

**REFERENCE VALUES AND ANTHROPOMETRIC CORRELATES OF FINGER
TIP UNIT METRIC LENGTH IN CHILDREN AND ADOLESCENTS**

BY

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ABSTRACT

This study provided age and reference values for Finger Tip Unit Metric Length (FTUML) for children and adolescents, assessed relationship between FTUML and selected anthropometric parameters (height, weight, BMI and body somatotype); and determined socio-demographic (age and sex) and anthropometric predictors of FTUML with the end view of providing objective FTUML reference values for quantifying dosages of topical medications. It will also contribute to the emerging literature on objective dosage prescription for topical medications.

Sample of convenience sampling technique was used to recruit 440 children and adolescents who were participants in this correlation study. Their ages were classified into three categories, 1 – 6, 7 - 12 and 13 – 17 years with 140 participants in each. Standard bathroom weighing scale, 10cm plastic meter ruler, tape rule and height meter were used to measure weight, FTUML, girth, and height respectively while Body Mass Index (BMI) and somatotype were computed. The FTUML was determined using the Plastic meter ruler and it was used to measure the distance between the distal skin-crease and the tip of the index finger of each participant. The data were analysed by using descriptive statistics, Pearson's product moment correlation, Students t-tests, Analysis of Variance, Chi-square test of association and Multiple regression analysis. Level of significance was set at $p < 0.05$.

The mean age of all the participants was 9.11 ± 4.64 years. The mean weight, height and BMI were 27.13 ± 13.50 kg, 1.28 ± 0.26 metres and 16.34 ± 11.3 kg/m² respectively. The mean FTUML of all participants was 1.98 ± 0.66 cm. The mean FTUML of different age classifications are 1.63 ± 0.93 cm, 1.97 ± 0.22 cm and 2.38 ± 0.19 for 1-6 years, 7 – 12 years and 13 – 17 years

respectively. The mean age of male and female were 8.94 ± 4.41 years and 9.25 ± 4.83 years respectively. There was significant difference in the ages of male and female ($t = 0.70$, $p = 0.003$). There was significant difference in the FTUML of participants across the groups ($F = 61.92$, $p = 0.001$). The mean FTUML of participants in the 13-17 years age group was significantly higher than that of 1-6 years ($p = 0.001$) and 7-12 years ($p = 0.001$). The FTUML of male participants was 2.01 ± 0.87 cm while that of female participants was 1.96 ± 0.42 cm. There was significant association between gender and FTUML ($\chi^2 = 47.50$, $p = 0.004$). There was no significant difference in the FTUML of male and female ($t = 0.65$, $p = 0.70$). There was significant correlation between FTUML and age; weight, height, somatotype and all the selected anatomic girths ($r = 0.48$, $p = 0.001$; $r = 0.48$, $p = 0.001$; $r = 0.45$, $p = 0.001$ and $r = 0.10$, $p = 0.05$ respectively). Multiple regression analysis showed that age, weight, height, body mass index (BMI) and somatotype are significant predictors of FTUML ($F = 11.26$, $p = 0.001$). All the independent variables contributed 24.1% to the prediction of FTUML.

This study has provided reference values for FTUML of children and adolescent and it differed across different age groups. Age, weight, height, somatotype and all the selected anatomic girths are correlates of Fingertip Unit Metric Length. The selected independent variables (age, height, weight, Body Mass Index, anatomic body girths and somatotype) are significant predictors of FTUML.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Drug administration is through different routes and this gives opportunity of choice among users. Transdermal application is of importance to physiotherapists and three identified areas of pharmacophysiotherapy are iontophoresis, phonophoresis and supplementary prescribing (Woolf, 2000). Iontophoresis and phonophoresis involve the administration of topical medications using a galvanic current and ultrasound. Topical medications are in different forms such as creams, gels, ointments and lotions and are usually administered epicutaneously through transdermal massage, iontophoresis or phonophoresis (Onigbinde, 2014).

According to Adelaide (2000), topical therapies are common yet often misused tools in paediatric skin care. Compared with adults, infants and children have an increased ratio of skin surface area to body weight, which enhances the danger of accumulating significant serum drug levels. He further opined that physiologic difference between children and adults affect drug absorption, metabolism, distribution and excretion. These differences are most significant for infants (Adelaide, 2000). Many paediatric conditions such as Obstetric brachial plexus injury, injection neuritis, poliomyelitis, Volkmann's Ischemic Contracture involves the use of topical medications. The topical agents are indicated in the treatment or temporary relief of pain and itching associated with these conditions. The topical analgesic and anesthetic agents are available in different formulations, have varying potencies and may have different indications and uses (Becker Dem, 2006). In general, the topical products exhibit minimal absorption and have few systemic adverse reactions or drug interactions. Treatment of pain associated with minor procedures and muscle, joint, or skin irritations is determined by clinical judgment based

upon location of procedure/pain, prior treatment, and other complicating conditions (infection, age of patient, duration of action) (McLure et al., 2005). Adequate knowledge of drug pharmacokinetics is therefore of importance as it helps to clarify the relationship between dose, dose frequency and intensity of pharmacological effects, disease and adverse events (McLeod, 2003). Quantifying appropriate and effective therapeutic dose of relevant medications has been major bane of providing qualitative care for clients (Nair et al., 2013). Studies have provided evidences that pharmacotherapy in recent days, has become an indispensable adjunct to the effectiveness of the practice of physiotherapy (Olszewskiet al,2007; Konitzer, 2003; Magos, 2006).

There are two major concepts used in the quantification of topical medications, these are: the Finger Tip Unit and Dosing card (Long *et al.*, 1991). Appreciable efforts had been made to provide quantification for topical creams and gels using Finger Tip Unit (FTU). A Finger Tip Unit is defined as the amount of cream, ointment, and lotion that is squeezed out from a standard tube with a 5mm diameter nozzle, which is applied from the distal skin-crease to the tip of the index finger of an adult and it is a practical measure for determining dose of topical medications (Lansbury et al., 1998; Long *et al.*, 1991). One FTU is enough to treat an area of skin twice the size of the flat of an adult's hand with the fingers together where 2FTUs are equivalent to 1g (Finlay *et al.*, 1989).

Finger Tip Unit is used in clinical practice to guide the amount of topical drugs that should be applied on the skin in order to minimize side effects and encourage adherence to therapy but rough guides are provided for both children and adults in the literature (McHenry *et al.* 1995, Futamura *et al.*, 2009). Aside this, FTU is still a subjective description without metric value or precise anthropometric measurement. Anthropometry is the measurement of body

parameters such as height or length, weight, mid-upper arm circumference (MUAC), demi-span or arm span, knee height, sitting height, skin fold thickness, head circumference, height (or length) and weight. Health care professionals rely on body measurements to evaluate a patient's overall health both in children and adolescents (Vegter, 2000 and Ulijaszek *et al*, 2005).

Several factors unique to children may lead to higher rates of percutaneous drug absorption and thus greater risks for toxicity in this unique group of patients. Compared with adults, infants and children have an increased ratio of skin surface area to body weight, which enhances the danger of accumulating significant serum drug levels. This is particularly a problem in newborn and premature infants, who also have higher rates of percutaneous absorption because the barrier function of the skin is relatively immature (Adelaide, 2000). The topical analgesic and anesthetic agents are available in different formulations, have varying potencies and may have different indications and uses (Becker Dem, 2006). The topical agents are indicated in the treatment or temporary relief of pain and itching associated with conditions such as Obstetric brachial plexus injury, injection neuritis, poliomyelitis, Volkmann's Ischemic Contracture. However, this topical therapies are often misused in paediatric care and this is as a result of physiologic difference between children and adults, and this thus affects drug absorption, metabolism, distribution and excretion (Adelaide, 2000). Infants and children have an increased ratio of skin surface area to body weight compared to adults and this enhances the danger of accumulating significant serum drug levels (Adelaide, 2000).

1.2 Statement of the Problem

There appears to be no specific dosages for topical medications and this has been the major bane of providing qualitative care for clients (Onigbinde, 2014). Finger Tip Unit (FTU) is used in

clinical practice to guide the amount of topical drugs that should be applied on the skin in order to minimize side effects and encourage adherence to therapy but rough guides are provided for both children and adults in the literature (Feldman et al; 2008). Quantifying appropriate doses for effective treatment has been a significant limitation of topical therapies. Topical therapies dosage prescription using FTU is still subjective especially among children and could lead to risk of toxicity. While there is emerging research on objective Finger Tip Unit Metric Length (FTUML) for adults, there is dearth of reference values for FTUML for clinical use for children and adolescents, hence, the need for this study.

1.3 Objectives of Study

The objectives of this study were to:

- i. generate age and sex reference values for Finger Tip Unit Metric Length (FTUML) for children and adolescents.
- ii. assess relationship between FTUML and selected anthropometric parameters (height, weight, BMI and body somatotype)
- iii. determine if age and anthropometric parameters are significant predictors of FTUML.

1.4 Hypotheses

- i. There would be no significant relationship between age, weight, height, BMI and Finger Tip Unit Metric Length (FTUML)