



# Correlation of hand anthropometry with incidences of carpal tunnel syndrome in fish net industry

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**Abstract:** Fishing in India is a major industry in the coastal states employment over 14 million people. Although the fishing industry have developed with good fishing equipment and technology, it involves strenuous physical labor of netting, catching fish, carrying heavy activities with irregular working hours and prolonged sitting. Fish net industry mainly involves frequent use of hand, repetitive grasping or extreme hyper extended position of wrist joint. Studies have been done on cumulative traumatic disorder. Carpal tunnel syndrome is very common disorder related to this working environment hence this study aims at correlating anthropometric measurements of hand with CTS in fish net industry. The study group was composed of 50 fishermen mainly related to Fish net weaving with positive signs of CTS was included in the study. The age group between 25 to 40 years was considered. An anthropometre was used for hand anthropometric measurements and through clinical examination along with tests like Phalen was done to assess them for CTS. During measurements values for hand with positive clinical signs were obtained. 7 anthropometric parameters were evaluated. Hand width, hand length, 3rd digit length, wrist depth were measured with Lafayette Anthropometer (model no: 01291) and body height and weight was noted. BRIGHAM AND WOMEN'S HOSPITAL HAND SYMPTOM SEVERITY SCALE (SSS) was also applied. Statistical analyses done using spss 16 and Pearson correlation test was used. BMI ( $p=0.003$ ) and wrist ratio ( $p=0.061$ ) has shown strong association with CTS. Anthropometric dimensions of hand has association with development of carpal tunnel syndrome.

**Key words:** hand anthropometry, carpal tunnel syndrome, fish industry

## 1. Introduction

Hand is important sensory organ of the body. Good dexterous hand is a prerequisite for various occupations. Fish net industry mainly involves use of hand for prolonged period of time, repetitive grasping or extreme hyper extended position of wrist and repetitive movement of flexion and extension of wrist joint. The job of these fishermen involves catching fish, storing them and bringing them back to shore to sell. Their job also involve transferring of heavy loads of fish which involve a lot of forward bending from standing position. They also need repeated shoulder, elbow, wrist and hand activities to throw and pull the net and to lift heavy fishes. Constant bending action and lifting heavy weights puts excessive strain on the back leading to development of back pain. Shoulder pain may also

occur due to heavy weight lifting and repeated throwing and pulling of net from water. It is observed that there is repeated movement at wrist and hand which mainly puts stress on the small muscles around the wrist and hand. This also appears as a predisposing factor for carpal tunnel syndrome. This put them at risk of various hand related problems. As stated by Armstrong et al in 1993 individual factors also has key role in development of work – related musculoskeletal disorders. Anthropometric dimensions are important risk factors which have correlation with hand function like grip strength.

Carpal tunnel syndrome (CTS) is one of the most common hand problems among adults. The complexity of symptoms results from compression of the median nerve at the carpal tunnel and includes pain, numbness or tingling anywhere along the median nerve distribution.] Some patients experience a weakened grip or nocturnal exacerbation of the symptoms (Surut Jianmongkol 2005). According to the study which have done 96% have discomfort due to contact with ice. Due to continuous contact of hand with ice there is a chances of vasospasm of the vasculature supplying hand, because which there are chances of which easy fatigue and decrease in functional capacity of structures surrounding wrist and hand. Easy fatigue can be a reason for repetitive trauma, followed by swelling which is a major cause compression effect on median nerve and produce carpal tunnel syndrome like pathology.

Studies have been done on cumulative traumatic disorder. There are studies which have shown correlation of hand anthropometry and CTD mainly involving CTS. There is a study of "Prevalence of carpal tunnel syndrome in workers from a Fishnet factory in Thailand" (Surut Jianmongkolet al, 2005.). This study was mainly done in Thailand and not in India. Thus there is a difference in technique, equipment and method of fishing in India and Thailand so we are doing this study to find out the correlation of hand anthropometry and cumulative traumatic disorder in fishing industry in India. There are some article which have shown correlation and carpal tunnel syndrome which have been conducted on women, dentist and on any other worker on any other worker of different fields one of the study is "Association of anthropometric factors and predisposition to carpal tunnel syndrome".

There is a study of "Assessment of body mass index and hand anthropometric measurements as independent risk factors for carpal tunnel syndrome" (A. Sharifi-Mollayousefi, et al 2008.). In this study total of 131 patients with clinical symptoms of CTS and 131 normal subjects were enrolled, of whom 121 were female both in the CTS cases and the controls. All cases were electro diagnostically confirmed and assigned to three severity groups. The BMI, wrist ratio, shape index, digit index and hand length/height ratio were measured in all participants. This study stated BMI, wrist ratio and shape index as independent risk factors for CTS. The study by Boz et al also revealed shape index and digit index as determinant factors in the development of CTS. Any factor that causes increasing the pressure of the content or decreasing of carpal tunnel capacity leads to signs of this syndrome. Physiologically this syndrome is caused by ischemia of the median nerve that follows increasing the internal canal pressure and vein circulatory disorder. One of the most important problems in pathogenesis is size of wrist canal. Some studies showed that cases with wrist ratio (i.e. anterior-posterior diameter to medio-lateral diameter of wrist) of more than 0.7 are more at risk for developing this syndrome. (Dumitru D et al 2002)



## 2. Methodology

The study group was composed of 50 fishermen mainly related to Fish net weaving with positive signs of CTS was included in the study. The age group between 25 to 40 years was considered. The fishermen from Mumbai and Navi Mumbai area were involved. The .CTS.Study continued for 6 month duration. Ethical approval was taken from institutional ethics committee of D.Y.Patil University. And informed consent were done.

Subjects with more than 1 years of experience were involved in study. Those with previous history of musculoskeletal trauma were not included in the study. Basic assessment of anthropometric parameters were done along with details related to their job requirement were collected. The participants were asked about age, gender, occupation, any previous or current general medical condition, cervical radiculopathy, previous trauma to the neck or upper extremities or surgery involving these regions, history of neuropathy, demyelinating disease and thoracic outlet syndrome. A thorough review was made of systems and a physical examination was performed and appropriate laboratory data was obtained for participants with findings that aroused suspicion. Participants with abnormalities in any of the above areas were excluded from the study. Subjects with diabetics, rheumatoid arthritis and thyroid problems were excluded from study. Survey consisted of a hand diagram and survey to evaluate symptoms consistent with CTS [Franzblau et al., 1993] as well as discomfort survey was also used. Subjects were instructed to rate hand or wrist symptoms, such as numbness, tingling, or ache, on a 0–10 scale (0–2= none; 3–7 = moderate; 8–10 =severe), and shade on a hand diagram where the symptoms were located. Clinical test of phalens and tinels were performed on subjects. 50 subjects in our study noted some or the other finding related to CTS on dominant hand. Clinical finding of CTS were assessed using symptom severity scale and functional severity scale of carpal tunnel syndrome. All the subjects in our study were right dominant.

Carpel tunnel syndrome is accurately diagnosed by the presence of any two of threecriteria:

- 1) Clinical symptoms;
- 2) physical tests (i.e., Phalen’s test, Reverse Phalen’s test)

2.1Phalens test- At first the procedures were explained for subjects. subjects were asked to put their hand tangent in front of chest with vertical angle in location of wrist. They were asked to bend their wrist for one minute. About 20% fishermen in this study complained parasthesia and numbness whereas 80% fishermen reportedparasthesia& pain .

2.2Anthropometric measurements: Anthropometric parameters were evaluated in subjects with positive clinical finding related to CTS.

Seven parameters related with hand dimensions and ratios were evaluated. Hand width, hand length, 3rd digit length, wrist depth were measured with Lafayette Anthropometer (model no: 01291) and body height and weight was noted. The hand length/body height ratio, the shape index which determines hand shape, the digit index which determines grasping capability and palmar length/width ratio which determines palmar type without the digits were also assessed(A. Sharifi-Mollayousefi2008),(Çaratay et al 2008); Kulaksiz Get al 2002, )

1.Palmar length: The palmar length defined as the distance between the midpoint of the distal wrist crease and the midpoint of the proximal digit crease, was calculated according to the

formula hand length minus 3rd digit length. Measurements were taken from the palmar side with digits fully stretched touching on a flat, hard surface and the 2nd to 5th digit adducted and the thumb slightly extended. Hand width, hand length, 3rd digit length and body height were measured with the method stated by Pheasant 1990 .The hand length/body height ratio, the shape index which determines hand shape and the digit index which determines grasping capability were also assessed Wrist depth: The maximum anteroposterior distance at the distal palmar crease were measured.

2. Wrist width: The maximum mediolateral distances at the distal palmar crease were measured. [A. Sharifi-Mollayousefi 2008

Shape index: Hand width [mm]/hand length [mm] \*100.

Digit index: third finger length [mm]/hand length [mm].

Wrist ratio: Antero-posterior diameter / medial-lateral diameter of wrist.

Thumb length: the distance between the midpoints of the distal crease of the thumb to the tip of the thumb.

BMI: BMI stands for body mass index. BMI was calculated as weight divided by the square of the height and expressed in kg/m<sup>2</sup>.

Body weight was measured using a standard scale with light clothing on and without any footwear. Height was measured with the individual in upright position in front of a wall looking ahead and heels touching one another. Statistical analysis was done using spss 16 and test used is Pearson correlation test.

### 3. Results

Data analysis-

Mean age of study population was 32.55± 4.12 with mean work experience was 9.23± 4.2.

Table 1: Correlation matrix of Anthropometric measurements with CTS score

VARIABLES		
BMI	Pearson Correlation	.483***
	Sig. (2-tailed)	.0003
WRIST RATIO	Pearson Correlation	.301*
	Sig. (2-tailed)	.061

BMI (p=0.005) and wrist ratio (p 0.061) has shown strong association with CTSQ.



#### 4. Discussion

The personal characteristics like BMI, hand length, width, 3rd finger length, wrist width and depth were taken into considerations for assessing shape index, digit index hand length / height ratio and wrist ratio respectively. These parameters were considered to correlate them as risk factors for Carpal Tunnel Syndrome (CTS). There have been few studies which has seen, correlation between hand anthropometric indices and development of CTS. In a recent study Moghtaderi et al revealed that wrist ratio could be an independent risk for CTS development, while the wrist circumference might have a protective effect. Boz et al. 5 showed that wrist ratio, shape index and digit index were independent risk factors in females, but failed to show statistically any significant difference between groups. In our study it was found that wrist ratio is a determinant of CTS development in fishermen which is consistent with the results of the previous studies, (Boz C et al 2004, Kouyoumdjian et al 2002, Kamolz LP et al 2004, Radecki P. A et al 1994) This could be because of age and increased number of practicing years. The role of anthropometry in CTS development is not fully understood but several explanations have been proposed. One of it says that there may be a potential link between wrist ratio and variations in carpal stenosis in the dynamic and static relationship of structures and median nerve abnormalities. (Johnson EW et al 1983, Szabo RM. et al 1998) Specific wrist shapes may increase the potential for CTS. An increase in repetitive hand movements, makes the subject more susceptible to CTS (Pheasant S. et al 1990); Kamolz LP et al 2004). Our study found that there is not much association of digit index and hand length / height ratio as risk factors for fishermen. BMI shows strong association with CTS among all the samples. There are number of studies supporting this result. (Boz C, Ozmenoglu M, Altunayoglu V, Velioglu S, Alioglu Z (2004), Moghtaderi A et al 2005. Evaluation of hand anthropometric measurements and grip strength in basketball, volleyball and handball players. International Journal Experimental and clinical Anatomy. Anatomy 2008. Proposed mechanism might be increased carpal tunnel fat content in fat people, which in turn causes the hydrostatic pressure to rise (Werner RA et al 2002, Becker J et al 2002.)

#### 5. Conclusion

Anthrometric dimentions of hand has association with development of carpal tunnel syndrome

#### References

1. A. Sharifi-Mollayousefi, M. Yazdchi-Marandi, H. Ayramlou<sup>1</sup>, P. Heidari, A. Salavati, S. Zarrintan, A. Sharifi-Mollayousefi. "Assessment of body mass index and hand anthropometric measurements as independent risk factors for carpal tunnel syndrome". Received 23 August 2007; Revised 15 January 2008; Accepted 15 January 2008.
2. Boz C, Ozmenoglu M, Altunayoglu V, Velioglu S, Alioglu Z (2004) Individual risk factors for carpal tunnel syndrome: an evaluation of body mass index, wrist index and hand anthropometric measurements. Clin Neurol Neurosurg, 106: 294–299.
3. Becker J, Nora DB, Gomes I, Stringari FF, Seitensus R, Panosso JS, Ehlers JC. An Evaluation of gender, Obesity, age and Diabetes mellitus as risk factor for Carpal Tunnel Syndrome. Clin Neurophysiology. 2002; 113: 1429-1434.

4. ÇaratayBarut, P>narDemirel, SibelK>ran;; Evaluation of hand anthropometric measurements and grip strength in basketball, volleyball and handball players. *International Journal Experimental and clinical Anatomy. Anatomy* 2008; 55-58.Recieved: February 10, 2008; Accepted: April 22, 2008; Published online:31 October 2008 doi:10.2399/ana.08.055
5. Dumitru D, Amato AA, Zwarts MJ. *Electro diagnostic medicine*. Texas: Hanley and Belfus San Antonio; 2002.
6. Johnson EW, Gatens T, Poindexter D, Bowers D (1983) Wrist dimensions: correlation with median sensory la- tencies. *Arch Phys Med Rehabil*, 64: 556–557
7. Kulaksiz G, Gozil R. The effect of hand preference on hand anthropometric measurements in healthy individuals. *Ann Anat* 2002; 184: 257-65.
8. Kouyoumdjian JA, Zanetta DM, Morita MP (2002) Evaluation of age, body mass index, and wrist index as risk factors for carpal tunnel syndrome severity. *Mus- cle Nerve*, 25: 93–97,
9. Kamolz LP, Beck H, Haslik W, Hogler R, Rab M, Schrogendorfer KF, Frey M .Carpal tunnel syndrome: a question of hand and wrist configurations? 2004;*J Hand Surg Br*, 29: 321–324.
10. Moghtaderi A, Izadi S, Sharafadinzadeh N (2005) Aneva- luation of gender, body mass index, wrist circumference and wrist ratio as independent risk factors for carpal tun- nel syndrome. *ActaNeurolScand*, 112: 375–379
11. Pheasant S. *Anthropometrics: An Introduction*. United Kingdom: British Standards Institution; 1990. p. 18-9
12. SurutJianmongkol, WeerachaiKosuwon, EkamolThumroj and SermsakSumanont. "PREVALENCE OF CARPAL TUNNEL SYNDROME IN WORKERS FROM A FISHNET FACTORY IN THAILAND". Received 14 July 2004; Accepted 13 June 2005
13. Szabo RM. Carpal Tunnel Syndrome as a repetitive Motion Disorder. *ClinOrthopRelat Res*.1998; 351: 78-79.
14. Werner RA, Andarym.Carpal Tunnel Syndrome; Pathophysiology and clinical Neurophysiology. *Clin Neurophysiol*.2002; 113:1373- 1381.