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E.I. Edibamode¹ R. S. Osaat² and E. B. Bekibele¹

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Authors and affiliations

¹Department of Anatomy, Faculty of Basic Medical Sciences, University of Port Harcourt

²Department of Anatomy, Faculty of Basic Medical Sciences, Federal University, Otuoke Bayelsa

edibamode.innocent@gmail.com, osaatrs@fuotuoke.edu.ng, ebrusbeks@gmail.com

Corresponding author: Osaat RS, Email Address: osaatrs@fuotuoke.edu.ng, 08060294136

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ABSTRACT

Despite the numerous actions and functions of the Palmaris longus, its absence and presence is of scientific and medical interest because it varies with sex, laterality, ethnicity, and population. This study investigated the prevalence of the presence and absence of the palmaris longus tendon in the Ikwerre ethnic group of Aluu community of Rivers State, Nigeria. A total of 384 subjects (192 males and 192 females) were recruited for the study. The study made use of the Schaeffer's test, and confirmation tests by Thompson's and Pushpakumar's. Results indicated that 147(76.6%) of females and 160(83.3%) of males exhibited bilateral presence of Palmaris longus tendon (PLT), while unilateral presence was noted in 30(15.6%) of females and 23(12.0%) of males. A total absence of 15(7.8%) and 9(4.7%) in females and males was observed respectively. The differences observed between prevalence of the presence and absence of Palmaris longus and gender, age, and sides (laterality) showed no statistical significant differences ($p>0.05$). Though no significant difference observed but the differences observed conformed to most researchers' reports and therefore means that if more sample size were employed for the research probably the differences could have shown significant difference. Therefore the study is recommended to the medical practitioners or scientists concerned to be used for the population understudy.

Keywords: Palmaris longus, prevalence, presence, absence, Aluu community

INTRODUCTION

Palmaris Longus has been a subject of considerable interest in the fields of anatomy, anthropology, evolution and clinical medicine due to its high rate of absence in certain populations (Yammine, 2014). As one of the muscles of the anterior compartment of the forearm, it passes between the flexor carpi ulnaris and flexor carpi radialis muscles, finally attaches to the flexor retinaculum, and to a thick deep fascia known as the palmar aponeurosis (Drake *et al.*, 2015). It is a weak flexion of the wrist and it tenses the palmar fascia, however its absence does not result in any significant impairment of hand function (Kuran, 2019). The PL is assumed to be of great clinical significance in reconstructive surgeries. Because of its length and diameter, It is a popular choice for tendon grafts in various reconstructive surgeries (Alva *et al.*, 2013) as it is easily accessible and again 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 (Abledu & 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 and Ejiwunmi, 2009).

Despite its uses or applications, studies revealed its high variability in ethnicity/population (Chakravarthy and Vasanthakumar, 2022). They reported a lesser prevalence in the African Antigua population than the standard incidence of 15% in the standard textbooks. Again in Nigeria, the South west population was reported to have high incidence of Palmaris longus (Kayode *et al.*, 2008). Palmaris longus is dependent on gender, its absence was common in females than males (Oviosun *et al.*, 2023) and on the left hand than the right hand (Oviosun *et al.*, 2023).

The Palmaris longus tendon 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 15% to 63.9% (Ioannis *et al.*, 2015; Lahiji *et al.*, 2013), though this may not apply to the entire world's population. Lower incidence too (0.6%) has been recorded in some populations (Kyung *et al.*, 2012). Its absence is the most prevalent variant being totally missing in certain situations, either bilaterally or unilaterally, which is more commonly seen on the left side (Kayode *et al.*, 2008).

Despite the several studies to determine the prevalence of the palmaris longus tendon in various ethnic groups worldwide, there is limited information on the Aluu community of Ikwerre ethnicity.

MATERIALS AND METHODS

The sample size was determined using the Cochran formula calculated as;

$$n = Z^2 p (1-q)/d^2$$

Where n = sample size, Z = confidence level, p = approximate proportion of the event in the population, d = margin of error

Assuming the maximum variability, which is equal to 50% (p=0.5) and taking a 95% (1.96) confidence level with a 5% margin of error, the calculation for the required sample size will be as follows:

$$n = 1.962 \times 0.50 (1 - 0.50) / 0.05^2$$

$$n = 0.9604 / 0.0025$$

$$n = 384$$

The minimum sample size for the study consists of 384 individuals. 192(50%) were males and 192(50%) were females, age of the subjects range from 20 years and above.

The study made use of the Schaeffer's Test which is the standard and most common test for the study where the volar aspect of the wrist was examined to ascertain whether the palmaris longus tendon was present or absent in its typical anatomical location. However, to confirm the previous test, each individual went through two more tests - Thompson's and Pushpakumar's tests to confirm the absence of the tendon. These tests were chosen because they were easy to use and suitable for a wide range of subjects with a significant level of accuracy. The presence or absence of the palmaris longus tendon was recorded for both sides. Also a standard questionnaire which contains socio-demographic characteristics (age, sex) and handedness of the subject (left or right hand dominant) and whether the PL was present or absent was given to the subjects. If present, the type of tendon was also captured. The collected data was computed, and analyzed using SPSS software version 26 and presented in tables. Chi-square was used to test for its association and probability less than 0.05 was considered statistically significant (p<0.05).

Ethical considerations were adhered to throughout the study. All individuals were provided with information about the research objectives, and verbal consent was obtained from each of them.

RESULTS

Table 1: The prevalence and association of palmaris longus tendon (PLT) among sexes

		Overall presence	uni-lateral absence	bi-lateral absence	Total	X ²	p-value	Inference
Sex	Female	147 (76.6%)	30 (15.6%)	15 (7.8%)	192 (50%)	2.98	0.23	NS
	Male	160 (83.3%)	23 (12.0%)	9 (4.7%)	192 (50%)			
	Prevalence	307 (79.9%)	53 (13.8%)	24 (6.3%)				

NS= non-significant, X²=chi-square, (p<0.05)

The table 1 above showed the association of palmaris longus tendon among the sexes and the result showed that 76.6% of the female's population had bi-lateral PLT, 25.6% has Uni-lateral PLT and 7.8% has total absence while among the male population 83.3% has bi-lateral PLT, 12.0% has Uni-lateral PLT and only 4.7% has total absence. However, the association showed no statistical difference between the males and females with PLT. The prevalence denoted that 79.9% of the total population has bi-lateral or total presence of PLT, 13.8% has uni-lateral absence of PLT and 6.3% has bilateral or total absence.

Table 2: The prevalence and association of the palmaris longus tendon across age interval

		bi-lateral	uni-lateral	total absent	X ²	p-value	Inference
Age	<= 20	5 (71.4%)	2 (28.6%)	0 (0.0%)	11.48	0.32	NS
	21 – 25	87 (77.0%)	20 (17.7%)	6 (5.3%)			
	26 – 30	41 (77.4%)	7 (13.2%)	5 (9.4%)			
	31 – 35	61 (79.2%)	13 (16.9%)	3 (3.9%)			
	36 – 40	23 (79.3%)	2 (6.9%)	4 (13.8%)			
	41+	90 (85.7%)	9 (8.6%)	6 (5.7%)			
Prevalence		307 (78.9%)	53 (13.8%)	24 (6.3%)			

NS= non-significant, X²=chi-square, (p<0.05)

The Table 2 above shows the prevalence and association of the palmaris longus tendon across the age interval and the result showed that there was no association of the palmaris longus tendon across the different age interval (p>0.05).

Table 3: Distribution of palmaris longus tendon on the right and left forearms in sex

		left forearm		right forearm	
		Absent	Present	Absent	Present
Sex	Female	38 (19.8%)	154 (80.2%)	22 (11.50%)	170 (88.50%)
	Male	26 (13.5%)	166 (86.5%)	15 (7.80%)	177 (92.20%)
		X²=2.70, p=0.1		X²=1.47, p=0.23	
Prevalences		64 (16.7%)	320 (83.3%)	37 (9.60%)	347 (90.40%)

$X^2=chi-square, p= p-value$

Table 3 shows the distribution of the palmaris longus tendon on the right and left forearms and the results showed that in the left forearm, 80.2% of the females were observed to have a pronounced PLT, and 86.5% of males had pronounced PLT while in the right forearm, 88.50% of the females were observed to have the PLT pronounced and 92.20% of the males had the PLT pronounced. However, the association of both the left and right forearm has shown no statistical significant ($p>0.05$).

DISCUSSION

Palmaris longus tendon was a muscle of choice for surgeons in cosmetics, plastic and reconstructive hand surgeries because it met the criteria of length, thickness, and availability (Kayode *et al.*, 2008;Chakravarthy and Vasanthakumar, 2022; Adejuwon *et al.*, 2012)). Despite its functions in the body, its removal never had any effect on the donor (Lamichhane *et al.*, 2017; Lahiji *et al.*, 2013). Palmaris longus (PL) tendon is one of the most anatomically variable muscles in the human body. Its absence appears to be the most common variation (Standring *et al.*, 2016). The appearance of the PL tendon has been commonly reported to be variable in population, races and hereditary traits (Alabbad *et al.*, 2018).

In the present study, the PL muscle was present in 79.9% subjects used for this study. The result was similar to the Punjabi (Kular *et al.*, 2019) and African Antigua (Chakravarthy and Vasanthakumar, 2022) which recorded a slightly lower prevalence of PL(70-80%). A lower prevalence of presence (36.1%) was reported in Turkey population (Ceyhan and Mart, 1997). In the present study, 79.9% exhibited bilateral presence while 13.8% showed unilateral presence. This

indicates that the PL muscle is more commonly present bilaterally than unilaterally. Our findings conformed to that of Iran (77.2%)(Lahiji *et al.*, 2013). A study conducted on Nigeria subjects reveals south-west zone of Nigeria having the highest incidence of absence Palmaris longus muscle attributing that the gene responsible for the formation of this muscle is less dominant in this zone (Kayode *et al.*, 2008)

Palmaris Longus was also reported to be gender and laterality specific – its presence was more in the male than the female subjects and more in right than in the left hands. In the present study on the left hand, 80.2% of the females were observed to have a pronounced PLT, and 86.5% of males had pronounced PLT while in the right forearm, 88.50% of the females were observed to have the PLT pronounced and 92.20% of the males had the PLT pronounced. However, the association of both the left and right forearm has shown no statistical significance ($p>0.05$). Also males exhibited a slightly higher bilateral presence 160(83.3%) compared to females 147(76.6%).

However, females showed higher unilateral and bilateral absence than the male subjects. However, these differences were not statistically significant.

On the other hand, many studies have recorded the prevalence of absence of the PL tendon on human subjects. The prevalence of its absence in our study was seen to be 24(6.3%). This value is similar to the study by Mbaka and Ejiwunmi (2009) that recorded a 6.7% prevalence of absence among the Yoruba population in Nigeria. This study is also slightly higher than the studies recorded in East Africa (4.4%) (Kigeria and Mukwaya, 2011), Ghana (3.8%) (Abledu and Offei, 2014), Nigeria (3.7%) (Okafor *et al.*, 2017), Zimbabwe (1.5%) (Gangata, 2009) - all in Africa. Also, a slightly higher value of the tendon's absence was reported in Punjabi population (11.3%) (Kular *et al.*, 2019), South eastern United States (14%) (Holzgreffe *et al.*, 2019) and in North Cyprus (17.4%) (Aliyu *et al.*, 2021). Other studies reported higher prevalence 31.05% in Turkish subjects (Abledu and Offei, 2014), 28% in Palestine subjects (Sabouba *et al.*, 2022), and 40.5% in Saudi Arabia (Alabbad *et al.*, 2021). Alves *et al.* (2011) reported a higher prevalence of its absence in females (15.1%) compared to males (11.2%). This current study also showed a slightly higher prevalence of absence in females 15(7.8%) compared to males 9(4.7%). For the unilateral absence, the PL tendon was found in 53 (13.8%) individuals. Females exhibited a slightly higher unilateral absence 30 (15.6%) compared to males 23(12.0%) The unilateral absence was seen to be slightly higher on the right for both genders, compared to the left. However, the prevalence of the PLT

absence with respect to sexes showed no statistical differences. A study in Nigeria also documented a 6.9% absence rate in males and 6.4% in females (Mbaka and Ejiwunmi, 2009). However, a study by Kayode *et al.* (2008) reported as high as 31.25% total absence of *Palmaris longus* as against 20.1% in the present study.

Other studies have also attempted to correlate the occurrence of the PLT with right and left forearms. This study showed that the palmaris longus (PL) tendon is a relatively common anatomical feature, with a higher prevalence in the right forearm (90.4%) compared to the left (83.3%). For the left forearm, 154(80.2%) of females and 166(86.5%) of males showed the prevalence of the presence of the PL tendon, while 38(19.8%) of females and 26(13.5%) of males showed the prevalence of absence of the PLT. For the right forearm, 170(88.5%) of females and 177(92.2%) of males showed the prevalence of presence of the PLT, while 22(11.5%) of females and 15(7.8%) of males showed the prevalence of absence of the PLT. This finding was also supported by the study which reported 37.5% prevalence of absence in females and 27.9% in males (Aliyu and Tiryakioglu, 2021). A study conducted in Malaysia also reported a higher frequency in females (11.5% compared to 7.1% in males). While there is a slight difference in prevalence between genders, the association of both the left and right forearm showed no statistical significance ($p > 0.05$). This suggests that the presence or absence of the PL tendon is not strongly influenced by sexes.

Age was also considered for the presence and association of PL, however, this study revealed that the palmaris longus (PL) tendon is a prevalent anatomical structure, consistently present across diverse age groups. While there are slight variations in prevalence between age intervals, the statistical analysis showed that these differences are not statistically significant. This suggests that the presence or absence of the PL tendon is largely independent of age.

Conclusion

The prevalence of the presence and absence of the palmaris longus tendon in the Ikwerre ethnic group of Aluu community in Rivers State, showed a higher prevalence of presence as compared to the absence. With regards to the presence, bilateral presence of PLT was higher compared to unilateral. The unilateral presence was predominant on the right forearm. The prevalence of the absence of the palmaris longus tendon was higher in females as compared to that of males. The

presence and absence of palmaris longus tendon association with respect to age and sex showed no statistical significant difference. This study conformed to other studies done within and outside Nigeria.

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Authors' contribution

The first author designed the work and wrote the first manuscript, the second author wrote the final manuscript and managed the literature review, while the third author managed the statistical analysis. All the authors read and approved the final manuscript for submission.

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