TURKISH REPUBLIC OF NORTH CYPRUS

NEAR EAST UNIVERSITY

HEALTH SCIENCES INSTITUTE

ANATOMICAL VARIATIONS OF PALMARIS LONGUS: A SURFACE STUDY OF NORTH CYPRUS POPULATION

MARYAM ALIYU

MASTER OF SCIENCE (ANATOMY)

DEPARTMENT OF ANATOMY

SUPERVISOR: PROF. DR. MEHTAP TIRYAKIOĞLU

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APPROVAL

Thesis submitted to the Institute of Health Sciences of Near East University in partial fulfillment of the requirement for the degree of Master of Science in Anatomy.

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STATEMENT (DECLARATION)

I hereby declare that the thesis study titled, **Anatomical Variations of the Palmaris Longus: A Surface Study of North Cyprus Population**, is the bonafide research carried out by me under the supervision of Prof. Dr. Mehtap Tiryakioğlu, Department of Anatomy and Dean of Sports faculty, Near East University, Nicosia, TRNC. I was not involved in any unethical behavior throughout the course of this study. I obtained all the information in the thesis based on academic and ethical guidelines. All the information not obtained by the study was properly referenced. I further declare that there was no breach of patent rights or copyright infringement during the course of this thesis.

Maryam Aliyu

Date:

Signature:

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ABBREVIATIONS AND SYMBOLS LIST

PLM :Palmaris longus muscle

PL :Palmaris longus

PLA :Palmaris longus agenesis

PT :Pronator teres

FCR :Flexor carpi radialis

FCU :Flexor carpi ulnaris

FDS :Flexor digitorum superficialis

ANATOMICAL VARIATIONS OF THE PALMARIS LONGUS: A SURFACE STUDY OF THE NORTH CYPRUS POPULATION

Student name: Maryam Aliyu
Supervisor: Prof. Dr. Mehtap Tiryakioğlu
Department: Anatomy

SUMMARY

AIM: To determine the frequency of surface anatomical variations of palmaris longus muscle in North Cyprus and their association with gender, body side and hand dominance.

MATERIALS AND METHOD: The presence of palmaris longus muscle was determined in 1280 subjects (660 females and 620 males) using the standard Shaeffer's testing method. In subjects with an absent PL, 3 other tests were done to confirm absence; and palpation was the final confirmatory test for absence.

FINDINGS AND RESULTS: The overall frequency of absence was 17.4% (n=223) with unilateral absence 12.3% (n=158) and bilateral absence 5.1% (n=65). The absence of PL occurred more frequently on the left side (118 cases, 9.2%) compared to the right (40 cases, 3.1%) and the difference was statistically significant at $p < .05$. Female subjects showed a higher frequency of absence of 10.6% compared to males (6.8%) and the difference was statistically significant at $p < .05$. In those that had the PL, there were 28 (2.6%) cases of a split tendon and 3 cases (0.2%) of a laterally displaced tendon of the PL. The split tendon occurred more frequently in females (18 cases, 1.7%) compared to males (10 cases, 0.9%) although there was no statistically significant difference. The split tendon occurred on the right in 24 cases, on the left in 2 cases and bilaterally in 2 cases. The value for the right side was statistically significant at $p < .05$.

The relationship between the palmaris longus absence and handedness was statistically significant and absence was more likely to occur in the non-dominant hand.

CONCLUSION: The overall frequency of absence was 17.4% and absence is more likely to occur in females, on the left side and in the non-dominant hand.

Key words: palmaris longus, variation, agenesis, forearm, North Cyprus

1. INTRODUCTION AND AIM

1.1 Introduction

The palmaris longus muscle (PL) is one of the superficial muscles of the anterior (or flexor) compartment of the forearm. Other superficial muscles are pronator teres (PT), flexor carpi radialis (FCR), flexor carpi ulnaris (FCU) and flexor digitorum superficialis (FDS) (Standring et al., 2016). The superficial forearm muscles can each be easily palpated using different testing methods for the different muscles (Smith et al., 2018; Standring et al., 2016; Moore et al., 2014).

The PL is a small, vestigial muscle with a small muscle belly and a long tendon (Moore et al., 2014; Mbaka & Ejiwunmi 2009; Pai et al., 2008) that has received the attention of researchers worldwide, as it is one of the most variable muscles in the body (Lahiji et al., 2013; Kyung et al., 2012; Gangata, 2009). The variations of PL include absence, duplication, proximal tendon (or reversed PL), bifid (Adejuwon et al., 2012; Kigera and Mukwaya, 2011), hypertrophy (Das and Farihah, 2013), split or tendinous (Alabbad et al., 2018), incomplete or exhibit anomalous insertions (Pai et al., 2008), multiple headed (Abledu and Offei, 2014) or present accessory slips (Hiz et al., 2011) and it can be unilaterally or bilaterally absent (Ndou et al., 2010; Abledu and Offei, 2014; Alves et al., 2012).

The PL has been extensively studied in various ethnic groups in order to establish the prevalence of its anomalies especially its absence. Based on the numerous studies carried out in many different countries, the absence of PL has a prevalence range of 1.5% to 63.9% (Ioannis et al., 2015; Lahiji et al., 2013), although lower incidence (0.6%) has been recorded in Korean population (Kyung et al., 2012).

1.1.1 Background of the Study

The PL is a small, fusiform and slender muscle located medial to the FCR (Cerda & del Sol, 2016; Pai et al., 2008), lying between the FCR and FCU muscles (Kyung et al., 2012; Ndou et al., 2010) and superficial to the FDS (Lamichhane et al., 2017; Ioannis et al., 2015; Natsis et al., 2006). Many researchers have described the PL as a phylogenetically degenerating muscle that has lost its function in the course of human evolution (Arquez, 2017; Alves et al., 2012; Mbaka & Ejiwunmi, 2009). It is a weak flexor of the wrist and so is regarded by most surgeons as a dispensable muscle, since its actions are secondary and its absence doesn't produce any deformity or functional deficit. Surgeons agree it is the tendon of choice in many reconstructive procedures as it fulfills the criteria of being the right length and diameter and is easily accessible and is dispensable (Alabbad et al., 2018; Lamichhane et al., 2017; Lahiji et al., 2013).

The PL is a highly variable muscle both in morphology and in number (Arquez, 2017; Lamichhane et al., 2017; Lahiji et al., 2013); the variations include agenesis (absence), duplication, split tendon, reversed PL, hypertrophy, accessory PL and multiple heads (Alabbad et al., 2018; Arques, 2017; Adejuwon et al., 2012). Among the many anatomical variations of the PL, absence of PL (or PL agenesis, PLA) has been reported by various researchers as the commonest (Alabbad et al., 2018; Lahiji et al., 2013; Alves et al., 2012).

The PL has received worldwide attention and has become one of the most extensively and intensively studied muscle (Lamichhane et al., 2017). There have been several studies to demonstrate the ethnic variations in the frequency of absence of the PL in various ethnic groups worldwide. According to many anatomy textbooks, the worldwide prevalence of PL agenesis is between 10-15% (Standring et al., 2016; Moore et al., 2014; Saladin, 2014; Snell, 2012). The highest prevalence of PL agenesis was recorded by Ceyhan and Mavt in 1997 as 63.9% in a Turkish population. The prevalence of PL agenesis was 4.6% in a study conducted on a Chinese population (Sebastin et al., 2006). A study in Ghana recorded a prevalence of 3.8% (Abledu & Offei, 2014), while Gangata (2009) reported 1.6% in a Zimbabwean population. Roohi et al. (2007) studied the

multiracial population of Malaysia and reported prevalence of absence of 11.3% in Malays, 10.7% in Indians and 6.0% in Chinese.

These studies were conducted using various testing methods that can detect the presence or absence of the PL on the volar aspect of the wrist. Therefore, these are all surface anatomical studies. Detailed studies into other variations of the PL have also been conducted using cadaveric dissections. Pai et al. (2008) studied 30 cadavers (60 upper limbs) and reported complete agenesis in 2 male and 2 female cadavers, a case of reversed PL in 2 cadavers, and a case of duplication of the tendon in one cadaver. Natsis et al. (2006) reported a case of 3-headed reversed PL in the left hand of a 73 year old female cadaver. Apart from the various studies to establish the frequency of absence of the PL in various populations, other abnormalities have been studied such as Cerda and del Sol (2016) who studied the morphometric characteristics of the PL and extensor carpi radialis muscles. Researches have also been conducted to establish a correlation between the absence of PL and gender, body side and handedness of the test subjects.

There are various clinical assessments for the presence or absence of PL, which have been shown to have varying accuracies. Kigeria and Mukwaya (2012) assessed the accuracies of 10 testing methods and reported Shaeffer's test as having the highest accuracy.

1.1.2 Significance of the Study

The palmaris longus muscle has received worldwide attention from researchers, despite the fact that functionally, it is a negligible muscle. It is believed to be functionally more active in mammals that use their upper limbs for mobilization (Lahiji et al., 2013; Pai et al., 2008). It has lost its function in the course of human evolution and is gradually becoming extinct (Alves et al., 2012; Hiz et al., 2011; Kose et al., 2009). This evolution-induced morphometric change has made the PL one of the most variable muscles in the body (Lahiji et al., 2013; Kigera & Mukwaya, 2011; Pai et al., 2008). It may be absent on one or both sides (Standring et al., 2016 & Moore et al., 2014; Snell, 2012) may be reversed, duplicated or digastric (Adejuwon et al., 2012).

Surgeons consider the tendon of palmaris longus as the tendon of choice in reconstructive surgeries, because it is of the right length and diameter, it is easily accessible and its absence does not produce any functional deformity (Lamichhane et al., 2017; Lahiji et al., 2013). It is used by plastic surgeons in treatment of facial paralysis, repairing ptosis, lip augmentation and in the restoration of lip and chin defects (Alabbad et al., 2018; Devi Sankar et al., 2011; Roohi et al., 2007). Mbaka and Ejiwunmi (2009) reported that the tendon of palmaris longus is harvested to repair oncologic defects of head and neck and arthritis of the thumb.

The variations of PL can cause many clinical syndromes as reported by various researchers. Lorenzo et al. (1996) reported a clinical case of a bitendinous PL causing median nerve compression during a standard carpal tunnel release.

Many textbooks of anatomy show a worldwide prevalence of absence of PL of 10-15% (Standring et al., 2016, Drake et al., 2015; Moore et al., 2014; Saladin, 2014), although prevalence as low as 0.6% has been recorded in the Korean population (Kyung et al., 2012) and as high as 63.9% in the Turkish population (Ceyhan & Mavt, 1997).

However, despite the several studies to determine the prevalence of absence of the PL in various ethnic groups worldwide, there is a dearth of information on the North Cyprus population. To the best of the author's knowledge, the prevalence of absence of the PL in the North Cyprus population is unknown. Therefore, the aim of this research is to establish the frequency of absence of the palmaris longus muscle. The findings will be useful to surgeons working in North Cyprus, especially in the fields of plastic surgery and orthopedics. It will also increase the available data on the PL, thus contributing to the research community. It will also open up avenues for further researches on the PL.

1.2 Aims and Objectives

1.2.1 Aim

To determine the frequency of surface anatomical variations of palmaris longus muscle in North Cyprus

1.2.2 Objectives

1. To investigate the frequency of absence of the palmaris longus muscle in the North Cyprus population
2. To demonstrate the presence of other surface anatomical variations of the palmaris longus in the North Cyprus population
3. To determine the relationship between gender, handedness with variations in the palmaris longus among the North Cyprus population

2. GENERAL INFORMATION

2.1. Introduction

The forearm muscles are classified into anterior (flexor) compartment and posterior (extensor) compartment. The muscles of the anterior compartment of the forearm are arranged in superficial, intermediate and deep layers (Smith et al., 2018; Drake et al., 2015; Moore et al., 2014; Snell, 2012). The superficial muscles are pronator teres, flexor carpi radialis, palmaris longus and flexor carpi ulnaris. The palmaris longus muscle (PL) is the subject of this research. Some authors classify the FDS as belonging to the intermediate layer of the muscles of the forearm, as its tendon lies under the PL (Drake et al., 2015; Moore et al., 2014; Snell, 2012).

2.1.1 Origin and Insertion

The PL is a small, slender, fusiform shaped muscle located between the flexor carpi ulnaris (FCU) and flexor carpi radialis (FCR), lying medial to the FCR and superficial to the flexor digitorum superficialis (Cerda & del Sol, 2016; Kyung et al., 2012; Ndou et al., 2010). The PL takes its origin from the common flexor tendon, at the medial epicondyle of the humerus and from adjacent intermuscular septa and deep fascia (Standring et al., 2016; Saladin, 2014; Moore et al., 2014). It is a muscle with a short belly muscle that runs between the muscle bellies of FCU and FCR, before becoming tendinous in the mid-forearm (Cerda & del Sol, 2016; Standring et al., 2016; Natsis et al., 2007). At the level of the wrist, it crosses the flexor retinaculum anteriorly and partly attaches and then flattens out into a broad sheet that inserts into the palmar aponeurosis (Standring et al., 2016; Moore et al., 2014; Snell, 2012).

2.1.2 Action and Innervation

Studies have shown that the functions of PL are secondary and include weak wrist flexion, stretching of the palmar aponeurosis, anchoring of skin and fascia of the hand, as well as resisting shearing forces applied to the skin (Standring et al., 2016; Drake et

al., 2015; Saladin, 2014). Because these functions are negligible, many studies have established that the absence of the PL does not cause any loss of function or deformity of the hand (Moore et al., 2014; Lahiji et al., 2013; Alves et al., 2012; Snell, 2012). Like most flexor compartment muscles, the PL is supplied by the median nerve (Standring et al., 2016; Moore et al., 2014; Snell, 2012). It also provides a somewhat protective cover for the median nerve as it lies over and slightly medial to it (Standring et al., 2016; Moore et al., 2014; Cetin et al., 2013), therefore, its tendon is used as an important landmark to identify the median nerve during operations (Arquez, 2017).

2.2. Variations

The PL is only present in mammals and is more developed in mammals that use the upper limb for movement (Lahiji et al., 2013). In humans, it seems to have lost its function during evolution, and is gradually becoming extinct (Lahiji et al., 2013; Alves et al., 2011; Hiz et al., 2011; Pai et al., 2008). Due to this evolution-induced morphometric change, the PL is classified as a phylogenetically degenerating muscle (Lamichhane et al., 2017; Alves et al., 2012; Mbaka & Ejiwunmi, 2009; Pai et al., 2008). As a result of this, the PL is one of the most random and highly variable muscle in the body (Lahiji et al., 2013; Kyung et al., 2012; Gangata, 2009) and numerous variations have been reported by various researchers. The commonest of the anatomical variations of the PL is its absence / agenesis (Alabbad et al., 2018; Lahiji et al., 2013); others include duplication of the tendon (Abledu & Offei, 2014; Mbaka & Ejiwunmi 2009); digastric (Adejuwon et al., 2012); split tendon (Arquez, 2017); bifid tendon (Das & Farihah, 2013).

The PL can also be present as a reversed PL in which the tendon is proximal and the muscle belly is proximal; it can present with multiple heads (Abledu & Offei, 2014); it can have a proximal or distal tendon with a fleshy central muscle belly; it could be fleshy throughout or it could be degenerated to a tendinous band (Arquez, 2017).

The PL has been reported to exhibit anomalous insertions (Pai et al., 2008). Koo and Roberts (1997) reported a case in which the palmaris longus passes deep to the flexor

retinaculum (instead of superficial to it) and then inserts into the undersurface of the palmar aponeurosis. There has been a case report on a hypertrophied PL muscle (Ashby, 1964). Eren et al. (2015) made a case report of a reversed palmaris longus in the forearm of a 21 year old male who presented with a soft tissue mass in the distal aspect of the forearm.

Despite its negligible functions, the PL has assumed to be of great clinical significance in reconstructive surgeries. It is the tendon of choice in reconstructive surgeries as it fulfills the criteria of being the appropriate length and diameter, it is easily accessible and its absence does not produce any functional deficit (Lamichhane et al., 2017; Lahiji et al., 2013). Orthopedics and plastic surgeons harvest the tendon for hand surgeries (Devi Sankar et al., 2011; Kose et al., 2009), repair of ptosis, facial paralysis and lip augmentation (Ableduˆ & Offei, 2014; Lahiji et al., 2013; Adejuwon et al., 2012). It has also been used for the restoration of lip and chin defects (Alabbad et al., 2018; Devi Sankar et al., 2011; Roohi et al., 2007), repair of oncologic defects of the head and neck and arthritis of the thumb (Mbaka & Ejiwunmi 2009).

2.2.1 Ethnic variations in PL absence

Absence of the PL (PL agenesis, PLA) can be unilateral or bilateral. PL agenesis has been shown to exhibit a wide range of ethnic variations. Extensive studies have been conducted worldwide to establish the prevalence or frequency of absence of the PL. Textbooks of anatomy report a worldwide prevalence of PLA as 10% (Snell, 2012); 14% (Moore *et al*., 2014) and 15% (Drake *et al*., 2014). Researches have shown the prevalence of PL agenesis to range from 1.5% to as high as 63.9% (Ioannis *et al*., 2015), although Kyung et al. (2012) reported a lower prevalence of 0.6%. A study conducted on school pupils in Zimbabwe showed the total prevalence of absence of PL to be 1.5% with 0.9% being unilateral and 0.6% bilateral (Gangata, 2009). A similar study was done in a selected population of school children in Nigeria, which showed a prevalence of absence of 26.7% with 13% unilateral and 13.7% bilateral. Lahiji et al. (2013) conducted a study on 1000 patients of a major orthopedics hospital in Iran and reported a total

prevalence of absence of 22.8%. In the multiracial population of Malaysia, a study by Roohi et al. (2007) showed a prevalence of absence of 11.3% in Malays, 10.7% in Indians and 6.0% of Chinese. A similar study was conducted on 201 persons in the mixed race South African population by Ndou et al. (2010) and the total prevalence of absence was reported to be 11.5% out of which 5.5% were bilateral. Kigera and Mukwaya (2011) studied the East African population and found an overall rate of absence of 4.4% with 3.3% unilateral and 1.1% bilateral. Two studies conducted in the Turkish population reported a large difference in prevalence of PL absence of 26.6% of 1350 subjects (Kose et al., 2009) and 63.9% of 7000 subjects (Ceyhan & Mavt 1997).

Aside from the absence of PL which is the most common of it its variations, other types of variations have also been described. Gangata (2009) reported 1.1% lateral shift in the tendon of the PL and 0.2% duplication of the tendon.

It has been documented that absence of PL is hereditary (Alabbad et al., 2018; Cetin et al., 2013); although genetic transmission is unclear. The Hox gene is responsible for the regulation of the development of PL and a dominant expression of genes is responsible for the variations of PL in family members (Alabbad et al., 2018).

2.2.2 Dissection studies

Several dissection studies have also be conducted to demonstrate anomalies that cannot be assessed on the surface. Pai et al. (2008) dissected 30 cadavers (60 limbs) and reported complete agenesis of PL in 2 males and 2 females; a case of reversed PL in 2 cadavers and another with duplication of the tendon. Arquez (2017) dissected 17 cadavers and reported a case of duplicated PL in 1 male subject, with median nerve supplying the main muscle and the accessory PL being supplied by the deep branch of the ulnar nerve.

Natsis et al. (2006) reported a case of 3-headed reversed PL in the left upper extremity of a 73 year old female cadaver. These anatomical anomalies are of great clinical significance as they can present with clinical symptoms. Lorenzo et al. (1996) reported a case of a bitendinous palmaris longus causing median nerve compression in the right

hand of a 45 year old woman, during a standard carpal tunnel release. Ashby in 1964 reported a rare case of hypertrophy of the PL in a 13 year old girl with a swelling on the front of the right forearm, and the hypertrophied fleshy muscle belly found distally, in place of the tendon (i.e. reversed PL). Reimann et al. (1946) studied 1600 arms and reported the following anomalies in the attachment of the PL; it may be inserted in the antebrachial fascia, or partially or totally attached to the fascia of the thenar eminence or may blend with the expansion of the flexor carpi ulnaris.

2.3 Relationship between PL variations, gender, body side and handedness

Apart from the numerous studies to record the prevalence of the absence of the PL in various populations around the world, studies have also been conducted to establish correlation between absence of the PL and gender as well as body side and handedness. Lamichhane et al. (2017) studied 503 first year medical students and reported that there was no significant gender or laterality difference in the incidence of the absence of PL. Cetin et al. (2013) studied 585 subjects and reported the prevalence of absence of PL as being higher in females and on the left side. Lahiji et al. (2013) studied 1000 Iranian subjects in a major orthopedics hospital and reported the agenesis was 3.7% more likely to occur on the left but there is no statistically significant difference between genders. In another study conducted in a selected population of school children in Nigeria, the prevalence of PLA was higher in females and on the left (Adejuwon et al., 2012). In a similar study on Chilean subjects, Alves et al. (2011) reported a higher frequency of agenesis in women and on the left side compared to male subjects and on the right. Another research on the frequency of agenesis of PL on an East African study population concluded that there was no statistically significant difference between male and female subjects (Kigera & Mukwaya, 2011). A similar study in the Andhra population of India concluded that unilateral agenesis was more common on the left side and more likely in female subjects (Devi Sankar et al., 2011). Eric et al. (2011) conducted a study on Caucasian subjects in order to determine the prevalence of the PL in relation to hand dominance, and concluded that right sided absence was more common in left-handed persons while left-sided absence was more common in right-

handed persons and unilateral tendon absence was more common on the non-dominant hand. The research by Ndou et al. (2010) showed that there is no statistically significant difference between unilateral and bilateral absence of PL and also none between males and females.

Mbaka and Ejiwunmi (2009) studied a Yoruba population in Nigeria and found no statistically significant difference in unilateral absence between males and females. Kapoor et al. (2007) in their study concluded that the prevalence of agenesis was significantly more common on the left and males were more likely to have unilateral agenesis while females were more likely to have bilateral agenesis. In the study on a Turkish population, absence of PL in women was statistically more common than men; but there was no significant difference between body sides (Kose et al., 2009). Thompson et al. (2001) studied 300 Caucasians and reported that even though unilateral and bilateral agenesis were more common in males, it was not statistically significant.

Some studies have also been conducted on the PL and anomalies of neighboring structures. Abledu and Offei (2014) studied agenesis of PL and other associated anomalies such as functional loss of flexor digitorum superficialis (FDS) to the little finger or anomalous superficial palmar arch and found no correlation. Alzahrani et al. (2017) studied 331 subjects and reported bilateral absence of palmaris longus and FDS to be 15.1 and 14.8% respectively.

2.4 Testing methods

There are many tests that have been used to assess the presence of the PL in living subjects. These testing methods have been shown to have different accuracies. The first test to be described is the Shaeffer's (traditional) test in which oppose the thumb and the little finger are opposed while the wrist is slightly flexed (Kigera & Mukwaya, 2012). Sandeep et al. (2006) in their study on the Chinese population assessed the accuracy of the following tests; Shaeffer's test, Thompson's test, Mishra's test I, Mishra's test II and Pushpakumar's test; the study concluded that although the clinical tests for the palmaris longus are equally effective, the Mishara's first test was the easiest to explain to the

subjects and seems the best to assess for the presence of the palmaris longus. Kyung et al. (2012) studied the accuracy of three tests, namely, the Traditional test, Mishra's test II and the Gangata test and concluded that the Shaeffer's traditional test with 93% effectiveness was the most accurate in determining the presence or absence of PL. Kigera and Makwaya (2012) studied the accuracy of 10 common testing methods and concluded that the Standard test best demonstrates the palmaris longus with 98.1% accuracy. Barkats (2014) used the Thompson, Shaeffer, Pushpakumar, Mishra, Hiz-Ediz and Gangata tests to demonstrate a case of hypertrophied palmaris longus in the left forearm of a female subject.

3. MATERIALS AND METHODS

3.1 Time and place

The study was conducted in 3 schools within the Nicosia (Lefkoşa) district of North Cyprus. The schools are Turkish High School of Nicosia (Lefkoşa Türk Lisesi), Turkish Education College (Türk Maarif Koleji) and Near East University. The study was conducted from June to October 2019.

3.2 Type of study

The study is a cross sectional study. The sampling was done sequentially until the target population is reached.

3.3 Sample size

The sample size was determined using the population of 300,000 North Cypriots (www.worldpopulationreview.com, Accession date: 20 April 2019), confidence interval of 95% and a margin of error of 3% and was calculated to be 1,064.

3.4 Study population

The study will be carried out on males and females who fall within the age range of 10 to 60 years. The verbal consent was asked to the subjects before conducting the study.

3.4.1 Inclusion criteria

Consenting and healthy males and females whose age falls within the range of 10 to 60 years were included in the study.

3.4.2 Exclusion criteria

Subjects with hand and wrist deformities, previous injuries or surgeries in the forearm and wrist, less than 10 years age or above 60 years, were excluded from the study.

3.5 Data collection method

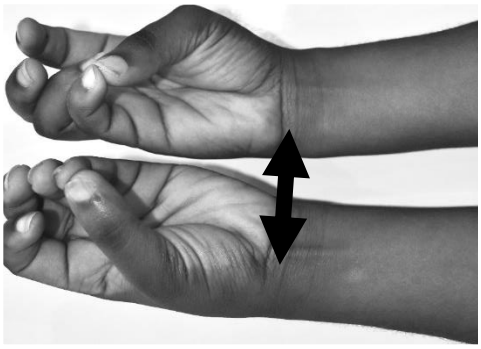
The data was collected using a specially prepared data collection table and the information was entered by the researcher. The table contains socio-demographic characteristics (age, sex), handedness of the subject (left or right hand dominant) and distribution based on nationalities and/or regions of the subjects. The remaining columns capture information on whether the PL was present or absent. If present, the type of tendon is described in the next column. The last columns show the testing methods for the presence or absence of PL.

3.5.1 Testing methods

The anterior aspect of the distal forearm was examined for the palmaris longus muscle and its variations. The Shaeffer's test was used to determine the presence of the PL tendon. Three other testing methods were used if the tendon was not visualized: Thompson's test, Pushpakumar's test, and Bhattacharya's test. In cases where the tendon was absent after these 4 tests, palpation was the final method used to confirm absence of the PL.

3.5.1.1 Shaeffer's Traditional Test

This involves slight wrist flexion while the thumb opposes the 5th digit (Adejuwon et al., 2012; Alves et al., 2012; Kyung et al., 2012; Roohi et al., 2007).



Picture 1a. Shaeffer's traditional method showing bilateral palmaris longus tendon

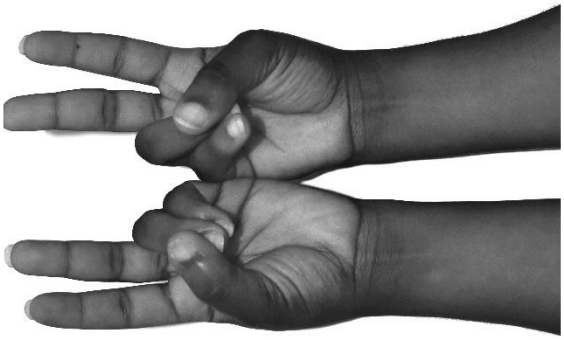
3.5.1.2 Thompson's Test

This involves making a fist while flexing the wrist against resistance with the thumb placed over the fingers (Adejuwon et al., 2012; Alves et al., 2012; Kigera & Mukwaya, 2011).

Picture 1b. Thompson's test showing normal bilateral palmaris longus

3.5.1.3 Pushpakumar's 2-finger Test

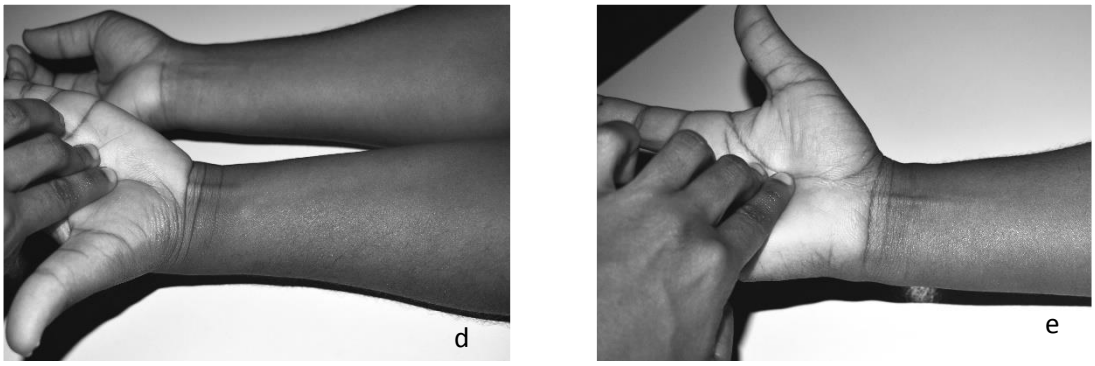
This involves fully extending the index and middle fingers while fully flexing the wrist and other fingers with the thumb opposed and flexed (Adejuwon et al., 2012; Kigera & Mukwaya, 2011; Mbaka & Ejiwunmi, 2009).



Picture 1c. Pushpakumar's 2 finger test showing normal bilateral palmaris longus tendon

3.5.1.4 Bhattacharya's Test

The wrist is flexed against resistance (Adejuwon et al., 2012; Kigera & Mukwaya, 2011).



Picture 1d. Bhattacharya's wrist flexion against resistance showing normal palmaris longus tendon on the left and (e) on the right

3.6. Data analysis

The data collected was entered into a Microsoft Excel spreadsheet then exported to SPSS version 20. All statistical analyses were carried out using SPSS. These include frequencies, percentages and chi-square tests. A value of $p < 0.05$ was considered to indicate a statistical significance between variables and the degree of freedom was taken as 1.

3.7. Ethical considerations

The study was done after approval of the Ethical Board of the Institute of Health Sciences, Near East University (Enclosure 1) and the Ministry of Education, North Cyprus (Enclosure 2). Informed consent was sought from participants before the study was carried out.

3.8 Limitations

Due to the numerous variations of the PL especially in terms of attachments, which cannot be studied by physical, clinical assessments alone, one of the limitations is the difficulty in assessing all the variations of PL.

The sample size of the study is little compared to the general population, as a consequence, the result cannot be used to make a generalization. Comparisons based on nationalities and/or regions could not be made because of the uneven distribution of the subjects.

4. FINDINGS

4.1 Socio-demographic features

A total of 1,280 subjects were examined in three schools in the Nicosia District of North Cyprus; of these subjects, 660 were females and 620 were males (Table 1). The age range in this study was between 10 years to 60 years.

Table 1. Socio-demographic characteristics of participants (Nicosia, 2019) (N=1280)

Gender	n	%
Female	660	51.6
Male	620	48.4
Father's nationality and/or region		
Cypriot	633	42.8
Turkish	517	38.7
Arab	66	13.5
African	45	3.2
Other*	18	1.8
Mother's nationality and/or region		
Cypriot	623	48.7
Turkish	529	41.3
Arab	67	5.2
African	44	3.4
Other*	17	1.3

***Other includes Bulgarians, Turkmenistans, Russians, Iranians and Afghans**

The father's ethnic group distribution was recorded as Cypriots (42.8%, n=633), Turkish (38.7%, n=517), Arabs (13.5%, n=66), Africans (1.8%, n=45), and others (3.2%, n=18). The mother's ethnic group was found to be Cypriots (48.7%, n=623), Turkish (41.3%, n=529), Arab (5.2%, n=67), Africans (3.4%, n=44) and others (1.3%, n=17).

4.2 Variations of the palmaris longus

Out of the total study subjects (N=1280), palmaris longus agenesis was found in 223 cases (17.4%). 28 cases (2.6%) showed a split (bifid) tendon and 3 cases (0.2%) presented with a laterally shifted tendon (Figure 1).

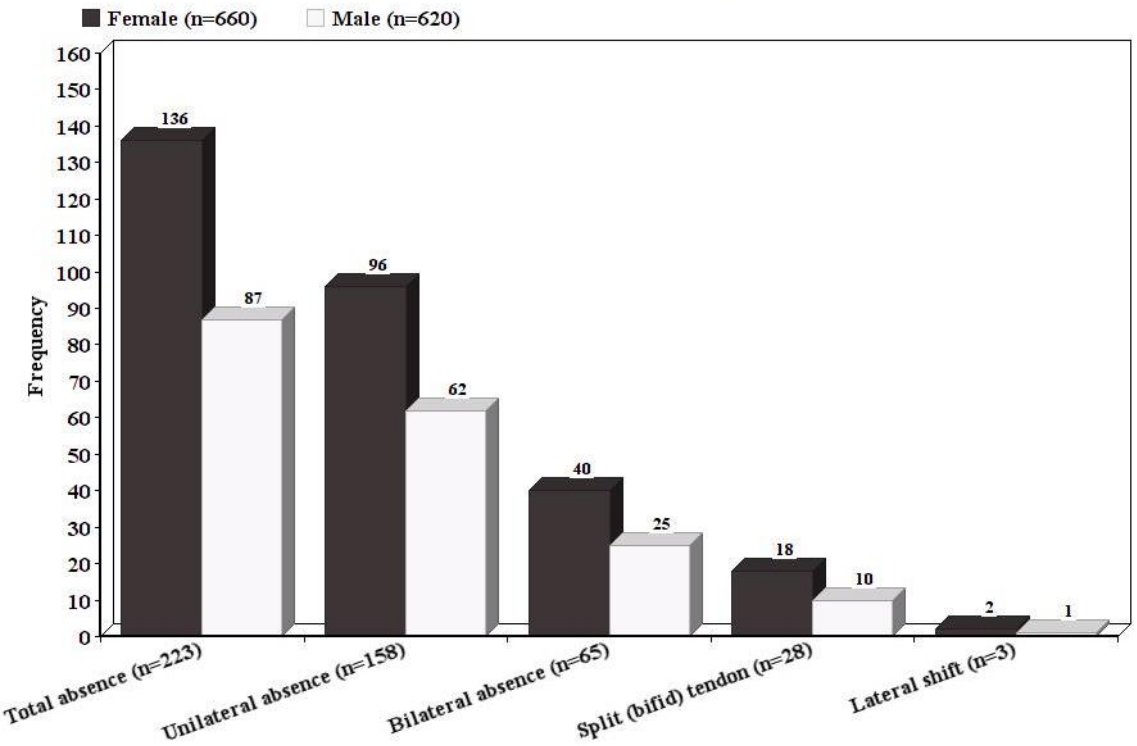


Figure 1. Distribution of variations of palmaris longus based on sex (Nicosia, 2019)(N=1280)

4.2.1 Palmaris longus agenesis

The overall frequency of absence of palmaris longus muscle in both males and females, either unilaterally or bilaterally was found to be 17.4% (n=223)(Table 2).

Table 2. Sex distribution of palmaris longus absence (agenesis) (Nicosia, 2019)(n=223)

PL absence	Female		Male		Total	%
	n	%	n	%		
Unilateral absence (Right)	19	47.5	21	52.5	40	100
Unilateral absence (Left)	77	65.3	41	34.7	118	100
Bilateral absence	40	61.5	25	38.5	65	100
Total	136		87		223	

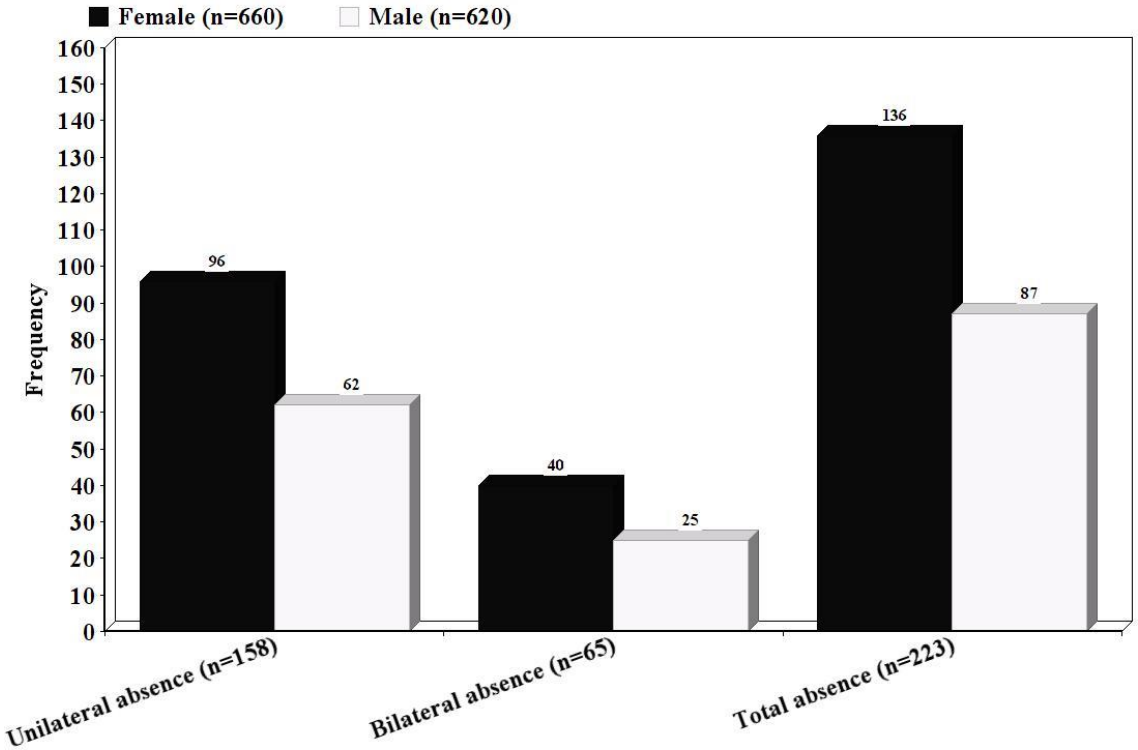
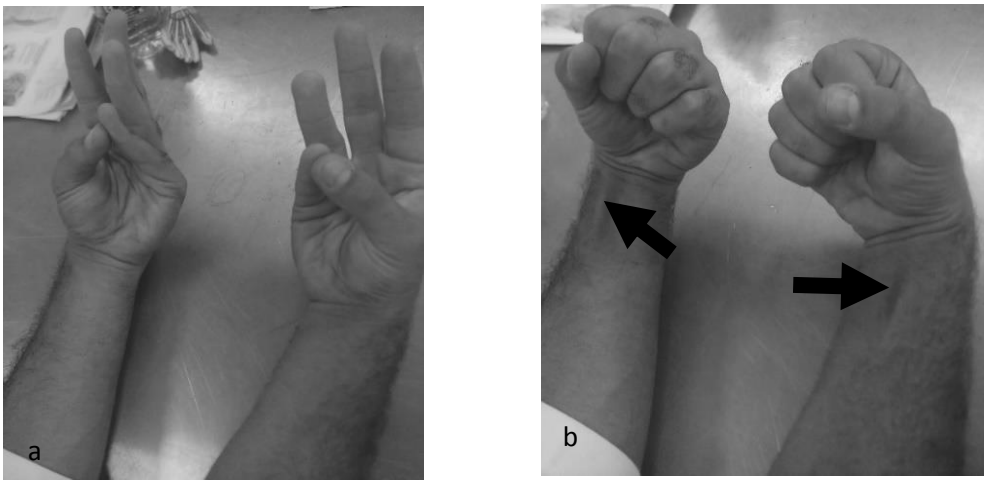


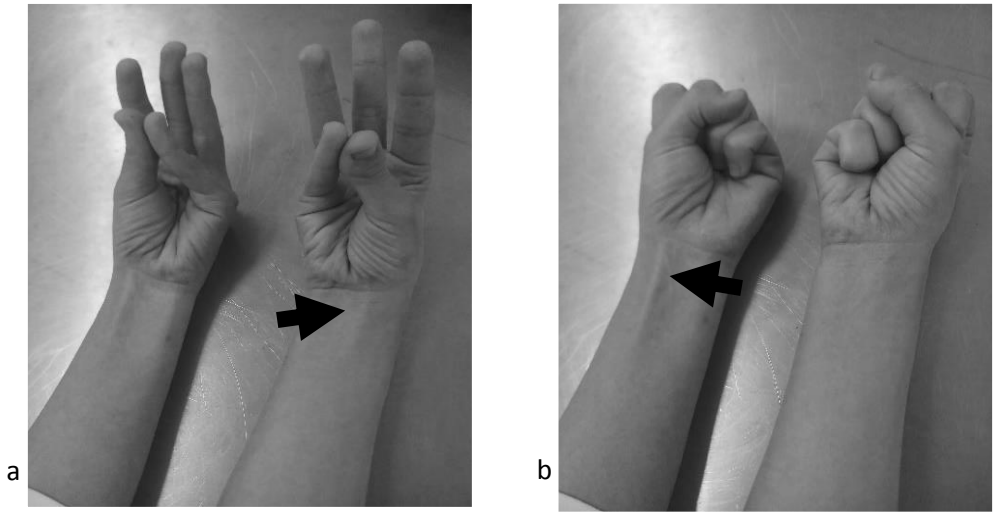
Figure 2. Distribution of palmaris longus absence (Nicosia, 2019)(N=1280)

Out of the total, unilateral absence was observed to be 158 (12.3%), of which right unilateral absence was 40 (3.1%) and left unilateral absence was 118 (9.3%). The frequency of bilateral absence of palmaris longus was observed to be 65 (5.1%). The

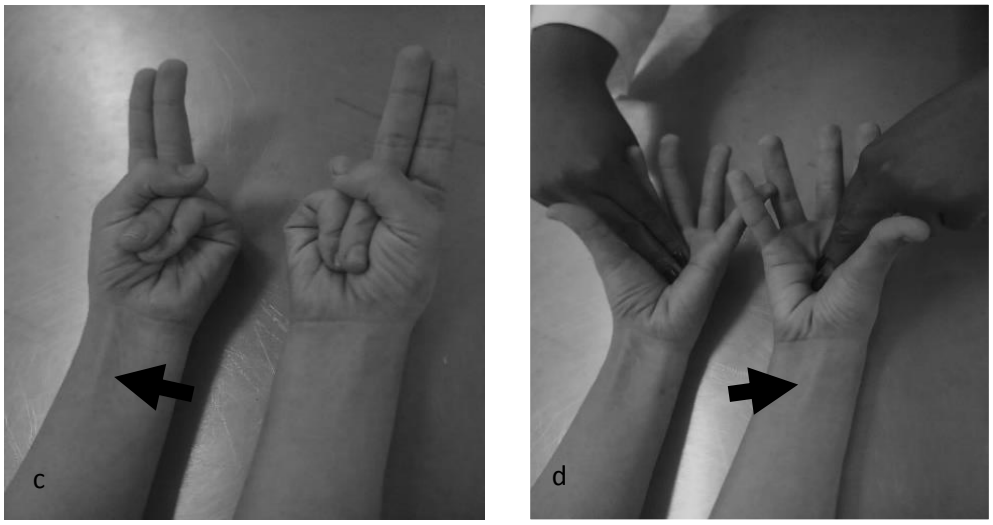
distribution of absence is based on gender is given by Figure 2. The preceding pictures the cases of bilateral absence in both males and females.



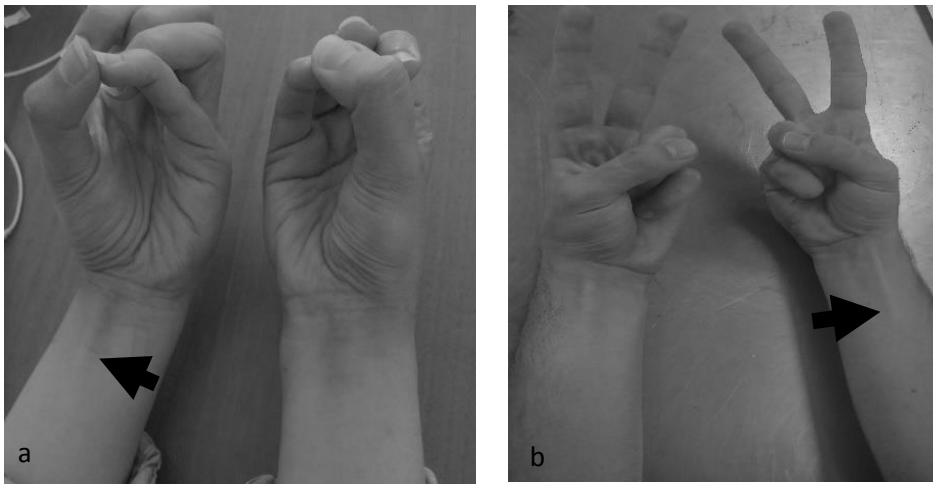
Picture 2. Bilateral absence of palmaris longus in a 20y old Cypriot male demonstrated by (a) Shaeffer's test for which the tendon could not be visualized (b) Thompson's test clearly showing the bilateral absence of palmaris longus tendon. Only the tendons of flexor carpi radialis (arrow heads) were present in the distal forearms of both right and left sides.



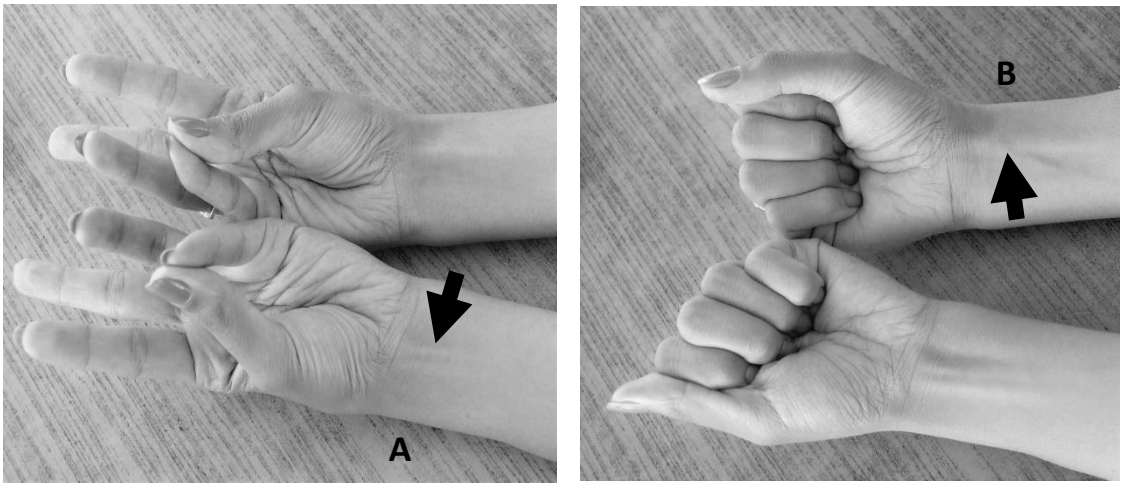
Picture 3. Bilateral absence of palmaris longus tendon in a 22y old Persian female demonstrated by (a) Shaeffer's test (b)Pushpakumar's 2-finger test



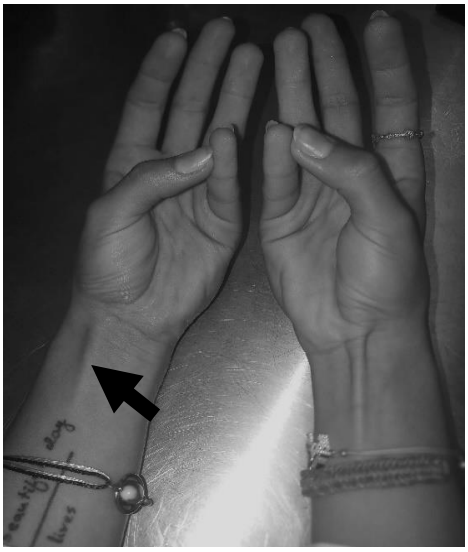
Picture 3. Bilateral absence of palmaris longus tendon in a 22y old Persian female demonstrated by (c)Thompson's test (d) Bhattacharya's wrist flexion with resistance. Only tendons of flexor carpi radialis are visible (arrows).



Picture 4. Bilateral absence of palmaris longus in a 20y old Arab female (a) and a 23y old Turkish male (b) demonstrated by the Shaeffer's test. Only tendons of flexor carpi radialis are present (arrows)



Picture 5. Unilateral absence of palmaris longus tendon on the right forearm of a 30y old Afghan female. The arrow A is pointing towards the tendon of palmaris longus on the left; B is pointing towards the flexor carpi radialis which has become more prominent due to absence of palmaris longus.



Picture 6. Unilateral absence of palmaris longus on the left forearm of a 19y old Cypriot female. The arrow shows the tendon of flexor carpi radialis on the left.

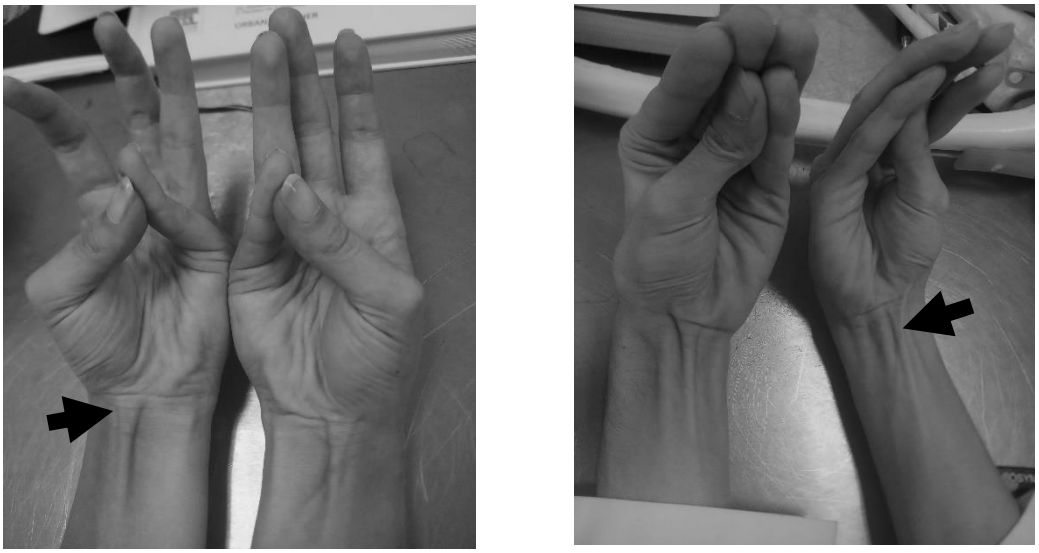
The distribution of palmaris longus agenesis among the different nationalities and/or regions was found to be 96 (7.5%) for Cypriots, 86 (6.7%) for Turkish, 30 (2.3%) for Arabs, 4 (0.3%) for Africans and 7 (0.5%) for others (Table 3).

Table 3. Distribution of palmaris longus absence based on nationalities and/or regions (Nicosia, 2019)(N=1280)

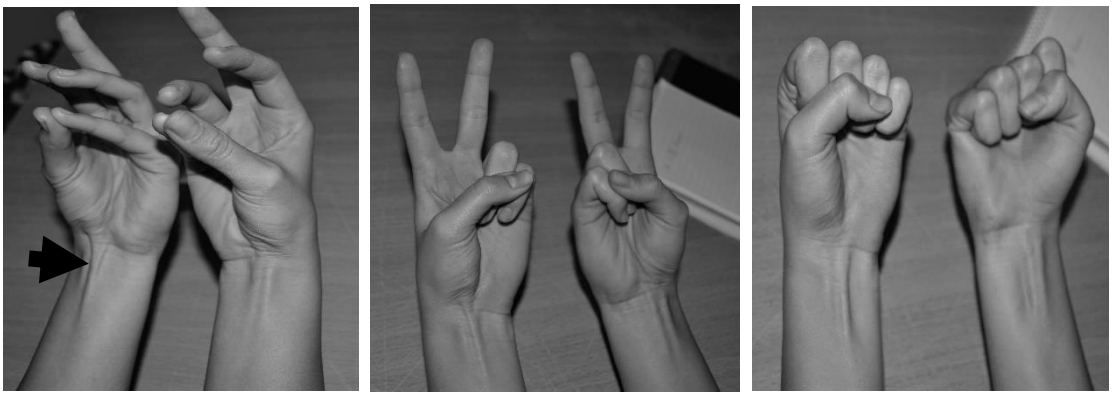
	Right Absence		Left Absence		Bilateral Absence		Total	
	n	%	n	%	n	%	n	%
Cypriot (n=633)	20	20.8	43	44.8	26	27.1	96	100
Turkish (n=517)	16	18.6	45	52.3	32	33.3	86	100
Arab (n=66)	2	6.7	25	83.3	3	10	30	100
African (n=45)	1	25.0	1	25.0	2	50	4	100
Others (n=18)	1	14.2	4	57.1	2	28.6	7	100
Total	40		118		65		223	

4.2.2 Split (bifid) tendon of palmaris longus

The presence of a split tendon was observed in 28 subjects (2.6%); 24 cases occurred on the right, 2 on the left, and 2 bilaterally. One Turkish male (Picture 7) and one Turkish female subject presented with bilaterally split PL; while another, a Turkish male presented with a laterally displaced tendon on the right forearm and a split tendon on the left forearm. One of the cases of left unilateral split tendon was observed in a Russian female (Picture 8).



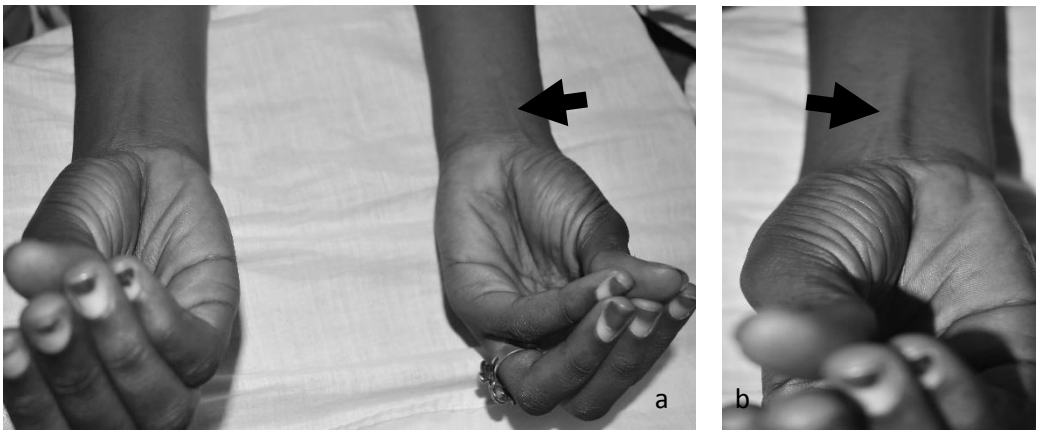
Picture 7. Bilateral split tendon of palmaris longus in a 23y old male Turkish subject. In both forearms, the tendon split into a Y or V shape as shown by the arrow heads.



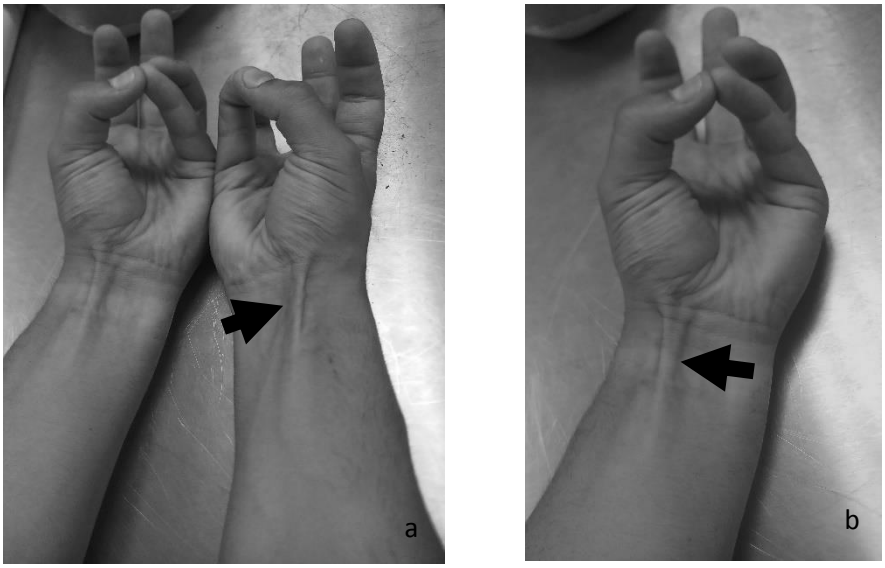
Picture 8. Left split tendon (shown by arrow head) in a 22y old Russian female visualized by (a) Shaeffer's test and (b) Pushpakumar's 2-finger test. (c) Thompson test showing the tendons of the palmaris longus but the splitting

4.2.3 Laterally displaced tendon of palmaris longus

Out of the total number of cases that presented with PL tendon (n=1057), 3 cases (0.2%) were observed to have a laterally displaced tendon (Picture 9); 2 cases were females (an African and a Turk) and the other was a Turkish male (Picture 10).



Picture 9 (a). Laterally displaced tendon of palmaris longus on the left distal forearm of a 16y old African female (b) Right forearm of same subject showing a split tendon of palmaris longus



Picture 10 (a). Laterally displaced tendon of palmaris longus in the right distal forearm of a 24y old Turkish male (b) Split tendon of palmaris longus on the right in the same subject

4.3 Relationship between PL variations and gender, body side and handedness

4.3.1 PL variations and gender

The overall difference in palmaris longus agenesis between males and females is statistically significant ($p < .05$), which implies that females have a higher frequency of absence of palmaris longus muscle (Table 4).

Table 4. Relationship between absence of palmaris longus and gender (Nicosia, 2019)(N=1280)

Gender	Present		Absent		Total	x^2	p-value
	n	%	n	%			
Female	524	79.4	136	20.6	660	9.61	0.002
Male	533	86.0	87	14.0	620		
Total	1057		223		1280		

While trying to find a correlation between the occurrence of the split tendon and gender, the result was not statistically significant ($p > .05$). Although the frequency of a split tendon was higher in females, the chi-square test was not statistically significant (Table 5).

Table 5. Correlation between split tendon and gender (Nicosia, 2019)(N=1280)

Tendon	Normal		Split		x^{2*}	P-value
	n	%	n	%		
Male	533	98.2	10	1.8	1.39	0.238
Female	524	96.7	18	3.3		
Total	1057		28			

***Yates correction**

4.3.2 PL variations and laterality/body side

Concerning laterality or body side, there is also significant statistical difference ($p < .05$) between right and left sides, which means that palmaris longus agenesis occurs more frequently on the left side (Table 6).

Table 6. Laterality in palmaris longus muscle absence (Nicosia, 2019)(N=1280)

Laterality	Present		Absent		Total	x^2	P-value
	n	%	n	%			
Right	1240	96.9	40	3.1	1280	41.04	P<0.001
Left	1162	90.8	118	9.2	1280		

The correlation between body side, gender and frequency of absence of the palmaris longus, was statistically significant ($p < .05$), which implies that PL agenesis is more likely to occur in females and on the left side (Table 7).

Table 7. Relationship between gender, laterality and absence of palmaris longus (Nicosia, 2019) (n=223)

Gender	Right		Left			
	n	%	n	%	x^2	p-value
Male	21	33.8	41	66.1	3.95	0.047
Female	19	19.8	77	80.2		
Total	40		118			

The result of the correlation between body side and occurrence of a split tendon was statistically significant at $p < .05$, and shows that the split tendon is more likely to occur on the right side (Table 8).

Table 8. Relationship between body side and split tendon of palmaris longus (Nicosia, 2019)(N=1280)

	Normal		Split tendon		Total	x^{2*}	p-value
	n	%	n	%			
Right	1240	98.1	24	1.9	1264	13.40	p<0.001
Left	1162	99.7	4	0.3	1166		

***Yates correction**

4.3.3 PL variations and hand dominance

Out of the 1280 subjects, 1214 were right handed and 66 were left handed. 40 cases showed absence of PL on the right and 118 on the left. Out of the total 223 cases of absence, bilateral absence occurred in 57 right hand dominant subjects and 8 left hand dominant subjects.

Left sided unilateral absence occurs in 109 right handed subjects and 9 left handed subjects while right sided unilateral absence occurred in 37 right handed subjects and 3 left handed subjects. The relationship between handedness and frequency of absence of palmaris longus is statistically significant ($p < .05$) in that the absence is more likely to occur in the non-dominant hand. The p – value for the left hand is < .001 which means PL agenesis is more likely to occur on the left side in a right handed individual (Table 9).

Table 9. Relationship between handedness and frequency of absence palmaris longus (Nicosia, 1280)(N=1280)

	Handedness		Absence of PL		x^2	p-value
	n	%	n	%		
Right	1214	96.8	40	3.2	609.27	P < 0.001
Left	66	35.9	118	64.1		
Total	1280		158			

All the cases of the split tendon occurred in right handed subjects, so a comparison couldn't be made. There were only 3 cases of a laterally displaced tendon, so no statistical analysis could be made.

5. DISCUSSION

The tendon of palmaris longus muscle (PL), an anterior forearm flexor muscle is found at the level of the wrist lying between the tendons of flexor carpi ulnaris and flexor carpi radialis. Various studies have reported many different variations of the tendon of PL, especially its absence. More studies have been conducted to establish a correlation of the absence of PL to body side, gender and hand dominance.

In this study, the overall frequency of absence of PL among the North Cyprus population was found to be 17.4% (Table 2). This value is comparable to the study by Lamichchane et al. (2017) that recorded a 17.09% frequency of absence among first year Filipino medical students. A similar study conducted on 500 Indian subjects recorded a similar prevalence of absence of 17.2% (Sebastin et al., 2005). Another study on an Indian population also reported a similar prevalence of 17.2% (Kapoor et al., 2008). The value is also somewhat similar to the worldwide prevalence of absence of 15% (Drake et al., 2014). A study in Van, Turkey also recorded a total prevalence of 15.1% (Hiz et al., 2011). Higher prevalence of PL agenesis have been given in Chilean subjects as 21% (Alves et al., 2011), in Iran as 22.8% (Lahiji et al., 2013), in Caucasians (25%) in the study by Thompson et al. (2001), Turkey (26.6%) in the study by Kose et al. (2009), Nigeria (26.7%) by Adejuwon et al. (2012); India (28%) in the study by Devi Sankar et al. (2011) and 40.5% in Saudi Arabia (Alabbad et al., 2018). The study by Ceyhan and Mavt (1997) in the Gaziantep population of Turkey reported the highest prevalence of 63.9%. Many studies have recorded lower prevalence of absence especially in studies conducted in Africa and Asia. Ndou et al. (2010) reported 11.5% in South Africa; Lahiji et al. (2013) studied Iranian subjects and reported 10.2% prevalence of absence; Roohi et al. (2007) reported total prevalence of 9.3% in Malaysia; Yoruba population of Nigeria (6.7%) according to Mbaka and Ejiwunmi (2009); East Africa (Kigera & Mukwaya, 2011) as 4.4%; Korea (4.1%) by Kyung et al. (2012); Ghana (3.8%) by Abledu and Offei (2014); Zimbabwe (1.6%) by Gangata (2009).

Out of the total prevalence of absence in this study (17.4%), a total of 158 (12.3%) cases exhibited unilateral absence while 65 (5.1%) cases showed bilateral absence (Picture 2).

In the unilateral cases, 40 subjects (3.1%) exhibited unilaterality on the right, and 118 (9.3%) showed left unilateral absence (Figure 2). From this study, it was inferred that there is a higher frequency of unilateral absence of the PL tendon. This is supported by Alves et al. (2011) that reported that of the total prevalence of absence of 21%, 11% were unilateral and 9% bilateral. Roohi et al. (2007) also recorded 6.4% unilateral absence and 2.9% bilateral absence, out of the total 8.3%. Also, the East African study (Kigera & Mukwaya, 2011) reported that out of the total 4.4% cases of absence, 3.3% were unilateral and 1.1% were bilateral. The current study however contrasts with Lahiji et al. (2013) that reported a higher incidence of bilateral absence (6.7% out of the total 10.2%). Some other studies show no significant difference between unilateral and bilateral cases; Adejuwon et al. (2012) reported that of the 26.7% cases of absence, 13% were unilateral and 13.7% were bilateral. In the current study, the unilateral cases were 3.1% on the right (Picture 5) and 9.3% on the left (Picture 6). This contrasts with the study by Lahiji et al. (2013) which showed a higher distribution on the right side (10.2%) compared to the 5.9% on the left. In comparison, the study by Adejuwon et al. (2012) which showed equal distribution on both right and left sides (5.6%), same as the study by Abledu and Offei (2014) which showed 1.4% prevalence of absence on both sides. The study by Alves et al. (2011) showed a slightly higher prevalence on the left (6%) compared to the 5% on the right side.

Studies have tried to correlate the frequency of absence of the PL with gender. Alves et al. (2011) reported a higher frequency of absence in females (15.1%) compared to males (11.2); of these cases, 9.0% cases were on the left side. The current study also showed a higher frequency of absence in females (10.6%) compared to the males (6.8%). The relationship between gender and absence of the PL was statistically significant at $p < .05$. The total frequency of absence on the right side was 3.1% while on the left, it was 9.2%; 19 of the female subjects (1.9%) had unilateral absence on the right and 77 (6.0%) had unilateral absence on the left; while the male frequency of absence was 1.6% on the right and 3.2% on the left. In this study, the p – value for the left was statistically significant at $p < .05$ (Table 6). This finding is also supported by Cetin et al. (2013) that reported 37.5% absence in females and 27.9% in males, with p – value for left hand

being 0.017. Adejuwon et al. (2012) also reported a higher frequency of absence in females and on the left. In contrast, Kyung et al. (2012) reported a higher frequency of absence in males (4.7%) compared to 3.3% in females, with no statistically significant difference as to laterality. Roohi et al. (2007) reported a higher frequency in females (11.5% compared to 7.1% in males) but there was no statistically significant difference in laterality as the p – value for the left was 0.105. This finding contrasts the studies by Lahiji et al. (2013) and Ndou et al. (2010), which showed no statistically significant difference in genders. Alves et al. (2011) reported that the PL is most frequently absent on the left side and in women, but the statistical test was not significant.

The current study recorded a bilateral absence of PL in 57 (4.5%) right hand dominant subjects and 8 (0.6%) in left hand dominant subjects. 109 cases (8.5%) had unilateral absence on the left side while 9 cases (0.7%) had unilateral absence on the left side. On the other hand, 37 right-handed subjects (2.9%) had unilateral absence on the right; while 3 (0.2%) left-handed subjects had absence on the right. The difference between right and left hand dominance and frequency of absence of PL was statistically significant (p – value is $< .001$ at $p < .05$), which means that absence of PL was more likely to occur in the non-dominant hand (Table 9). This finding is supported by the Eric et al. (2011) study which concluded that right-sided absence was more common in left-handed persons while left-sided absence was more common in the right-handed persons. Kigera and Mukwaya (2011) are reported similar findings that PL agenesis is more likely to occur in a non-dominant hand. Abledu and Offei (2014) reported no significant difference in terms of gender, body side and handedness, but concluded that the absence of PL tendon was more likely to occur in the non-dominant hand. Lahiji et al. (2013) reported a contradicting result that there is a significant relationship between PL agenesis and left hand dominance, that those with PL agenesis were 3.7 times more likely to be left-hand dominant and left handed people were 3.7 times more likely to have PL agenesis. No other study has reported similar findings. Kyung et al. (2012) on the other hand, concluded that there was no relationship between hand dominance and PL absence.

The study also documented 28 cases (2.5%) of the total number of those that are positive for the PL tendon) of a split (bifid) tendon of PL, of which 10 (0.9%) cases occurred in males and 17 (1.6%) in females. Although the frequency of a split tendon was higher in females, the chi-square test was 1.43 and p-value was .23 which is $p > .05$ (Table 5); this implies that the difference in gender is not statistically significant. In the cases with split tendon, 24 cases occurred on the right, 1 bilaterally and 2 on the left side. The chi-square test was 14.86 and p – value was < 0.001 which is statistically significant at $p < .05$, which means that the split tendon is more likely to occur on the right side (Table 8). However, no similar studies were found to compare and contrast this result. In the literature, Alshalam et al. (2010) made a case report of 2 cases of an anomalous V-shaped bifid tendon of PL.

There were 3 cases (0.2%) of a laterally displaced tendon of PL on right forearms of a Turkish male (Picture 10), Turkish female and the left forearm of an African female (Picture 9). Gangata (2009) reported a lateral shift in the tendon of PL in 1.1% of subjects.

The frequency of absence in the ethnic groups of North Cyprus could not be compared as there were no similar studies in the region to compare. No other abnormalities have been observed in this study.

6. CONCLUSION

In summary, the study investigated 1280 subjects out of which 660 were females and 620 were males. The overall frequency of absence of PL in North Cyprus, based on this study was 17.4% (10.6% females and 6.8% males). Females have a higher frequency of absence and on the left side as the statistical analysis was significant at $p < .05$. PL absence is more likely to occur in the non-dominant hand and statistical analysis was also significant at $p < .05$. Other variations of PL observed were 28 cases (2.5%) of split (bifid) tendon and 3 cases (0.2%) of laterally displaced tendon of the PL. There was no statistically significant difference in the presence of split PL in terms of gender; however, occurrence of the tendon on the right was statistically significant at $p < .05$.

The goals of this research were to establish the frequency of surface anatomical variations in the different races in North Cyprus and to correlate these variations with gender, body side and hand dominance. All these have been established in this research. The frequency of absence was 17.4%, frequency of split tendon was 2.5% and lateral tendon was 0.2%. There was significant statistical correlation between these variations, gender, body side and hand dominance. From this study, it can be concluded that PL agenesis is more likely to occur in females and on the left side, and in the non-dominant hand.

6.1 Recommendations

1. One of the limitations of this research was the sample size and the study area. Out of the 300,000 population of North Cyprus, the research only captured 1280 subjects and only in the Lefkosa district. Therefore, it is recommended that similar studies be carried out in other districts and larger sample sizes, in order to have in depth results.

2. In this research, only surface anatomical variations of the palmaris longus were studied. For a detailed understanding of these variations, several studies have to be undertaken including cadaveric studies and radiological investigations.

3. Other studies need to be conducted to associate variations of the PL and other muscle tendons in the distal forearm.

4. It is recommended that further researchers need to be conducted to establish if there is any difference in hand function for those with absent palmaris longus or those with variations in the tendon.

5. More studies need to be done regarding the use of palmaris longus for reconstructive surgeries here in North Cyprus and to compare with other muscles in terms of advantages and disadvantages.

7. REFERENCES

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ATTACHMENTS

Annex 1.

ANATOMICAL VARIATIONS OF THE PALMARIS LONGUS: A SURFACE STUDY OF THE NORTH CYPRUS POPULATION

DATA COLLECTION TABLE

Dear participant,

Thank you for agreeing to participate in this study which involves an **observation** for the **presence of the palmaris longus muscle** in the forearm. This is a **Masters thesis** for **Near East University**. The study also includes taking **photographs** of the forearm. The information you provide will be used for **research purposes** and your responses will be completely **anonymous**. Your name will not appear anywhere. Your participation means you have given your **consent**.

If you have any questions, please do not hesitate to ask.

S/N	**Initials**	**Sex**	**Age**	**Handedness**		**Ethnic Group**		**PLM (+/-)**			**Tendon**				**Testing methods** I (Shaeffer's test); II (2 finger test); III (Wrist flexion against resistance); IV (Thompson's test)				**Palpation**
				R	L	**Mother**	**Father**	R	L	B	N	Split	Double	Other	I	II	III	IV	

S/N	Initials	Sex	Age	Handedness		Ethnic Group		PLM (+/-)			Tendon				Testing methods I (Shaeffer's test); II (2 finger test); III (Wrist flexion against resistance); IV (Thompson's test)				Palpation
				R	L	**Mother**	**Father**	R	L	B	N	Split	Double	Other	I	II	III	IV	

Annex 2.

KUZEY KIBRIS TÜRK CUMHURİYETİ
MİLLİ EĞİTİM VE KÜLTÜR BAKANLIĞI
GENEL ORTAÖĞRETİM DAİRESİ MÜDÜRLÜĞÜ

Sayı : GOÖ.0.00-174/06-19-E.3745 13 Mayıs 2019

Konu : Maryam Aliyu'nun Anket Başvurusu Hk.

Sayın Maryam ALİYU

İlgi : 9 Mayıs 2019 tarihli ve TTD.0.00-174/06[174/06]-19-E.678 sayılı yazınız.

Talim ve Terbiye Dairesi Müdürlüğü'nün ilgi yazısı uyarınca "Palmaris Longus'un Anatomik Varyasyonları: Kuzey Kıbrıs Nüfusu Üzerine bir yüzey Çalışması (Anatomical Variations Of The Palmaris Longus: A Surface Of Tje North Cyprus Population) konulu çalışmanız incelenmiş olup, yapılan ineleme sonucunda;

- Tüm bireyi tanıma teknikleri; gizlilik ve gönüllülük ilkelerine dayalı olarak yapılmalı ve çalışmaya katılan tüm katılımcıların kimlik bilgileri gizli tutulmalıdır.
- Araştırma sonuçlarına ilişkin geri bildirimler; ailelerin ve öğrencilerin, etkilenmesine karşılık gelmeyecek şekilde iletilmelidir.
- Okul idaresi, öğrenci ve veliler, çalışmanın amacı ve uygulama süreçleri hakkında detaylı bilgilendirilmeli, uygulama için gerekli etik ilkeler, yazılı olarak okul yöneticilerine ve ailelere iletilmeli ve yazılı izinler alınmalıdır.
- Çalışmanın her aşamasında pdagojik formasyona sahip bir uzman ve/veya okulun Psikolojik Danışman ve Rehber Öğretmeni liderlik üstlenmelidir.

Gerçekleştirilecek çalışma; ugulanacak okulların bağlı bulunduğu okul müdürlüğüyle istişarede bulunulup, görüşmenin ne zaman uygulanacağı birlikte saptanmalı ve **yukarıda belirtilen hususların yerine getirilmesi** koşulu ile uygun görülmüştür.

Çalışmayı uyguladıktan sonra sonuçlarının Talim ve Terbiye Dairesi Müdürlüğü'ne ulaştırılması gerekmektedir.

Bilgilerinize saygı ile rica ederim.

e-imzalıdır
Aktan ERDOĞA
Daire Müdürü

Not: 93/2007 sayılı Elektronik İmza Yasası 'nın 6.maddesi gereği bu belge elektronik imza ile imzalanmıştır.

Evrak Doğrulama Kodu : CYQCUKCVHAQQQAGAPCOS Evrak Takip Adresi: http://dogrulama-ebys.gov.ct.tr
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Bilgi için:Pınar CANTÜRK
2.Derece 1.Sınıf Katip

Annex 3.

EK-883-2019

YAKIN DOĞU ÜNİVERSİTESİ
BİLİMSEL ARAŞTIRMALAR ETİK KURULU

ARAŞTIRMA PROJESİ DEĞERLENDİRME RAPORU

Toplantı Tarihi :02.05.2019
Toplantı No : 2019/68
Proje No : 807

Yakın Doğu Üniversitesi Tıp Fakültesi öğretim üyelerinden Prof. Dr. Mehtap Tiryakioglu'nun sorumlu araştırmacısı olduğu, YDU/2019/68-807 proje numaralı ve **"Anatomical variations of the palmaris longus: A surface study of the North Cyprus population"** başlıklı proje önerisi kurulumuzca değerlendirilmiş olup, etik olarak uygun bulunmuştur.

1. Prof. Dr. Rüştü Onur (BAŞKAN)
2. Prof. Dr. Nerin Bahçeciler Önder (ÜYE) KATILMADI
3. Prof. Dr. Tamer Yılmaz (ÜYE)
4. Prof. Dr. Şahan Saygı (ÜYE)
5. Prof. Dr. Şanda Çalı (ÜYE) KATILMADI
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8. Doç. Dr. Ümran Dal Yılmaz (ÜYE)
9. Doç. Dr. Nilüfer Galip Çelik (ÜYE) KATILMADI
10. Doç.Dr. Emil Mammadov (ÜYE)
11. Doç. Dr. Mehtap Tınazlı (ÜYE) KATILMADI

CURRICULUM VITAE

Name	MARYAM	**Surname**	ALIYU
Place of Birth	Kano	**Date of Birth**	
Nationality	Nigerian	**Tel**	+905488335390
Email	maryamkurawa@gmail.com		

Education level

	Name of Institution where he/she was graduated	**Graduation Year**
Postgraduate		
Masters		
Undergraduate	Bayero University Kano	2013
High school	St Louis Secondary School, Kano	2004

Job Experience

Duty	**Institution**	**Duration (Year-Year)**
House Officer	Murtala Muhammad Specialist Hospital, Kano	2013-2014
Youth Corper	Muhammad Abdullahi Wase Specialist Hospital, Kano	2014-2015
Medical Officer	Aminu Kano Teaching Hospital, Kano	2016-2016
Lecturer II	Northwest University Kano	2016-date

Foreign Languages	**Reading comprehension**	**Speaking**	**Writing**
English	Very good	Very good	Very good
Arabic	Good	Moderate	Moderate

Computer Knowledge

Program	**Use proficiency**
Microsoft Office	Very good
Adobe Photoshop	Very good
Corel draw	Moderate
SPSS	Moderate