

ACKNOWLEDGEMENTS

**NORMATIVE ISOKINETIC TORQUE
VALUES FOR REHABILITATION
IN SOUTH AFRICA**

The present study is dedicated to thank the following persons for their assistance and guidance during the study

Firstly, my Promotor, Professor P.E. Krüger who was very understanding and supportive throughout the whole process.

Secondly, to my wife Dana, boys Zander and Bernard for their love and support.

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Thirdly, to my parents who supported and encouraged me

Fourthly, to all my colleagues in the SAMS and RAU who supported me during the study.

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PROMOTOR: PROF. E. KRÜGER

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SYNOPSIS

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The present author would like to make use of the opportunity to thank the following persons for their assistance and guidance during this study:

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SYNOPSIS

Title: Normative isokinetic torque values for rehabilitation in South Africa.

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Degree: Doctor Philosophiae (D.Phil.)

The goal of effective rehabilitation should always be to restore “normal” function if possible. What is “normal” function? Although many subjective definitions may describe what is “normal”, it is the search for objective criteria of what constitutes “normality” that inspires exercise scientists worldwide! The primary aim of this study was to establish **normative** isokinetic torque values in young males, for rehabilitation purposes in South Africa. Four hundred and forty four (444) healthy male subjects participated in the study. A Cybex 340 isokinetic dynamometer was used to measure peak torque, using a quantitative experimental design. No correction was made for the effects of gravity. The following movement patterns were included: ankle plantar/dorsiflexion, knee flexion/extension, shoulder external/internal rotation, shoulder horizontal abduction/adduction, shoulder flexion/extension, elbow flexion/extension (using two different grip positions), and forearm pronation/supination. Descriptive statistics together with percentile scaling were used to develop normative values for the movement patterns studied. Normative

values were presented in relative terms and expressed as a percentage in terms of Nm torque per kg body mass (% BM). In addition to the relative isokinetic torque values, the agonist/antagonist ratios were also expressed as a percentage. The percentile scales were also included to be used by clinicians involved in talent identification programmes and the screening of elite athletes. To conclude, normative isokinetic values were developed for young South African males. To enable subjects with large variations in body weight to utilize these **norms**, they were expressed in relative terms (% BM) instead of absolute terms (Nm). The possible benefit of the study was that population-specific and objective normative values were established for rehabilitation purposes and for use in sport science programs.

Key words: Isokinetics, torque, norms, rehabilitation, South Africa

SAMEVATTING

Titel: Normatiewe isokinetiese wringkragwaardes vir rehabilitasie in Suid-Afrika.

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Die herstel van “normale” funksie behoort altyd die doelwit van effektiewe rehabilitasie te wees. Wat is egter “normale” funksie? Alhoewel daar vele subjektiewe definisies gevind mag word wat “normaal” omskryf, is navorsers wêreldwyd op soek na objektiewe kriteria vir “normaliteit”! Die hoofdoel van hierdie studie was om **normatiewe** isokinetiese wringkragwaardes vir rehabilitasie-doeleindes vir jong Suid-Afrikaanse mans te bepaal. Vierhonderd-drie-en veertig (444) gesonde manlike proefpersone het deelgeneem aan die studie. ‘n Cybex 340 isokinetiese dinamometer is gebruik om piek wringkrag, deur middel van ‘n kwantitatiewe eksperimentele navorsingsontwerp te bepaal. Geen korreksie is gemaak vir die effek van gravitasie nie. Die volgende bewegingspatrone is ingesluit: enkel plantaar/dorsi fleksie, knie fleksie/ekstensie, skouer eksterne/interne rotasie, skouer horisontale abduksie/adduksie, skouer fleksie/ekstensie, elmboog

fleksie/ekstensie, en voorarm pronasie/supinasie. Beskrywende statistiek en persentielskaling is gebruik om normatiewe waardes vir bogenoemde bewegingspatrone te ontwikkel. Hierdie normatiewe waardes is uitgedruk in relatiewe terme as 'n persentasie van Nm wringkrag per kg liggaamsmassa (% LM). Verder is die agonis/antagonis verhoudings ook uitgedruk as 'n persentasie. Die persentielskale word ook ingesluit vir gebruik in talentidentifikasie-programme en die sifting van elite atlete. In samevatting is normatiewe isokinetiese waardes ontwikkel vir jong Suid-Afrikaanse mans. Hierdie waardes is uitgedruk in relatiewe terme (% LM) in plaas van in absolute terme (Nm), sodat selfs individue met groot variasies in liggaamsmassa hierdie **norms** kan gebruik. Die moontlike bydrae van hierdie studie is dat objektiewe populasie-spesifieke normatiewe waardes ontwikkel is vir rehabilitasie-doeleindes, sowel as vir sportwetenskapprogramme.

1.2 Aim of the study

Sleutelwoorde: Isokineties, wringkrag, norme, rehabilitasie, Suid-Afrika

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LIST OF ABBREVIATIONS

°:	degrees
°/s:	degrees per second
\$:	Dollar
%:	percentage
% BM:	percentage body mass
1RM:	one repetition maximum
A:	angular displacement
ADL:	activities of daily living
ACL:	anterior cruciate ligament
ASD:	average standard deviation
AVG:	average
BM:	body mass
BMR:	body mass ratio
BP:	blood pressure
CI:	contractual impulse
CKC:	closed-kinetic-chain
CON:	concentric
COV:	coefficient of variance
cm:	centimetres
DBP:	diastolic blood pressure
DOMS:	delayed onset of muscle soreness
ECC:	eccentric

ECG:	electrocardiogram
Ext.:	extension
Fig.:	figure
Flex.:	flexion
Ft-lb:	foot-pounds
GC:	gravity corrected
GET:	gravity effect torque
H/Q:	hamstrings divided by quadriceps
HR:	heart rate
IPA:	isometric pre-activation
J:	joules
KE:	knee extension
KF:	knee flexion
kg:	kilogram
LBM:	lean body mass
LIB:	lower isometric bias
m:	metre
MOGAP:	Montreal Olympic Games Anthropometrical Project
n:	number of subjects
N:	Newton
NGC:	not gravity corrected
Nm:	Newton-metres
Nm/kg:	Newton-metres per kilogram body mass
OKC:	open-kinetic-chain

P:	power
PFS:	patella femoral syndrome
ROM:	range of motion
RPP:	rate pressure product
SAAF:	South African Air Force
SAMS:	South African Medical Services
SANDEF:	South African National Defence Force
SBP:	systolic blood pressure
STD:	standard deviation
T:	torque or time
TAE:	torque acceleration energy
TAS:	total arm strength
TLS:	total leg strength
UBX:	upper body exercise bench
UMP:	upper moment limit
W:	work