	22.77	511	512
252.9	248.9	23.52	23.46	565	563
273.4	274.2	22.17	22.23	496	506
247.6	246.6	24.86	24.81	511	513
289.1	285.4	23.71	23.54	533	531
262.9	259	24.32	24	503	511
252	254.1	24.74	24.47	527	527
250.4	246.8	23.33	23.04	528	534
270.1	272.4	24.11	23.94	530	538

Lens Thickness RE	Lens Thickness LE	Retinal Nerve Fiber La	Retinal Nerve Fiber La	Refractive Power RE	Refractive Power LE
4.91	4.38	98	89	+0.75	+1.00
4.74	4.73	104	83	+1.75	+2.75
4.05	4.03	116	116	+1.25	+1.00
3.54	3.48	107	105	-0.75	plano
3.73	3.71	103	106	-6.75	-6.5
3.62	3.62	99	99	-0.25	-0.5
3.78	3.78	102	105	-0.25	-0.25
3.5	3.54	85	90	-0.25	-0.25
3.5	3.54	105	103	-0.5	-1
3.59	3.63	113	109	-1.5	-1.75
3.57	3.59	97	97	-1.75	-1.5
3.29	3.33	110	111	-0.25	-0.25
3.34	3.29	106	106	-3.25	-5
3.7	3.73	107	104	plano	-0.25
3.92	3.92	86	85	-3.75	-3.75
3.71	3.73	96	96	-8.25	-7.25
3.52	3.51	85	87	-0.5	-0.5
4.93	4.69	89	102	+1.50	+3.00
4.06	3.97	91	86	+1.00	+0.50
3.64	3.54	102	101	-1.25	-1.5
3.8	3.82	100	102	-1.75	-1.5
4.67	4.09	103	98	+2.25	+2.75
4.66	4.19	118	119	+2.00	+1.50
5.38	5.05	102	99	+3.00	+1.75
3.68	3.67	99	102	-3	-3.5
3.19	3.19	97	93	-5	-4
3.19	3.23	113	114	-1.25	-1.5
4.09	4.07	109	112	-1.75	-2.25
4.01	4.04	100	98	+0.25	+0.25
3.51	3.51	104	100	-0.25	-0.25
3.6	3.63	93	105	-6.75	-7
4.02	3.93	100	96	-1.5	-1.25
3.48	3.48	95	96	-2	-1.75

Corneal Topography I	Corneal Topography I	WTW Corneal Diameter	WTW Corneal Diameter	Intraocular Pressure I	Intraocular Pressure I	Weight	Height	BMI: weight (kg) / [height (m)]²
42.86	42.67	12.15	12.38	15	12.7	75.4kg	1.77m	24.07
43.67	43.48	11.68	11.99	11.3	10	81.2kg	1.67m	29.1
43.18	43.51	12.17	12.13	13.7	11	78.3kg	1.81m	23.9
44.36	44.67	12.32	12.23	10.3	12.3	65.2kg	1.66m	23.66
45.3	44.84	11.88	11.88	21	19.3	41.1kg	1.59m	16.26
43.67	43.96	11.74	11.79	12.3	15.7	93.0kg	1.67m	33.35
44.01	43.92	12.27	12.19	15.3	11	81.7kg	1.67m	29.3
47.26	46.34	11.38	11.42	12.7	13.7	47.5kg	1.55m	19.8
42.13	42.25	12.52	12.63	20.3	20	61.8kg	1.55m	25.7
45.05	44.61	11.89	11.86	16	14.3	61.4kg	1.62m	23.4
46.49	46.34	11.95	12.16	11.7	11	41.6kg	1.70m	14.4
42.1	42.02	12.66	12.92	14	17.3	83.0kg	1.83m	24.8
42.67	42.89	11.8	11.86	14.7	14.3	99.8kg	1.85m	26.8
41.82	42.3	12.24	12.26	13.3	11	63.5kg	1.73m	21.2
42.58	42.39	11.73	11.63	13.7	13.7	81.7kg	1.75m	26.7
42.47	42.67	11.38	11.66	13	13	48.53kg	1.76m	15.7
43.48	43.34	12.59	12.57	16	18	66.4kg	1.80m	20.5
44.07	43.89	11.76	12.13	17	16.3	50.3kg	1.61m	19.4
44.34	43.9	11.77	11.31	16.3	15.3	76.1kg	1.60m	29.7
45.41	45.46	11.83	12.02	12.3	16.3	60.9kg	1.52m	26.4
44.23	44.01	12.34	12.42	13.3	14	67.4kg	1.77m	21.5
44.43	44.8	12.01	12	15.3	15.3	65.2kg	1.73m	21.8
43.39	43.95	11.98	11.91	19	17	51.1kg	1.63m	19.2
45.18	45	11.17	11.44	21.7	20.3	86.2kg	1.66m	31.3
45.82	45.62	11.98	11.91	12	13	56.6kg	1.74m	18.7
44.86	44.77	12.21	12.1	10.7	9	65.0kg	1.65m	23.9
47.04	47	12	11.86	12	12.7	54.0kg	1.64m	20.1
41.19	41.25	11.73	11.7	12.1	12.5	64.0kg	1.66m	23.2
43.48	43.34	12.59	12.57	13.1	12.7	61.0kg	1.68m	21.6
42.45	42.88	11.81	12.01	14.1	14.3	97.2kg	1.82m	29.3
45.09	45.66	11.95	11.66	15	16.1	46.0kg	1.52m	19.9
44.01	45.09	12.28	12.2	16	14.3	84.2kg	1.58m	33.7
43.03	42.84	12.1	11.98	18.3	17.3	49.9kg	1.61m	19.3