

**FAKTOR-FAKTOR YANG BERHUBUNGAN DENGAN
POWER TUNGKAI ATLET TAEKWONDO DI KABUPATEN
BANDUNG BARAT**



SKRIPSI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar
Sarjana Gizi

Oleh:

Mochamad Sidiq Rifaldi

2104239

**PROGRAM STUDI GIZI
FAKULTAS PENDIDIKAN OLAAHRAGA DAN KESEHATAN
UNIVERSITAS PENDIDIKAN INDONESIA
2025**

LEMBAR HAK CIPTA

FAKTOR-FAKTOR YANG BERHUBUNGAN DENGAN *POWER* TUNGKAI ATLET TAEKWONDO DI KABUPATEN BANDUNG BARAT

Oleh
Mochamad Sidiq Rifaldi

Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh
gelar Sarjana Gizi pada Fakultas Pendidikan Olahraga dan Kesehatan

© Mochamad Sidiq Rifaldi 2025
Universitas Pendidikan Indonesia
Agustus 2025

Hak Cipta dilindungi undang-undang.
Skripsi ini tidak boleh diperbanyak seluruhnya atau sebagian, dengan dicetak
ulang, difoto kopi, atau cara lainnya tanpa ijin dari penulis.

MOCHAMAD SIDIQ RIFALDI
HUBUNGAN *ENERGY AVAILABILITY*, KECUKUPAN ZAT
GIZI MAKRO, KECUKUPAN CAIRAN, DAN
ANTROPOMETRI DENGAN *POWER TUNGKAI*
(Studi Kasus pada Atlet Taekwondo di Kabupaten Bandung
Barat)

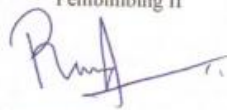
disetujui dan disahkan oleh pembimbing:

Pembimbing I



Dr. Syifa F. Syihab, S.TP., M.Si
NIPT. 920190219840801201

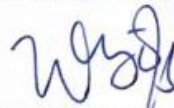
Pembimbing II



Muchamad Rizki Sentani, S.Si., M.Pd
NIPT. 920200419941122101

Mengetahui,

Ketua Program Studi Gizi



Widya Astuti, S.Or., M.Si
NIPT. 920200419930102201

PERNYATAAN TENTANG KEASLIAN SKRIPSI DAN PERNYATAAN BEBAS PLAGIARISME

Saya yang bertanda tangan di bawah ini:

Nama : Mochamad Sidiq Rifaldi
NIM : 2104239
Program Studi : Gizi
Judul Karya : Faktor-Faktor yang Berhubungan dengan *Power*
Tungkai Atlet Taekwondo di Kabupaten Bandung Barat

Dengan ini menyatakan bahwa karya tulis ini merupakan hasil kerja saya sendiri. Saya menjamin bahwa seluruh isi karya ini, baik sebagian maupun keseluruhan, bukan merupakan plagiarisme dari karya orang lain, kecuali pada bagian yang telah dinyatakan dan disebutkan sumbernya dengan jelas.

Jika di kemudian hari ditemukan pelanggaran terhadap etika akademik atau unsur plagiarisme, saya bersedia menerima sanksi sesuai peraturan yang berlaku di Universitas Pendidikan Indonesia.

Bandung, 15 Agustus 2025



Tanda tangan: _____

Mochamad Sidiq Rifaldi

KATA PENGANTAR

Puji syukur kehadiran Allah SWT atas segala limpahan rahmat, taufik, dan hidayah-Nya sehingga penulis dapat menyelesaikan skripsi yang berjudul "Faktor-Faktor yang Berhubungan dengan *Power* Tungkai Atlet Taekwondo di Kabupaten Bandung Barat" sebagai salah satu syarat untuk memperoleh gelar Sarjana pada Program Studi Gizi, Fakultas Pendidikan Olahraga dan Kesehatan, Universitas Pendidikan Indonesia. Penyusunan skripsi ini tentu tidak lepas dari bantuan, dukungan, dan doa dari berbagai pihak. Oleh karena itu, penulis menyampaikan ucapan terima kasih dan penghargaan yang setulus-tulusnya kepada:

1. Bapak Prof. Dr. Komarudin, M.Pd., selaku Dekan Fakultas Pendidikan Olahraga dan Kesehatan, Universitas Pendidikan Indonesia atas arahannya selama menjalani proses akademik.
2. Ibu Widya Astuti, S.Gz., M.Si., selaku Ketua Program Studi Gizi, yang telah memfasilitasi dan mendukung kelancaran studi penulis.
3. Ibu Dr. Syifa F. Syihab, S.TP., M.Si. dan Bapak Muchamad Rizki Sentani S.Si., M.Pd., selaku dosen pembimbing skripsi, atas bimbingan, arahan, dan motivasi yang diberikan selama penyusunan skripsi ini.
4. Ibu Fajria Saliha Puspita Prameswari, S.Gz., M.Si., RD., selaku dosen penguji, yang telah memberikan masukan dan saran yang sangat berarti dalam penyempurnaan skripsi ini.
5. Seluruh dosen dan staf akademik Program Studi Gizi Universitas Pendidikan Indonesia, atas ilmu dan pelayanan selama penulis menempuh pendidikan.
6. Tim Pelatih Pengurus Cabang Taekwondo Indonesia Kabupaten Bandung Barat yang telah memberikan izin, dukungan, dan fasilitas sebagai tempat pelaksanaan penelitian, sehingga proses pengumpulan data dapat berjalan dengan lancar.
7. Seluruh responden/informan yang telah bersedia meluangkan waktu dan memberikan informasi yang berharga dalam penelitian ini.
8. Orang tua tercinta Bapak Edi Supriadi dan Ibu Eva Noviani, yang selalu mendoakan, mendukung secara moril maupun materiil, serta menjadi sumber semangat utama dalam menyelesaikan studi ini.

9. Sahabat-sahabat dan rekan seperjuangan, khususnya teman-teman Gizi Angkatan 2021, atas kebersamaan, kerja sama, dan saling menyemangati selama masa perkuliahan hingga penyusunan skripsi ini.
10. Pihak-pihak lain yang tidak dapat disebutkan satu per satu, yang telah membantu dan memberikan dukungan dalam berbagai bentuk.

Penulis menyadari bahwa skripsi ini masih jauh dari sempurna. Oleh karena itu, penulis sangat mengharapkan kritik dan saran yang membangun demi perbaikan di masa yang akan datang. Akhir kata, semoga skripsi ini dapat memberikan manfaat dan menjadi kontribusi ilmiah yang bermanfaat bagi semua pihak

Bandung, 15 Agustus 2025

Penulis

ABSTRAK

Latar Belakang: *Power* tungkai merupakan komponen fisik penting dalam olahraga taekwondo, terutama dalam mendukung kekuatan dan kecepatan tendangan. Faktor-faktor seperti kecukupan gizi, status hidrasi, komposisi tubuh dan somatotipe diduga memiliki pengaruh signifikan terhadap kemampuan *power* tungkai atlet. **Tujuan:** Penelitian ini bertujuan untuk menganalisis hubungan antara *energy availability*, kecukupan zat gizi makro, kecukupan cairan, massa otot, total lemak tubuh, dan somatotipe dengan *power* tungkai pada atlet taekwondo. **Metode:** Penelitian ini menggunakan desain kuantitatif dengan pendekatan *cross-sectional*, melibatkan 35 atlet taekwondo. *Power* tungkai diukur menggunakan instrumen *vertical jump test*, sedangkan kecukupan zat gizi makro dan cairan diukur melalui hasil perhitungan dari *food recall* 2x24 jam, komposisi tubuh diukur dengan menggunakan stadiometer, *body composition monitor* Karada Scan, *skinfold calipers*, *metline*, dan jangka sorong, serta somatotipe ditentukan menggunakan metode Heath-Carter (1990). Analisis data dilakukan menggunakan regresi logistik multinomial. **Hasil:** Hasil penelitian menunjukkan bahwa variabel somatotipe kategori endomorf memiliki pengaruh signifikan terhadap *power* tungkai tinggi dibandingkan kategori rendah ($p < 0,05$), sedangkan variabel kecukupan cairan, kecukupan lemak, dan total lemak tubuh tidak menunjukkan pengaruh signifikan ($< 0,05$). **Kesimpulan:** somatotipe endomorf memiliki pengaruh dalam pencapaian *power* tungkai pada atlet taekwondo, sementara faktor gizi dan hidrasi memerlukan kajian lebih lanjut untuk melihat pengaruhnya terhadap *power* tungkai.

Kata kunci: *energy availability*, *power* tungkai, somatotipe, taekwondo, zat gizi makro

ABSTRACT

Background: Leg power is an important physical component in taekwondo, especially in supporting kicking power and speed. Factors such as nutritional adequacy, hydration status, body composition and somatotype are thought to have a significant influence on athletes' leg power capabilities. **Objectives:** This study aims to analyze the relationship between energy availability, macronutrient adequacy, fluid adequacy, muscle mass, total body fat, and somatotype with leg power in taekwondo athletes. **Methods:** This study used a quantitative design with a cross-sectional approach, involving 35 taekwondo athletes. Leg power was measured using a vertical jump test instrument, while macronutrient and fluid adequacy were measured through the results of 2x24-hour food recall calculations, body composition was measured using a stadiometer, Karada Scan body composition monitor, skinfold calipers, metline, and calipers, and somatotype was determined using the Heath-Carter method (1990). Data analysis was performed using multinomial logistic regression. **Results:** The results showed that the endomorph somatotype variable had a significant effect on high leg power compared to the low category ($p < 0.05$), while the variables of fluid adequacy, fat adequacy, and total body fat did not show a significant effect (< 0.05). **Conclusion:** Endomorph somatotype has an influence on leg power achievement in taekwondo athletes, while nutritional and hydration factors require further study to determine their effect on leg power.

Keywords: energy availability, leg power, macronutrients, somatotype, taekwondo

DAFTAR ISI

LEMBAR HAK CIPTA	i
LEMBAR PENGESAHAN SKRIPSI	ii
PERNYATAAN TENTANG KEASLIAN SKRIPSI DAN PERNYATAAN BEBAS PLAGIARISME	iii
KATA PENGANTAR	iv
ABSTRAK	vi
DAFTAR ISI	viii
DAFTAR TABEL	x
DAFTAR GAMBAR	xi
DAFTAR SINGKATAN	xii
DAFTAR LAMPIRAN	xiii
BAB I PENDAHULUAN	1
1.1 Latar Belakang	1
1.2 Rumusan Masalah	3
1.3 Tujuan Penelitian	3
1.3.1 Tujuan Umum	3
1.3.2 Tujuan Khusus	3
1.4 Manfaat Penelitian	3
1.4.1 Manfaat praktis	3
1.4.2 Manfaat Teoritis	4
1.5 Ruang Lingkup Penelitian	4
BAB II TINJAUAN PUSTAKA	6
2.1 Performa dan Taekwondo	6
2.2 Gizi dan Atlet Taekwondo	7
2.2.1 Kebutuhan Gizi Atlet Taekwondo	7
2.2.2 Kebutuhan Cairan Atlet Taekwondo	9
2.2.3 Permasalahan Kecukupan Gizi Pada Atlet Taekwondo	10
2.3 <i>Energy Availability</i>	13
2.4 Komposisi Tubuh Atlet	15
2.5 Somatotipe	16
2.6 Pengukuran <i>Power</i> Atlet Taekwondo	18
2.7 Penelitian Terdahulu	19
2.8 Kerangka Teori	22
2.9 Kerangka Konsep	23
2.10 Definisi Operasional	24
2.11 Hipotesis	27
BAB III METODE PENELITIAN	29
3.1 Desain Penelitian	29
3.2 Lokasi dan Waktu Penelitian	29
3.3 Populasi dan Sampel	29
3.3.1 Populasi	29
3.3.2 Sampel	29
3.3.3 Teknik Penarikan Sampel	30
3.4 Teknik Pengumpulan Data	30
3.4.1 Sumber Data	30
3.4.2 Instrumen Penelitian	31

3.4.3 Tahapan Pengumpulan Data.....	33
3.5 Prosedur Pengolahan Data.....	35
3.5.1 Pengolahan Data.....	35
3.5.2 Analisis Data	36
3.6 Isu Etik.....	37
BAB IV HASIL DAN PEMBAHASAN	39
4.1 Hasil Penelitian.....	39
4.1.1 Karakteristik Responden.....	39
4.1.2 Analisis Bivariat	43
4.1.3 Analisis Multivariat	44
4.2 Pembahasan	46
4.2.1 Gambaran Tingkat <i>Energy Availability</i> Atlet.....	46
4.2.2 Gambaran Kecukupan Gizi dan Cairan Atlet.....	48
4.2.3 Gambaran Profil saya Antropometri Atlet	49
4.2.4 Gambaran <i>Power</i> Tungkai Atlet	51
4.2.5 Hubungan Variabel Penelitian dengan <i>Power</i> Tungkai	52
4.2.6 Keterbatasan Penelitian	54
BAB V KESIMPULAN DAN SARAN.....	55
5.1 Kesimpulan.....	55
5.2 Saran.....	55
DAFTAR PUSTAKA	57
LAMPIRAN.....	72

DAFTAR TABEL

Tabel 2.1 Skala Intensitas Latihan	15
Tabel 2.2 Klasifikasi Level <i>Energy Availability</i> Atlet.....	15
Tabel 2.3 Norma Pengukuran Tes <i>Vertical Jump</i>	19
Tabel 2.4 Penelitian Terdahulu	20
Tabel 2.5 Definisi Operasional	24
Tabel 3.1 Pengkodean Variabel Penelitian	35
Tabel 4.1 Gambaran Karakteristik Atlet	39
Tabel 4.2 Gambaran Komposisi Tubuh Atlet	40
Tabel 4.3 Gambaran Kecukupan Gizi Atlet.....	41
Tabel 4.4 Gambaran <i>Power</i> Tungkai Atlet	42
Tabel 4.5 Hasil Uji Fisher Freeman-Halton antara Variabel Penelitian dengan Kategori <i>Power</i> Tungkai Atlet	43
Tabel 4.6 Hasil <i>Likelihood Ratio Test</i> Regresi Logistik Multinomial	44
Tabel 4.7 Parameter Estimasi Regresi Logistik Multinomial antara Faktor Penelitian dengan Kategori <i>Power</i> Tungkai	45

DAFTAR GAMBAR

Gambar 2.1 Diagram Somatotype Carter & Heath (1990)	17
Gambar 2.2 Kerangka Teori Power Menurut Jeukendrup & Gleeson (Modifikasi)	23
Gambar 2.3 Kerangka Konsep Penelitian	24

DAFTAR SINGKATAN

BB	: Berat Badan
CI	: <i>Confidence Interval</i>
CSAI-2	: <i>Competitive State Anxiety Inventory-2</i>
DBMP	: Daftar Bahan Makanan Penukar
DEXA	: <i>Dual Energy X-ray Absorptiometry</i>
DKBM	: Daftar Komposisi Bahan Makanan
EA	: <i>Energy Availability</i>
EEE	: <i>Exercise Energy Expenditure</i>
FAT	: <i>Female Athlete Triad</i>
FFM	: <i>Fat Free Mass</i>
GH	: <i>Growth Hormone</i>
IMT	: Indeks Massa Tubuh
IOC	: <i>International Olympic Committee</i>
LEA	: <i>Low Energy Availability</i>
LiLA	: Lingkar Lengan Atas
METs	: <i>Metabolic Equivalent of Task</i>
OR	: <i>Odd Ratio</i>
PON	: Pekan Olahraga Nasional
POPNAS	: Pekan Olahraga Pelajar Nasional
REDS	: <i>Relative Energy Deficiency in Sport</i>
RFD	: <i>Rate of Force Development</i>
SMA	: Sekolah Menengah Atas
SMP	: Sekolah Menengah Pertama
SPSS	: <i>Statistical Package for the Social Sciences</i>
SSC	: <i>Stretch Shortening Cycle</i>
STAI	: <i>State Trait Anxiety Inventory</i>
TAAA	: <i>Taekwondo Athlete Assessment Approach</i>
TKPI	: Tabel Komposisi Pangan Indonesia
WHO	: <i>World Health Organization</i>

DAFTAR LAMPIRAN

Lampiran 1. Biodata Peneliti	72
Lampiran 2. Lembar Pengesahan Proposal dan Skripsi.....	73
Lampiran 3. Surat Izin Penelitian.....	74
Lampiran 4. Surat Balasan Izin Penelitian	75
Lampiran 5. Sertifikat Ethical Clearance	76
Lampiran 6. Instrumen Penelitian	77
Lampiran 7. Pedoman Skoring Instrumen Penelitian	83
Lampiran 8. Output SPSS	85
Lampiran 9. Dokumentasi Penelitian	95
Lampiran 10. Draft Artikel Ilmiah	97
Lampiran 11. Bukti Turnitin Skripsi.....	107
Lampiran 12. Bukti Turnitin Draft Artikel Ilmiah	107

DAFTAR PUSTAKA

- Aaron D. Heishman, Bryce D. Daub, Ryan M. Miller, Eduardo D. S. Freitas, Michael G. Bemben. (2020) Monitoring External Training Loads and Neuromuscular Performance for Division I Basketball Players over the Preseason. *Journal of Sports Science and Medicine* (19), 204 - 212.
- Ackerman, K. E., Stellingwerff, T., Elliott-Sale, K. J., Baltzell, A., Cain, M., Goucher, K., Fleshman, L., & Mountjoy, M. L. (2020). #REDS (Relative Energy Deficiency in Sport): time for a revolution in sports culture and systems to improve athlete health and performance. *British journal of sports medicine*, 54(7), 369–370. <https://doi.org/10.1136/bjsports-2019-101926>
- Ackland, T.R., Lohman, T.G., Sundgot-Borgen, J. *et al.* Current Status of Body Composition Assessment in Sport. *Sports Med* 42, 227–249 (2012). <https://doi.org/10.2165/11597140-000000000-00000>
- Abduh, M., Alawiyah, T. Apriansyah, G. Sirodj, R. A. & Afgani, M. W. (2023). Survey Design: Cross Sectional dalam Penelitian Kualitatif. *Jurnal Pendidikan Sains dan Komputer*. Vol. 3, No. 1. E-ISSN: 2809-476X.
- Albuquerque, M. R., Tavares, L. D., Longo, A. R., Caldeira Mesquita, P. H., & Franchini, E. (2022). Relationship between Indirect Measures of Aerobic and Muscle Power with Frequency Speed of Kick Test Multiple Performance in Taekwondo Athletes. *International journal of sports medicine*, 43(3), 254–261. <https://doi.org/10.1055/a-1546-9221>
- Alejo, L. B., Montalvo-Pérez, A., Valenzuela, P. L., Revuelta, C., Ozcoidi, L. M., de la Calle, V., Mateo-March, M., Lucia, A., Santalla, A., & Barranco-Gil, D. (2022). Comparative analysis of endurance, strength and body composition indicators in professional, under-23 and junior cyclists. *Frontiers in physiology*, 13, 945552. <https://doi.org/10.3389/fphys.2022.945552>
- Amin, N. F. Sabaruddin, G., & Abunawas, K. (2023). Konsep Umum Populasi dan Sampel dalam Penelitian. *JURNAL PILAR: Jurnal Kajian Islam Kontemporer*. Vol. 14, No. 1.
- Anwari, A. S. N., Susanto, I. H., Firmansyah, A., & Mustar, Y. S. (2025). Relationship between body composition and limb muscle power of

- taekwondo athletes. *Sriwijaya Journal of Sport*, 4(2), 113–123.
<https://doi.org/10.55379/sjs.v4i2.30>
- Apollaro, G., Panasci, M., Ouerghi, I., Falcó, C., Franchini, E., Ruggeri, P., & Faelli, E. (2024). Influence of Body Composition and Muscle Power Performance on Multiple Frequency Speed of Kick Test in Taekwondo Athletes. *Sports*, 12(12), 322. <https://doi.org/10.3390/sports12120322>
- Areta, J. L., Iraki, J., Owens, D. J., Joannis, S., Philp, A., Morton, J. P., & Hallén, J. (2020). Achieving energy balance with a high-fat meal does not enhance skeletal muscle adaptation and impairs glycaemic response in a sleep-low training model. *Experimental physiology*, 105(10), 1778–1791.
<https://doi.org/10.1113/EP088795>
- Arifin, Z. (2017). Kriteria Instrumen dalam Suatu Penelitian. *Jurnal THEOREMS (The Original Research of Mathematics)*. Vol. 2, No.1. 28-36.
- Arikunto, Suharsimi. (2019). Prosedur Penelitian Suatu Pendekatan Praktik. Rineka Cipta.
- Arnaoutis, G., & Neophytou, P. (2025). The Effect of Acute Dehydration upon Muscle Strength Indices at Elite Karate Athletes: A Randomized Crossover Study. *Nutrients*, 17(9), 1452. <https://doi.org/10.3390/nu17091452>
- Arum sari, D. W., Ahmadi, H. U. al, Jordan, T., Puruhito, B., Basyar, E., & Indraswari, D. A. (2021). Correlation between Body Mass Index, Muscle Mass, and Muscle Explosive Power in First-Year Medical Students of Diponegoro University. *DIPONEGORO MEDICAL JOURNAL (JURNAL KEDOKTERAN DIPONEGORO)*, 10(6), 433–437.
<https://doi.org/10.14710/dmj.v10i6.31687>
- Babic, M., Marinovic, M., & Cular, D. (2023). Anthropometric variability of European taekwondo champions. *International Journal of Morphology*, 41(2), 380–388.
- Baranauskas, M., Kupčiūnaitė, I., Lieponienė, J., & Stukas, R. (2024). Dominant Somatotype Development in Relation to Body Composition and Dietary Macronutrient Intake among High-Performance Athletes in Water, Cycling and Combat Sports. *Nutrients*, 16(10), 1493.
<https://doi.org/10.3390/nu16101493>

- Barley, O.R., Chapman, D.W. & Abbiss, C.R. Reviewing the current methods of assessing hydration in athletes. *J Int Soc Sports Nutr* **17**, 52 (2020). <https://doi.org/10.1186/s12970-020-00381-6>
- Bchini, S., Hammami, N., Selmi, T., Zalleg, D., & Bouassida, A. (2023). Influence of muscle volume on jumping performance in healthy male and female youth and young adults. *BMC sports science, medicine & rehabilitation*, *15*(1), 26. <https://doi.org/10.1186/s13102-023-00639-x>
- Beato, M., Datson, N., Anderson, L., Brownlee, T., Coates, A., & Hulton, A. (2023). Rationale and Practical Recommendations for Testing Protocols in Female Soccer: A Narrative Review. *Journal of Strength & Conditioning Research*, *37*(9), 1912–1922. <https://doi.org/10.1519/JSC.0000000000004509>
- Ben Mansour, G., Kacem, A., Ishak, M. *et al.* The effect of body composition on strength and power in male and female students. *BMC Sports Sci Med Rehabil* **13**, 150 (2021). <https://doi.org/10.1186/s13102-021-00376-z>
- Berral-Aguilar, A. J., Schröder-Vilar, S., Rojano-Ortega, D., & Berral-de la Rosa, F. J. (2022). Body Composition, Somatotype and Raw Bioelectrical Impedance Parameters of Adolescent Elite Tennis Players: Age and Sex Differences. *International Journal of Environmental Research and Public Health*, *19*(24), 17045. <https://doi.org/10.3390/ijerph192417045>
- Bompa, T. O., & Buzzichelli, C. (2019). Periodization: Theory and Methodology of Training. *Human Kinetics*.
- Bompa, T. O., & Sarandan, S. O. (2023). *Training and Conditioning Young Athletes*. Human Kinetics. <https://doi.org/10.5040/9781718241077>
- Bridge, C. A., Ferreira da Silva Santos, J., Chaabène, H., Pieter, W., & Franchini, E. (2014). Physical and physiological profiles of taekwondo athletes. *Sports Medicine*, *44*(6), 713-733.
- Briggs, C., James, C., Kohlhardt, S., Pandya T. (2020). Relative Energy Deficiency in Sport (RED-S) - a Narrative Review and Perspectives from the UK. *German Journal of Sports Medicine*. *71*: 243-248. doi:10.5960/dzsm.2020.459

- Bucci, L. (2020). *Nutritional ergogenic aids: The science behind dietary supplements*. CRC Press.
- Burke, L. M., Whitfield, J., Heikura, I. A., Ross, M. L. R., Tee, N., Forbes, S. F., Hall, R., McKay, A. K. A., Walleit, A. M., & Sharma, A. P. (2021). Adaptation to a low carbohydrate high fat diet is rapid but impairs endurance exercise metabolism and performance despite enhanced glycogen availability. *The Journal of physiology*, 599(3), 771–790. <https://doi.org/10.1113/JP280221>
- Cahyani, I. P. R., Sulistiyani, Adi, D. I. (2024). Tingkat Konsumsi, Indeks Massa Tubuh (IMT), dan Status Anemia pada Atlet Karate Remaja Putri. *Jurnal Pendidikan Olahraga*. Vol. 14, No.4
- Campa, F., Piras, A., Raffi, M., Trofè, A., Perazzolo, M., Mascherini, G., & Toselli, S. (2020). The Effects of Dehydration on Metabolic and Neuromuscular Functionality During Cycling. *International journal of environmental research and public health*, 17(4), 1161. <https://doi.org/10.3390/ijerph17041161>
- Campa, F., Silva, A. M., Talluri, J., Matias, C. N., Badicu, G., & Toselli, S. (2020). Somatotype and Bioimpedance Vector Analysis: A New Target Zone for Male Athletes. *Sustainability*, 12(11), 4365. <https://doi.org/10.3390/su12114365>
- Capanema, F. D., Lamounier, J. A., Ribeiro, J. G. L., Lima, C. O. V., de Almeida Paiva, A. R., Quadros, P. R., Ferreira, N. S. K., de Almeida, T. S., & Santos, N. C. M. (2022). Anemia and Nutritional Aspects in Adolescent Athletes: A Cross-Sectional Study in a Reference Sport Organization. *Revista Paulista de Pediatria*, 40, 1–8.
- Carter, J. E. L., & Heath, B. H. (1990). *Somatotyping: Development and Applications*. Cambridge University Press.
- Casa, D. J., Chevront, S. N., Galloway, S. D., & Shirreffs, S. M. (2019). Fluid Needs for Training, Competition, and Recovery in Track-and-Field Athletes. *International journal of sport nutrition and exercise metabolism*, 29(2), 175–180. <https://doi.org/10.1123/ijsnem.2018-0374>

- Cid-Calfucura, I., Herrera-Valenzuela, T., Franchini, E., Falco, C., Alvial-Moscoso, J., Pardo-Tamayo, C., Zapata-Huenullán, C., Ojeda-Aravena, A., & Valdés-Badilla, P. (2023). Effects of Strength Training on Physical Fitness of Olympic Combat Sports Athletes: A Systematic Review. *International Journal of Environmental Research and Public Health*, 20(4), 3516. <https://doi.org/10.3390/ijerph20043516>
- Ciftci, R., & Kurtoglu, A. (2023). Examination of the Effect of Somatotype Profiles on Athletic Performance Indicators in Children Aged 48-72 Months. *Cureus*. <https://doi.org/10.7759/cureus.45430>
- Cinarli, F. S., Buyukcelebi, H., Esen, O., Barasinska, M., Cepicka, L., Gabrys, T., Nalbant, U., & Karayigit, R. (2022). Does Dominant Somatotype Differentiate Performance of Jumping and Sprinting Variables in Young Healthy Adults?. *International journal of environmental research and public health*, 19(19), 11873. <https://doi.org/10.3390/ijerph191911873>
- Cox, A. M., Langan-Evans, C., Jenkins, D., Reale, R., Pelly, F., & Slater, G. J. (2024). Body mass management practices of Olympic weightlifting athletes. *International Journal of Sport Nutrition and Exercise Metabolism*, 35(1), 67–75. <https://doi.org/10.1123/ijsnem.2024-0064>
- Daruhadi, G., Sopiati, P. (2024). Pengumpulan Data Penelitian. *J-CEKI: Jurnal Cendekia Ilmiah*. Vol. 3, No.5.
- de Souza, M. J., Williams, N. I., Koltun, K. J., & Strock, N. C. A. (2020). Female Athlete Triad Coalition risk assessment tool is an evidenced-based tool that is reliable and well-described. *Journal of Sports Sciences*, 38(9), 996–999. <https://doi.org/10.1080/02640414.2020.1738120>
- Donahue, P. T., Wilson, S. J., Williams, C. C., Hill, C. M., & Garner, J. C. (2021). Comparison of Countermovement and Squat Jumps Performance in Recreationally Trained Males. *International journal of exercise science*, 14(1), 462–472. <https://doi.org/10.70252/FXQB8485>
- Donahue, P. T., Wilson, S. J., Williams, C. C., Hill, C. M., Valliant, M., & Garner, J. C. (2020). Impact of Hydration Status on Jump Performance in Recreationally Trained Males. *International journal of exercise science*, 13(4), 826–836. <https://doi.org/10.70252/CZTP1455>

- Dos Santos, I. A., Bertochi, G. F. A., Higino, W. P., Papoti, M., & Puggina, E. F. (2023). The Percentage of Total and Regional Fat Is Negatively Correlated with Performance in Judo. *Sports (Basel, Switzerland)*, 11(9), 168. <https://doi.org/10.3390/sports11090168>
- Drapeau, V., Laramée, C., Lafreniere, J. *et al.* (2024). Assessing the relative validity of a web-based self-administered 24-hour dietary recall in a Canadian adolescent's population. *Nutr J* **23**, 66. <https://doi.org/10.1186/s12937-024-00954-0>
- Fitri, R. L., Putri, R. N., Fitriyah, S., Shaliha, L., Sari, R. (2024). Penerapan Uji Rank Spearman Terhadap Analisis Hubungan Tingkat Kemampuan Matematika Dengan Nilai Akhir Mata Kuliah Statistika dan Data Sains. *IJEDR: Indonesian Journal of Education and Development Research*. Vol. 2 No.1.
- Frstrup, B., Krstrup, P., Kristensen, K. H., Rasmussen, S., & Aagaard, P. (2024). Test-retest reliability of lower limb muscle strength, jump and sprint performance tests in elite female team handball players. *European journal of applied physiology*, 124(9), 2577–2589. <https://doi.org/10.1007/s00421-024-05470-x>
- Gervasi, M., Benelli, P., Venerandi, R., & Fernández-Peña, E. (2022). Relationship between Muscle-Tendon Stiffness and Drop Jump Performance in Young Male Basketball Players during Developmental Stages. *International journal of environmental research and public health*, 19(24), 17017. <https://doi.org/10.3390/ijerph192417017>
- Gibson, R. S. (2005). *Principles of Nutritional Assessment: Edisi ke-2*. Oxford University Press. New York (US).
- Haddad, M. (2015). *Performance Optimization in Taekwondo: From Laboratory to Field*. Foster: OMICS Group eBooks.
- Heikura, I. A., Stellingwerff, T., & Areta, J. L. (2022). Low energy availability in female athletes: From the lab to the field. *European journal of sport science*, 22(5), 709–719. <https://doi.org/10.1080/17461391.2021.1915391>
- Hernandez-Martinez, J., Perez-Carcamo, J., Coñapi-Union, B., Canales-Canales, S., Negron-Molina, M., Avila-Valencia, S., Cid-Calfucura, I., Herrera-

- Valenzuela, T., Cisterna, D., Branco, B. H. M., & Valdés-Badilla, P. (2024). Relationship between Body Composition and Physical Performance by Sex in Professional Basketball Players. *Applied Sciences*, 14(20), 9165. <https://doi.org/10.3390/app14209165>
- Horvath, P. J., Eagen, C. K., Fisher, N. M., Leddy, J. J., & Pendergast, D. R. (2000). The effects of varying dietary fat on performance and metabolism in trained male and female runners. *Journal of the American College of Nutrition*, 19(1), 52–60. <https://doi.org/10.1080/07315724.2000.10718914>
- Hutson, M.J., O'Donnell, E., Brooke-Wavell, K. *et al.* Effects of Low Energy Availability on Bone Health in Endurance Athletes and High-Impact Exercise as A Potential Countermeasure: A Narrative Review. *Sports Med* **51**, 391–403 (2021). <https://doi.org/10.1007/s40279-020-01396-4>
- IOTF, WHO. (2000). Klasifikasi Berat Badan berdasarkan BMI pada Penduduk Asia-Dewasa.
- Jeukendrup, A. & Gleeson M. (2019). Sport Nutrition (Third Edition). *Human Kinetics*.
- Jeukendrup, A. & Gleeson M. (2024). Sport Nutrition (Fourth Edition). *Human Kinetics*.
- Jiang, W., Chen, C., & Xu, Y. (2024). Muscle structure predictors of vertical jump performance in elite male volleyball players: a cross-sectional study based on ultrasonography. *Frontiers in physiology*, 15, 1427748. <https://doi.org/10.3389/fphys.2024.1427748>
- Kahraman, M. Z., & Okut, S. (2025). The relationship between body composition parameters, anaerobic power, and jumping performance in basketball players. *Physical Education of Students*, 29(1), 66–72. <https://doi.org/10.15561/20755279.2025.0107>
- Kementrian Kesehatan RI. (2019). Angka Kecukupan Gizi yang Dianjurkan untuk Masyarakat Indonesia.
- Kementerian Kesehatan RI. Direktorat Jenderal Kesehatan Masyarakat. 2021. Buku Pintar Gizi Bagi Atlet. Jakarta : Kementerian Kesehatan RI.
- Kettunen, O., Ihalainen, J. K., Ohtonen, O., Valtonen, M., Mursu, J., & Linnamo, V. (2021). Energy availability during training camp is associated with signs

- of overreaching and changes in performance in young female cross-country skiers. *Biomedical Human Kinetics*, 13(1), 246–254. <https://doi.org/10.2478/bhk-2021-0030>
- Kim, J. S., Lee, J. Y., & Kim, T. (2020). The role of flexibility and strength in taekwondo performance: Practical insights for athletes and coaches. *Journal of Strength and Conditioning Research*, 34(7), 1987–1994. <https://doi.org/10.1519/JSC.00000000000003204>
- Kojima C, Ishibashi A, Ebi K, Goto K (2022) Exogenous glucose oxidation during endurance exercise under low energy availability. *PLoS ONE* 17(10): e0276002. <https://doi.org/10.1371/journal.pone.0276002>
- Kopchick, J. J., Berryman, D. E., Puri, V., Lee, K. Y., & Jorgensen, J. O. L. (2020). The effects of growth hormone on adipose tissue: old observations, new mechanisms. *Nature reviews. Endocrinology*, 16(3), 135–146. <https://doi.org/10.1038/s41574-019-0280-9>
- Kuswari, M. & Gifari, N. (2020). *Periodisasi Gizi dan Latihan*. Depok: PT RajaGrafindo.
- Kuswari, M., Gifari, N., Nuzrina, R. (2019). Hubungan Asupan Energi, Zat Gizi Makro dan Mikro Terhadap Kebugaran Atlet Dyva Taekwondo Centre Cibinong.
- Kwon, H. E., Ko, N., Yuk, D., Choi, S. W., & Koh, S. E. (2023). Improved Muscle Mass and Function With Protein Supplementation in Older Adults With Sarcopenia: A Meta-Analysis. *Annals of rehabilitation medicine*, 47(5), 358–366. <https://doi.org/10.5535/arm.23076>
- Lee, J.-H., Kim, T., Lee, M., & Ha, M.-S. (2024). Latent profile analysis of spinal deep muscle strength and physical fitness in elite Taekwondo athletes. *BMC Sports Science, Medicine and Rehabilitation*, 16(1), 245. <https://doi.org/10.1186/s13102-024-01034-w>
- Legg, L., Rush, M., Rush, J., McCoy, S., Garner, J. C., & Donahue, P. T. (2021). Association Between Body Composition and Vertical Jump Performance in Female Collegiate Volleyball Athletes. *International Journal of Kinesiology and Sports Science*, 9(4), 43. <https://doi.org/10.7575/aiac.ijkss.v.9n.4p.43>

- Li, J., Yan, Y., Pan, X., Chen, J., & Sui, H. (2024). A179: Investigation of Hydration Status and Drinking Water Intake Recommendations in Taekwondo Athletes. *International Journal of Physical Activity and Health*, 3(3). <https://doi.org/10.18122/ijpah.3.3.179.boisestate>
- Li, W., Gao, Z., Liu, Y., & Wang, J. (2024). Effects of 4-week circuit strength combined with blood flow restriction training on muscle status and performance in Taekwondo athletes. *Journal of Human Sport and Exercise*, 19(2), 483-498. <https://doi.org/10.55860/ad6rd932>
- Ličen, U., & Kozinc, Ž. (2023). The influence of inter-limb asymmetries in muscle strength and power on athletic performance: a review. *Montenegrin Journal of Sports Science and Medicine*, 12(1), 75–86. <https://doi.org/10.26773/mjssm.230310>
- Lievens, E., Klass, M., Bex, T., & Derave, W. (2020). Muscle fiber typology substantially influences time to recover from high-intensity exercise. *Journal of Applied Physiology*, 128(3), 648–659. <https://doi.org/10.1152/japplphysiol.00636.2019>
- Logue, D. M., Madigan, S. M., Delahunt, E., Heinen, M., Mc Donnell, S. J., & Corish, C. A. (2020). Low energy availability in athletes 2020: An updated narrative review of evidence and recommended solutions. *Sports Medicine*, 50(11), 1937-1951.
- Logue, D. M., Madigan, S. M., Melin, A., Delahunt, E., Heinen, M., Donnell, S.-J. M., & Corish, C. A. (2020). Low Energy Availability in Athletes 2020: An Updated Narrative Review of Prevalence, Risk, Within-Day Energy Balance, Knowledge, and Impact on Sports Performance. *Nutrients*, 12(3), 835. <https://doi.org/10.3390/nu12030835>
- Loucks, A. B., Kiens, B., & Wright, H. H. (2011). Energy availability in athletes. *Journal of Sports Sciences*, 29(SUPPL.1), S7–S15. <https://doi.org/10.1080/02640414.2011.588958>
- Lubis, L., Salsabila, N., & Wiramihardja, S. (2021). Pengaruh protokol hidrasi dan status hidrasi terhadap kekuatan otot tungkai bawah, atensi, dan passing atlet futsal remaja. *Jurnal Keolahragaan*, 9(1). <https://doi.org/10.21831/jk.v9i1.29089>

- Ma, S., Xu, Y., & Xu, S. (2025). Effects of Physical Training Programs on Healthy Athletes' Vertical Jump Height: A Systematic Review With Meta-Analysis. *Journal of sports science & medicine*, 24(2), 236–257. <https://doi.org/10.52082/jssm.2025.236>
- Mackenzie, B. (2005). 101 Performance Evaluation Tests. Electric Word.
- Malisoux, L., Francaux, M., Nielens, H., & Theisen, D. (2006). Stretch-shortening cycle exercises: an effective training paradigm to enhance power output of human single muscle fibers. *Journal of Applied Physiology*, 100(3), 771–779. <https://doi.org/10.1152/jappphysiol.01027.2005>
- Mangona, L., Brasil, I. A., Prista, A., & Farinatti, P. (2024). Energy Expenditure, Intensity, and Perceived Effort in Recreational Functional Training. *Research quarterly for exercise and sport*, 95(1), 81–90. <https://doi.org/10.1080/02701367.2022.2148624>
- Melin, A. K., Areta, J. L., Heikura, I. A., Stellingwerff, T., Torstveit, M. K., & Hackney, A. C. (2024). Direct and indirect impact of low energy availability on sports performance. *Scandinavian journal of medicine & science in sports*, 34(1), e14327. <https://doi.org/10.1111/sms.14327>
- Melin, A. K., Heikura, I. A., Tenforde, A., & Mountjoy, M. (2019). Energy Availability in Athletics: Health, Performance, And Physique. *International Journal of Sport Nutrition and Exercise Metabolism*, 29(2), 152–164. <https://doi.org/10.1123/Ijsnem.2018-0201>
- Methenitis, S., Mpampoulis, T., Spiliopoulou, P., Papadimas, G., Papadopoulos, C., Chalari, E., Evangelidou, E., Stasinaki, A. N., Nomikos, T., & Terzis, G. (2020). Muscle fiber composition, jumping performance, and rate of force development adaptations induced by different power training volumes in females. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme*, 45(9), 996–1006. <https://doi.org/10.1139/apnm-2019-0786>
- Mocanu, G. D., Murariu, G., & Potop, V. (2023). Differences in explosive strength values for students of the faculty of physical education and sports (male) according to body mass index levels. *Pedagogy of Physical Culture and Sports*, 27(1), 71–83. <https://doi.org/10.15561/26649837.2023.0109>

- Mountjoy, M., Sundgot-Borgen, J. K., Burke, L. M., Ackerman, K. E., Blauwet, C., Constantini, N., Lebrun, C., Lundy, B., Melin, A. K., Meyer, N. L., Sherman, R. T., Tenforde, A. S., Klungland Torstveit, M., & Budgett, R. (2018). IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update. *British journal of sports medicine*, 52(11), 687–697. <https://doi.org/10.1136/bjsports-2018-099193>.
- National Cancer Institute. (2020). Metabolic Equivalent of Task Unit. NCI Thesaurus. Code C127805.
- Nawassyarif, Julkarnain, M., Ananda, K. R. (2020). Sistem Informasi Pengolahan Data Ternak Unit Pelaksana Produksi dan Kesehatan Hewan Berbasis Web. *Jurnal JINTEKS*. Vol. 2, No. 1.
- Ni'matush Sholihah, Sri Andari, & Bambang Wirjatmadi. (2019). Hubungan Tingkat Konsumsi Protein, Vitamin C, Zat Besi dan Asam Folat dengan Kejadian Anemia pada Remaja Putri SMAN 4 Surabaya. *Amerta Nutrition*, 3(3), 135–141.
- Ojeda-Aravena, A., Herrera-Valenzuela, T., Valdés-Badilla, P., Báez-San Martín, E., Thapa, R. K., & Ramirez-Campillo, R. (2023). A Systematic Review with Meta-Analysis on the Effects of Plyometric-Jump Training on the Physical Fitness of Combat Sport Athletes. *Sports (Basel, Switzerland)*, 11(2), 33. <https://doi.org/10.3390/sports11020033>
- Ojeda-Aravena, A., Warnier-Medina, A., & Brand, C. (2023). Relationship between body composition asymmetry and performance in taekwondo athletes: A cross-sectional study. *Symmetry*, 15(11), 2087.
- Pena-Sanchez, C., Mieleles-Ramirez, M., & Patino-Palma, B. (2022). Characterization of the Somatotype in Taekwondo: Systematic Review. *Clinical Medicine Research*, 11(2), 13. <https://doi.org/10.11648/j.cmr.20221102.11>
- Penggalih, M. H. S. T., Dewita, C. N. M., Pratiwi, D., Solichah, K. M., & Ibtadau, N. (2019). Sistem Energi, Antropometri, dan Asupan Makan Atlet (M. H. T. Penggalih (ed.); Pertama). Gadjah Mada University Press, Anggota IKAPI dan APPTI.

- Pengurus Besar Taekwondo Indonesia. (2024). Indonesia Borong 4 Emas. Diakses tanggal 22 Desember 2024 [Indonesia Borong 4 Emas – Pengurus Besar Taekwondo Indonesia](#)
- Pérez-Castillo, Í. M., Williams, J. A., López-Chicharro, J., Mihic, N., Rueda, R., Bouzamondo, H., & Horswill, C. A. (2023). Compositional Aspects of Beverages Designed to Promote Hydration Before, During, and After Exercise: Concepts Revisited. *Nutrients*, 16(1), 17. <https://doi.org/10.3390/nu16010017>
- Permadi, M. R., & Alist, A. N. (2025). Hubungan Massa Otot, Asupan Energi dan Protein Dengan Kekuatan Otot Tungkai Pada Atlet Sepak Bola. *JURNAL Riset GIZI*, 13(1), 12–17. <https://doi.org/10.31983/jrg.v13i1.12083>
- Pupo, J. D., Ache-Dias, J., Kons, R. L., & Detanico, D. (2020). Are vertical jump height and power output correlated to physical performance in different sports? An allometric approach. *Human Movement*, 22(2), 60–67. <https://doi.org/10.5114/hm.2021.100014>
- Puspaningtyas, D. E., Sari, S. P., Afriani, Y., & Mukarromah, N. (2019). Edukasi Gizi Efektif Meningkatkan Pengetahuan Atlet Mengenai Gizi Seimbang dan Pemenuhan Kebutuhan Cairan. *Jurnal Pengabdian Dharma Bakti*.
- Putri, N. R., & Dhanny, D. R. (2021). *Literature Review*: Konsumsi Energi, Protein, dan Zat Gizi Mikro dan Hubungannya dengan Performa Atlet. *Sport and Nutrition Journal*. Vol. 3, No. 2. Hal 14-24.
- Ramirez-Campillo, R., Andrade, D. C., Nikolaidis, P. T., Moran, J., Clemente, F. M., Chaabene, H., & Comfort, P. (2020). Effects of Plyometric Jump Training on Vertical Jump Height of Volleyball Players: A Systematic Review with Meta-Analysis of Randomized-Controlled Trial. *Journal of sports science & medicine*, 19(3), 489–499.
- Ramirez-Campillo, R., García-Pinillos, F., Nikolaidis, P. T., Clemente, F. M., Gentil, P., & García-Hermoso, A. (2022). Body composition adaptations to lower-body plyometric training: a systematic review and meta-analysis. *Biology of sport*, 39(2), 273–287. <https://doi.org/10.5114/biolsport.2022.104916>

- Reale, R., Burke, L. M., Cox, G. R., & Slater, G. (2020). Body composition of elite Olympic combat sport athletes. *European Journal of Sport Science*, 20(2), 147–156. <https://doi.org/10.1080/17461391.2019.1616826>
- Rokhmah, L. N. *et al.* (2022). Pangan dan Gizi. Yogyakarta: Yayasan Kita Menulis.
- Santos, J. F. da S., & Franchini, E. (2021). Developing muscle power for combat sports athletes. *Revista de Artes Marciales Asiáticas*, 16(1s), 133–173. <https://doi.org/10.18002/rama.v16i1s.7003>
- Sasmarianto & Nazirun, N. (2022). Pengelolaan Gizi Olahraga pada Atlet. Malang: AHLIMEDIA PRESS.
- Serrano-Huete, V., Latorre-Román, P. A., García-Pinillos, F., Morcillo-Losa, J. A., Jiménez-Reyes, P., & Párraga-Montilla, J. A. (2023). The variability of strength production capacities during a judo contest. *Physical Activity Review*, 11(1), 1–10. <https://doi.org/10.16926/par.2023.11.01>
- Simopoulos, A. P. (2020). Omega-6 and omega-3 fatty acids: Endocannabinoids, genetics and obesity. *OCL*, 27, 7. <https://doi.org/10.1051/ocl/2019046>
- Sousa, J. L., Gamonales, J. M., Hernández-Beltrán, V., Louro, H., & Ibáñez, S. J. (2024). Análisis de las técnicas efectivas en Taekwondo: Revisión sistemática exploratoria (Effective techniques analysis in taekwondo: A systematic review). *Retos*, 53, 78–90. <https://doi.org/10.47197/retos.v53.102399>
- Suchomel, T.J., Nimphius, S., Bellon, C.R. *et al.* Training for Muscular Strength: Methods for Monitoring and Adjusting Training Intensity. *Sports Med* **51**, 2051–2066 (2021). <https://doi.org/10.1007/s40279-021-01488-9>
- Sugiyono, D. (2015). Metode Penelitian Kuantitatif Kualitatif Dan R&D (Vol. 1, Issue April).
- Sultan, Z. H., & Speelman, D. (2025). A Systematic Review of the Effects of Low-Carbohydrate Diet on Athletic Physical Performance Parameters. *Cureus*, 17(2), e79166. <https://doi.org/10.7759/cureus.79166>
- Sunuwar, D. R., Singh, D. R., Bohara, M. P., Shrestha, V., Karki, K., & Pradhan, P. M. S. (2022). Association of Nutrition Knowledge, Practice, Supplement Use, and Nutrient Intake with Strength Performance among Taekwondo Players in Nepal. *Frontiers in Nutrition*. 9:1004288

- Taguchi, M., & Manore, M. M. (2022). Reexamining the calculations of exercise energy expenditure in the energy availability equation of free-living athletes. *Frontiers in Sports and Active Living*, 4. <https://doi.org/10.3389/fspor.2022.885631>
- Uchida, Y., Tsuji, K., & Ochi, E. (2024). Effects of Omega-3 fatty acids supplementation and resistance training on skeletal muscle. *Clinical nutrition ESPEN*, 61, 189–196. <https://doi.org/10.1016/j.clnesp.2024.03.019>
- Uddin, N., Tallent, J., Patterson, S.D. *et al.* Corticospinal and peripheral responses to heat-induced hypo-hydration: potential physiological mechanisms and implications for neuromuscular function. *Eur J Appl Physiol* **122**, 1797–1810 (2022). <https://doi.org/10.1007/s00421-022-04937-z>
- Wang, M., Chee, J., Tanaka, M. J., Lee, Y. H. D. (2024). Relative Energy Deficiency in Sport (REDs) and Knee Injuries: Current Concepts for Female Athletes. *Journal of ISAKOS*. 781-787.
- Whittaker, J., & Wu, K. (2021). Low-fat diets and testosterone in men: Systematic review and meta-analysis of intervention studies. *The Journal of steroid biochemistry and molecular biology*, 210, 105878. <https://doi.org/10.1016/j.jsbmb.2021.105878>
- Wigati, W. W., Ali, M. A., Kurniawati, D. M., & Anggita, G. M. (2022). Analisis Hubungan Makronutrisi Dengan Daya Tahan Kardiorespiratori, Kecepatan, Dan Kekuatan Otot Tungkai Pada Atlet Lari Amatir. *Majalah Kesehatan*, 9(3), 151–158. <https://doi.org/10.21776/majalahkesehatan.2022.009.03.4>
- Williams, J. M. (2020). *Applied Sport Psychology: Personal Growth to Peak Performance*. McGraw Hill.
- Witard, O. C., Hearris, M. T., & Morgan, P. T. (2025). *Protein nutrition for endurance athletes: A metabolic focus on promoting recovery and training adaptation*. *Sports Medicine*, 55, 1361–1376. <https://doi.org/10.1007/s40279-025-02203-8>
- Yumestri, Risnita, Sudur, & Asrulla. (2024). Etika dalam Penelitian Ilmiah. *Journal Genta Mulia*. Vol. 15, No. 2. E-ISSN: 2580-6414.
- Zhang, M., Chen, L., Dai, J., Yang, Q., Huang, Z., He, J., Ji, H., Sun, J., & Li, D. (2024). Application of a New Monitoring Variable: Effects of Power Loss

During Squat Training on Strength Gains and Sports Performance. *Journal of Strength & Conditioning Research*, 38(4), 656–670.
<https://doi.org/10.1519/JSC.00000000000004677>

Zhao, S., Zhang, H., Xu, Y., Li, J., Du, S., & Ning, Z. (2024). The effect of protein intake on athletic performance: a systematic review and meta-analysis. *Frontiers in nutrition*, 11, 1455728.
<https://doi.org/10.3389/fnut.2024.1455728>

Zheng, A. C., He, C. S., Lu, C. C., Hung, B. L., Chou, K. M., & Fang, S. H. (2024). The Cognitive Function and Taekwondo-Specific Kick Performance of Taekwondo Athletes at Different Hydration Statuses. *International journal of sports physiology and performance*, 19(7), 637–644.
<https://doi.org/10.1123/ijsp.2023-0332>