

**KORELASI TINGKAT KONSUMSI DAN *ENERGI*
AVAILABILITY DENGAN PERFORMA *AEROBIC ENDURANCE*
ATLET FUTSAL KOTA BANDUNG TAHUN 2025
(STUDI PADA PEMAIN FUTSAL 15 BANDUNG)**



SKRIPSI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Sarjana Gizi

Oleh:

Farrah Lula Klarissa Hendroyono

2102842

**PROGRAM STUDI GIZI
FAKULTAS PENDIDIKAN OLAHRAGA DAN KESEHATAN
UNIVERSITAS PENDIDIKAN INDONESIA
BANDUNG
2025**

=====

KORELASI TINGKAT KONSUMSI DAN ENERGI AVAILABILITY DENGAN PERFORMA AEROBIC ENDURANCE ATLET FUTSAL KOTA BANDUNG TAHUN 2025 (STUDI PADA PEMAIN FUTSAL 15 BANDUNG)

Oleh
Farrah Lula Klarissa Hendroyono

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

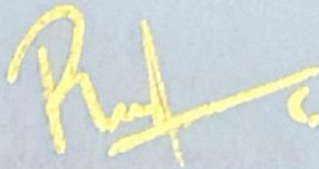
© Farrah Lula Klarissa Hendroyono 2025
Universitas Pendidikan Indonesia
Mei 2025

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.

FARRAH LULA KLARISSA HENDROYONO
KOLERASI TINGKAT KONSUMSI DAN *ENERGI AVAILABILITY*
DENGAN PERFORMA *AEROBIC ENDURANCE* ATLET FUTSAL KOTA
BANDUNG TAHUN 2025
(Studi pada Pemain Futsal 15 Bandung)

disetujui dan disahkan oleh pembimbing:

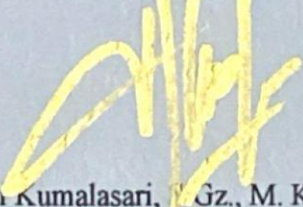
Pembimbing I



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

NIPT. 920200419941122101

Pembimbing II



Isti Kumalasari, S.Gz., M. KM

NIPT. 920190219860208201

Mengetahui,

Ketua Program Studi Gizi



Widya Astuti, S.Gz., M. Si

NIPT. 920200419930102201

ABSTRAK

Penelitian ini bertujuan untuk mengetahui hubungan antara tingkat asupan zat gizi, ketersediaan energi (EA), dan performa daya tahan aerobik pada atlet futsal remaja di Bandung. Sebanyak 47 atlet laki-laki berusia 13-21 tahun dari Futsal 15 Bandung berpartisipasi dalam penelitian potong lintang ini. Pengumpulan data meliputi *food recall* 3×24 jam untuk asupan makanan, pengukuran antropometri, dan *Multistage Fitness Test (Beep Test)* untuk mengestimasi $VO_2\text{max}$. Ketersediaan energi dihitung dengan mengurangi pengeluaran energi olahraga (EEE) dari asupan energi, yang dinormalisasi per massa bebas lemak (FFM). Hasil penelitian menunjukkan korelasi positif yang signifikan antara daya tahan aerobik ($VO_2\text{max}$) dan tingkat asupan energi ($p = 0,003$, $r = 0,427$), karbohidrat ($p = 0,003$, $r = 0,427$), protein ($p = 0,000$, $r = 0,514$), dan cairan ($p = 0,002$, $r = 0,446$). Namun, tidak ada korelasi yang signifikan yang ditemukan antara EA ($p = 0,700$) atau asupan lemak ($p = 0,465$) dan $VO_2\text{max}$. Sebagian besar atlet memiliki nilai EA yang rendah (<30 kkal/kg FFM/hari), yang mengindikasikan adanya potensi risiko nutrisi. Temuan ini menyoroti pentingnya asupan makronutrien dan cairan yang cukup untuk mendukung performa aerobik dan merekomendasikan intervensi nutrisi profesional dalam program pengembangan atlet.

Keywords: ketersediaan energi; asupan gizi; performa daya tahan aerobik

ABSTRACT

This study aims to determine the relationship between nutrient intake levels, energy availability (EA), and aerobic endurance performance among teenage futsal athletes in Bandung. A total of 47 male athletes aged 13–21 years from Futsal 15 Bandung participated in this cross-sectional study. Data collection included 3×24-hour food recall for dietary intake, anthropometric measurements, and the Multistage Fitness Test (Beep Test) for estimating VO_{2max} . Energy availability was calculated by subtracting exercise energy expenditure (EEE) from energy intake, normalized per fat-free mass (FFM). The results showed significant positive correlations between aerobic endurance (VO_{2max}) and intake levels of energy ($p = 0,003$, $r = 0,427$), carbohydrates ($p = 0,003$, $r = 0,427$), protein ($p = 0,000$, $r = 0,514$), and fluids ($p = 0,002$, $r = 0,446$). However, no significant correlation was found between EA ($p = 0,700$) or fat intake ($p = 0,465$) and VO_{2max} . Most athletes had low EA values (<30 kcal/kg FFM/day), indicating potential nutritional risks. These findings highlight the importance of adequate macronutrient and fluid intake to support aerobic performance and recommend professional nutritional intervention in athlete development programs.

Keywords: energy availability; nutritional intake; aerobic endurance performance

DAFTAR ISI

UCAPAN TERIMA KASIH.....	i
KATA PENGANTAR	iii
ABSTRAK	iv
DAFTAR ISI.....	vi
DAFTAR TABEL	viii
DAFTAR GAMBAR	ix
DAFTAR SINGKATAN	x
DAFTAR LAMPIRAN.....	xi
BAB I PENDAHULUAN	1
1.1 Latar Belakang Penelitian	1
1.2 Rumusan Masalah Penelitian	3
1.3 Tujuan Penelitian.....	3
1.3.1 Tujuan Umum	3
1.3.2 Tujuan Khusus	3
1.4 Manfaat Penelitian.....	4
1.4.1 Manfaat Praktis	4
1.4.2 Manfaat Teoritis.....	4
1.5 Ruang Lingkup Penelitian	4
BAB II TINJAUAN PUSTAKA.....	7
2.1 Performa Daya Tahan Aerobik pada Atlet Futsal	7
2.1.1 Futsal.....	7
2.1.2 Definisi Performa Daya Tahan Aerobik (<i>Aerobic Endurance</i>)	8
2.1.3 Faktor-Faktor Daya Tahan Aerobik (<i>Aerobic Endurance</i>).....	8
2.1.4 Instrumen Pengukuran Daya Tahan Aerobik (<i>Aerobic Endurance</i>).....	9
2.2 Tingkat Konsumsi	12
2.2.1 Definisi Tingkat Konsumsi.....	12
2.2.2 Faktor-Faktor Tingkat Konsumsi.....	12
2.2.3 Metode Penilaian Tingkat Konsumsi Makan.....	14
2.3 Energy Availability	16
2.3.1 Definisi Ketersediaan energi (<i>Energy Availability</i>).....	16
2.3.2 Penilaian Energy Availability	17
2.4 Penelitian Terdahulu.....	20
2.5 Kerangka Teori.....	23
2.6 Kerangka Konsep	25
2.7 Definisi Operasional.....	25
2.8 Hipotesis.....	27
BAB III METODOLOGI PENELITIAN.....	28
3.1 Jenis Penelitian	28
3.2 Lokasi dan Waktu Penelitian.....	28
3.3 Populasi dan Sampel	28
3.3.1 Populasi.....	28
3.3.2 Rumus Besar Sampel	29
3.3.3 Teknik Penarikan Sampel	29

3.4 Teknik Pengumpulan Data	30
3.4.1 Sumber Data	30
3.4.2 Instrumen Penelitian	31
3.4.3 Tahapan Pengumpulan Data	32
3.5 Prosedur Analisis Data	34
3.5.1 Pengolahan Data	34
3.5.2 Analisa Data.....	35
3.6 Isu Etik	36
BAB IV HASIL DAN PEMBAHASAN	38
4.1 Hasil.....	38
4.1.1 Gambaran Karakteristik Responden	38
4.1.2 Hubungan Tingkat Konsumsi dan <i>Energy Availability</i> dengan Performa <i>Aerobic Endurance</i>	42
4.2 Pembahasan	44
4.2.1 Gambaran Karakteristik Subjek Penelitian.....	44
4.2.2 Hubungan Tingkat Konsumsi dengan Performa <i>Aerobic Endurance</i> ..	47
4.2.3 Hubungan <i>Energy Availability</i> dengan Performa <i>Aerobic Endurance</i> .	51
4.4.4 Keterbatasan Penelitian.....	52
BAB V KESIMPULAN DAN SARAN.....	54
5.1 Kesimpulan.....	54
5.2 Saran	54
DAFTAR PUSTAKA	57
LAMPIRAN.....	64

DAFTAR TABEL

Tabel 2.1 <i>Female (Values in ml/kg/min)</i>	11
Tabel 2.2 <i>Male (Values in ml/kg/min)</i>	11
Tabel 2.3 Klasifikasi Tingkat Konsumsi Zat Gizi	16
Tabel 2.4 Skala Intensitas	19
Tabel 2.5 Penelitian Terdahulu	20
Tabel 2.6 Definisi Operasional Penelitian	25
Tabel 4.1 Gambaran Karakteristik dan Status Gizi Atlet.....	38
Tabel 4.2 Gambaran Pola Latihan Atlet.....	40
Tabel 4.3 Gambaran Kebutuhan Gizi dan <i>Energy Availability</i> Atlet	40
Tabel 4.4 Gambaran Tingkat Konsumsi Zat Gizi Atlet dan <i>Energy Availabiliy</i> ..	41
Tabel 4.5 Analisis hubungan antara Tingkat Konsumsi	42

DAFTAR GAMBAR

Gambar 2.1 Perubahan kontribusi relatif ATP.....	9
Gambar 2.2 Rumus $VO_2\text{Max}$ pada <i>Multi Stage Fitness Test</i>	11
Gambar 2.3 Rumus Tingkat Konsumsi.....	15
Gambar 2.4 Rumus <i>Total Daily Energy Expenditure</i>	15
Gambar 2.5 Rumus <i>Energy Availability</i>	17
Gambar 2.6 Rumus <i>Exercise Energy Expenditure</i>	19
Gambar 2.7 Kerangka Teori Penelitian.....	24
Gambar 2.8 Kerangka Konsep Penelitian	25

DAFTAR SINGKATAN

ATP	: Adenosin Trifosfat.
BIA	: <i>Bio Impedance Analysis.</i>
BMR	: <i>Basal Metabolic Rate.</i>
EA	: <i>Energy Availability.</i>
EEE	: <i>Exercise Energy Expenditure.</i>
FFM	: <i>Fat-Free Mass.</i>
IMT	: Indeks Massa Tubuh.
Kemenkes	: Kementerian Kesehatan.
LEA	: <i>Low Energy Availability.</i>
METs	: <i>Metabolic Equivalent of Task.</i>
MSFT	: <i>Multistage Fitness Test.</i>
PAL	: <i>Physical Activity Level.</i>
PSSI	: Persatuan Sepak Bola Seluruh Indonesia.
TDEE	: <i>Total Daily Energy Expenditure.</i>
VO₂Max	: Volume Oksigen Maksimal.
WHO	: <i>World Health Organization.</i>

DAFTAR LAMPIRAN

Lampiran 1 Biodata Peneliti.....	64
Lampiran 2 Lembar Pengesahan Proposal dan Skripsi.....	66
Lampiran 3 Surat Izin Penelitian dari Kampus	68
Lampiran 4 Surat Balasan Izin Penelitian dari Lokasi Penelitian.....	69
Lampiran 5 Sertifikat Ethical Clearance	70
Lampiran 6 Instrumen Penelitian	71
Lampiran 7 Pedoman Skoring Instrumen Penelitian	78
Lampiran 8 Output SPSS (Uji Univariat dan Uji Bivariat)	79
Lampiran 9 Dokumentasi Kegiatan Penelitian	84
Lampiran 10 Draft Artikel Ilmiah.....	85
Lampiran 11 Bukti Turnitin Skripsi (Plagiarisme < 20%).....	92
Lampiran 12 Bukti Turnitin Draft Artikel Ilmiah (Plagiarisme < 15%).....	93

DAFTAR PUSTAKA

- Amaliana, R. (2022). Hubungan tingkat kecukupan energi dan zat gizi makro dengan kebugaran (VO_2 maks) atlet sepakbola di Safin pati football academy. *Nutrition Research and Development Journal*, 2, 32–40. Diakses pada laman <https://journal.unnes.ac.id/sju/index.php/nutrizione/> pada Senin, 7 April 2025 pukul 22.10
- Bompa, T. O., & Buzzichelli, C. A. (2018). *Periodization Theory and Methodology of Training Sixth Edition* (R. W. Earle, Ed.; 6th ed.). Human Kinetics. Australia.
- Borges, U., Lobinger, B., Javelle, F., Watson, M., Mosley, E., & Laborde, S. (2021). Using slow-paced breathing to foster endurance, well-being, and sleep quality in athletes during the covid-19 pandemic. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.624655>
- Castillo, M., Martínez-Sanz, J. M., Penichet-Tomás, A., Sellés, S., González-Rodríguez, E., Hurtado-Sánchez, J. A., & Sospedra, I. (2022). Relationship between body composition and performance profile characteristics in female futsal players. *Applied Sciences (Switzerland)*, 12(22). <https://doi.org/10.3390/app122211492>
- Cheuvront, S. N., & Kenefick, R. W. (2014). Dehydration: physiology, assessment, and performance effects. *Comprehensive Physiology*, 4(1), 257–285. <https://doi.org/10.1002/cphy.c130017>
- Chu, X. Y., Xu, Y. Y., Tong, X. Y., Wang, G., & Zhang, H. Y. (2022). The legend of atp: from origin of life to precision medicine. *Metabolites*, 12(5). <https://doi.org/10.3390/metabo12050461>
- Cupka, M., & Sedliak, M. (2023). Hungry runners – Low energy availability in male endurance athletes and its impact on performance and testosterone: *Mini-review*. *Eur J Transl Myol*, 33 (2). doi: 10.4081/ejtm.2023.11104
- Dieny FF, Widyastuti N, Fitranti DY, Tsani AFA, J Fikri F. 2020. Profil asupan zat gizi, status gizi, dan status hidrasi berhubungan dengan performa atlet Sekolah Sepak Bola di Kota Semarang. *Indonesian Journal of Human Nutrition*. 7(2):108-119. <https://doi.org/10.21776/ub.ijhn.2020.007.02.3>
- Driskell, J. A. (2009). *Nutrition and Exercise Concerns of Middle Age* (Taylor and Francis Group, Ed.; 1st ed.). CRC Press. Prancis.
- Fernanda, C., Gifari, N., Mulyani, E. Y., Nuzrina, R., & Ronitawati, P. (2021). Hubungan asupan, status gizi, aktivitas fisik, tingkat stres dan siklus menstruasi atlet bulutangkis. *Sport and Nutrition Journal*, 3(1), 1-14. Diakses melalui <https://journal.unnes.ac.id/sju/index.php/spnj/> pada 21 Januari 2025
- Fronso, S. di, & Przybylska, D. B. (2023). Special issue: sport psychology interventions for athletes' performance and well-being. *International Journal of Environmental Research and Public Health*, 20(4). <https://doi.org/10.3390/ijerph20043712>
- Ge, Z., Lv, X., & Xue, Y. (2023). Correlation between aerobic training and physical endurance in basketball players. *Revista Brasileira de Medicina Do Esporte*, 29. https://doi.org/10.1590/1517-8692202329012022_0342

- Gibson, R. S. (2005). *Principles of Nutritional Assessment*. United States of America: Oxford University Press.
- Gifari, N., Hadiani, S., Nurjadin, S., & Sapang, M. (2022). Edukasi tentang pentingnya gizi olahraga pada atlet basket kursi roda. *Asmat Jurnal Pengabmas*, 1(2), 111–118. <https://doi.org/10.47539/ajpV1i1.22>
- Giraldo-Vallejo, J. E., Cardona-Guzmán, M., Rodríguez-Alcivar, E. J., Kočí, J., Petro, J. L., Kreider, R. B., Cannataro, R., & Bonilla, D. A. (2023). Nutritional strategies in the rehabilitation of musculoskeletal injuries in athletes: a systematic integrative review. *Nutrients*, 15(4). <https://doi.org/10.3390/nu15040819>
- Grabia, M., Perkowski, J., Socha, K., & Markiewicz-Żukowska, R. (2024). Female athlete triad and relative energy deficiency in sport (reds): nutritional management. *In Nutrients*, 16 (3). <https://doi.org/10.3390/nu16030359>
- Haqiqi, I. Al, Yunus, Moch., & Widiawati, P. (2022). Survei kondisi fisik dominan atlet futsal kabupaten lamongan usia 15-18 tahun. *Sport Science and Health*, 4(4), 331–337. <https://doi.org/10.17977/um062v4i42022p331-337>
- Hasanpour, A., Rahmani, B., Gharakhanlou, B. J., Solaimanian, S., Shahsavari, S., Rasouli, A., Abbasi, S., Ebrahimi-Kalan, A., Rouzitalab, T., Hoseinabadi, Z., & Shiri-Shahsavari, M. R. (2023). Nutritional knowledge, attitude, and practice of professional athletes in an Iranian population (a cross-sectional study). *BMC Sports Science, Medicine and Rehabilitation*, 15(1), 2–10. <https://doi.org/10.1186/s13102-023-00776-3>
- Heryana, A. (2019). Kerangka teori, konsep, dan definisi operasional. Universitas Esa Unggul. Artikel Tidak Dipublikasikan.
- Heumann, C., & Shalabh, M. S. (2020). *Introduction to Statistics and Data Analysis*. Springer. India: Springer Nature Switzerland AG.
- Hidayatulloh, K., & Gandasari, F. (2023). Dampak kehilangan cairan terhadap aktivitas lari 5 putaran sebelum dan sesudah dehidrasi. *Journal of Sport, Physical Education, Organization, Recreation, and Training*, 7. <https://doi.org/10.37058/sport>
- Hussain, P. H., Mukesh, P. O., Janakbhai, M. A., Parekh, V. D., Upadhyay, Jitendrakumar. B., & Boddula, R. (2024). Comprehensive review on bmi, tdee, bmr, and calories for weight management: insights into energy expenditure and nutrient balance for long-term well-being. *International Research Journal on Advanced Engineering and Management (IRJAEM)*, 2(10), 3119–3128. <https://doi.org/10.47392/IRJAEM.2024.0460>
- Imran, A. A. M., Fathoni, M., & Subekti, N. (2022). Faktor kondisi fisik dominan pemain futsal. *Journal Power of Sports*, 5, 84–95. Diakses pada laman <http://e-journal.unipma.ac.id/index.php/JPOS> pada Senin, 14 April 2025
- James, G., Witten, D., Hastie, T., Tibshirani, R., & Taylor, J. (2021). *An Introduction to Statistical Learning: With Applications in Python*. Springer Nature. Stanford: Springer.
- Jeukendrup, A., & Gleeson, M. (2018). *Sports nutrition* (4th ed.). Champaign: Human Kinetics.
- Jurov, I., Keay, N., & Rauter, S. (2022a). Reducing energy availability in male endurance athletes: a randomized trial with a three-step energy reduction.

- Journal of the International Society of Sports Nutrition*, 19(1), 179–195.
<https://doi.org/10.1080/15502783.2022.2065111>
- Jurov, I., Keay, N., Spudić, D., & Rauter, S. (2022b). Inducing low energy availability in trained endurance male athletes results in poorer explosive power. *European Journal of Applied Physiology*, 122(2), 503–513.
<https://doi.org/10.1007/s00421-021-04857-4>
- Kemenkes RI. (2019). Peraturan Menteri Kesehatan Republik Indonesia Nomor 28 Tahun 2019 Tentang Angka Kecukupan Gizi Yang Dianjurkan Untuk Masyarakat Indonesia. Jakarta.
- Kementerian Kesehatan Palangka Raya. (2022). *Modul Perkuliahan Gizi Olahraga*. Diakses melalui <https://poltekkes-palangkaraya.ac.id> pada Rabu, 1 Januari 2025 pukul 16.37
- Kementerian Kesehatan RI. (2021). *Buku Pintar Gizi Bagi Atlet Indonesia*. Jakarta: Kementerian Kesehatan RI.
- Kettunen O, Mikkonen R, Linnamo V, Mursu J, Kyröläinen H, Ihalainen JK. (2023). Nutritional intake and anthropometric characteristics are associated with endurance performance and markers of low energy availability in young female cross-country skiers. *J Int Soc Sports Nutr.* 20(1). doi: 10.1080/15502783.2023.2226639.
- Kusharto dan Supriasa. (2014). *Survei Konsumsi Gizi*. Yogyakarta: Graha Ilmu
- Kuswari, M., Nuzrina, R., Gifari, N., Dhyani Swamilaksita, P., & Tri Hapsari, J. (2020). Correlation intake of energy, protein, fluid, physical activity, and hydration status with vo2max at hockey atlet in ukm pancasila university. In *Proceedings of the 1st International Conference on Recent Innovations (ICRI 2018)* 512–518. <https://doi.org/10.5220/0009951805120518>
- Lee, B. L. (2024). Low energy availability (LEA) in male athletes: a review of the literature. *The Sport Journal*. Diakses melalui thesportjournal.org/article/low-energy-availability-lea-in-male-athletes-a-review-of-the-literature pada 23 Maret 2025
- Lee, Y., & Park, S. (2021). Understanding of physical activity in social ecological perspective: application of multilevel model. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.622929>
- Listianasari, Y., Hidayat, N., & Waluyo. (2022). Asupan protein, kadar hb, dan vo2maks pada atlet sepakbola di kabupaten sleman yogyakarta. *Pontianak Nutrition Journal*, 5. Diakses melalui <http://ejournal.poltekkes-pontianak.ac.id/index.php/PNJ/index> pada 13 April 2025.
- Logue, D. M., Madigan, S. M., Heinen, M., McDonnell, S. J., Delahunt, E., & Corish, C. A. (2019). Screening for risk of low energy availability in athletic and recreationally active females in Ireland. *European Journal of Sport Science*, 19(1), 112–122. <https://doi.org/10.1080/17461391.2018.1526973>
- Loucks, A. B., Kiens, B., & Wright, H. H. (2011). Energy availability in athletes. *Journal of Sports Sciences*, 29 (1), 7-15. <https://doi.org/10.1080/02640414.2011.588958>
- Machado C.L.F., Nakamura F.Y., de Andrade M.X., Dos Santos G.C., Carlet R., Brusco C.M., Reischak-Oliveira A, Voser R.D.C., Pinto, R.S. (2023). Total and regional body composition are related with aerobic fitness performance

- in elite futsal players. *J Bodyw Mov Ther*, 35:164-168. doi: 10.1016/j.jbmt.2023.04.030..
- Mackenzie, B. (2005). *101 Performance Evaluation Tests*. Electric Word. London: Jonathan Pye.
- Maulida, F., Hanum, F. N., & Arta, R. D. (2023). Hubungan asupan zat gizi makro terhadap tingkat kebugaran jasmani atlet di UPTD kebakaran olahraga provinsi sumatera barat. *Jurnal Gizi dan Kesehatan Indonesia*, 3, 169–174. <https://doi.org/10.37887/jgki.v2i4>
- Mbadi, S. U., Nokar, P. S., Alfrianto, A. B., & Hanief, Y. N. (2023). Evaluasi kondisi fisik tim futsal SMK nasional malang. *Jurnal Pendidikan Indonesia*, 4(05), 439–447. <https://doi.org/10.59141/japendi.v4i05.1766>
- 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>
- Méndez-Dominguez, C., Nakamura, F. Y., & Travassos, B. (2022). Editorial: futsal research and challenges for sport development. *In Frontiers in Psychology*. (13). <https://doi.org/10.3389/fpsyg.2022.856563>
- 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., Torstveit, M. K., & Budgett, R. (2018). IOC consensus statement on relative energy deficiency in sport (RED-S). *British Journal of Sports Medicine*, 52(11), 687–697. <https://doi.org/10.1136/bjsports-2018-099193>
- Mursu, J., Ristimäki, M., Malinen, I., Petäjä, P., Isola, V., Ahtiainen, J. P., & Hulmi, J. J. (2023). Dietary intake, serum hormone concentrations, amenorrhea and bone mineral density of physique athletes and active gym enthusiasts. *Nutrients*, 15(2), 382. <https://doi.org/10.3390/nu15020382>
- Neuhouser, M. L., Prentice, R. L., Tinker, L. F., & Lampe, J. W. (2024). Enhancing capacity for food and nutrient intake assessment in population sciences research. *Annual Review of Public Health Annu. Rev. Public Health*, 22(21), 21. <https://doi.org/10.1146/annurev-publhealth>
- Novianti, Y. K., & Winarno, M. E. (2023). Survei kondisi fisik dominan pemain futsal putri akademi futsal tulungagung U-18. *SPORT-Mu: Jurnal Pendidikan Olahraga*, 4(1), 1–11. <https://doi.org/10.32528/sport-mu.v4i1.18823>
- Oliveira, R. S. de, & Borin, J. P. (2021). Monitoring and behavior of biomotor skills in futsal athletes during a season. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.661262>
- Palazzo, R., Parisi, T., Rosa, S., Corsi, M., Falconi, E., & Stefani, L. (2024). Energy availability and body composition in professional athletes: two sides of the same coin. *Nutrients*, 16(20). <https://doi.org/10.3390/nu16203507>
- Pamungkas, Y. B., Hadi, Nasuka, & Wahadi. (2022). Korelasi multistage fitness test dan harvard test terhadap vo2max usia 20-23 atlet futsal venus fc tahun 2021. *Unnes Journal of Sport Sciences*, 6(2), 78–84. <https://journal.unnes.ac.id/sju/index.php/ujss/index>

- Paramita, R. W. D., Rizal, N., & Sulistyan, R. B. (2021). *Metode Penelitian Kuantitatif*. Lumajang: Widya Gama Press.
- Penggalih, M. H. S. T., Trisnantoro, L., Sofro, Z. M., Kusuma, M. T. P. L., Dewinta, M. C. N., Niamilah, I., Anastasia, M., & Susila, E. N. (2021). Analisis kebijakan penempatan ahli gizi sebagai tenaga keolahragaan Indonesia. *Jurnal Keolahragaan*, 9(2), 178–192. <https://doi.org/10.21831/jk.v9i2.38193>
- Plasqui G. (2022). Assessment of total energy expenditure and physical activity using activity monitors. *j nutr sci vitaminol*. 68. 49-51. doi: 10.3177/jnsv.68.S49. PMID: 36437015.
- Polar, R. C. (2021). Polar Activity Tracking: Background, Feedback and Validity. 1(8), 1–8. Diakses melalui <http://bit.ly/4jL7fbF> Pada 15 Januari 2025
- Pulita, J. G., Canesin, H., Oliveira, L. L. de, Silva, A. L. da, & Pereira, C. R. (2022). The role of traceability in food recall management: a systematic literature review. *Revista Gestão da Produção Operações e Sistemas*, 17(2), 86. <https://doi.org/10.15675/gepros.v17i2.2881>
- Purwaningtyas, D. R., Ghifari, N., Rachma, D. A. (2023). Hubungan pengetahuan gizi, asupan energi, zat gizi makro dan latihan fisik dengan kekuatan otot lengan atlet arung jeram jabodetabek. *Journal of Sport Science and Fitness*, 9(2): 95-103. Diakses melalui <http://journal.unnes.ac.id/sju/index.php/jssf> pada 21 Januari 2025
- Ramli, Juhanis, Rahmi, S., Iskandar, & Asyhari, H. (2024). Pengukuran daya tahan aerobik (vo2max) atlet futsal kabupaten gowa. *Communnity Development Journal*, 5(3), 4309–4311. <https://doi.org/10.31004/cdj.v5i3.28241>
- Ravindra, P. V., Janhavi, P., Divyashree, S., & Muthukumar, S. P. (2020). Nutritional interventions for improving the endurance performance in athletes. *Archives of Physiology and Biochemistry*, 128(4), 851–858. <https://doi.org/10.1080/13813455.2020.1733025>
- Ruta, D. (2024). Characteristics of physiological parameters determining endurance in prolonged physical efforts, definition and principles of health training and exercise intensity zones. *Journal of Education, Health and Sport*, 69, 55361. <https://doi.org/10.12775/JEHS.2024.69.55361>
- Sahara, M. P., Widyastuti, N., & Candra, A. (2019). Kualitas diet dan daya tahan (endurance) atlet bulutangkis remaja di kota semarang. *Journal of Nutrition College*, 8(1). Diakses melalui <http://ejournal3.undip.ac.id/index.php/jnc/> pada 21 Januari 2025
- Sanchez, E., Simpson, R. B., Zhang, Y., Sallade, L. E., & Naumova, E. N. (2022). Exploring risk factors of recall-associated foodborne disease outbreaks in the united states, 2009–2019. *International Journal of Environmental Research and Public Health*, 19(9). <https://doi.org/10.3390/ijerph19094947>
- Sanmiguel-Rodríguez, A., & Giraldez, V. A. (2021). Futsal in children and adolescents - a systematic review 2015-2020. *Physical Activity Review*, 9(2), 27–39. <https://doi.org/10.16926/par.2021.09.19>
- Santisteban, K. J., Lovering, A. T., Halliwill, J. R., & Minson, C. T. (2022). Sex d Differences in vo2max and the impact on endurance-exercise performance. In *International Journal of Environmental Research and Public Health* (Vol. 19, Issue 9). MDPI. <https://doi.org/10.3390/ijerph19094946>

- Sarfika, R., Wenny, B. P., Putri, D. E., Refnandes, R., Fernandes, F., Freska, W., & Rahayuningsih, A. (2024). Pemberian pendidikan kesehatan tumbuh kembang psikososial pada remaja sebagai upaya mencegah masalah kesehatan mental. *JMM (Jurnal Masyarakat Mandiri)*, 8(1), 95. <https://doi.org/10.31764/jmm.v8i1.19619>
- Sarwono, A. E., & Handayani, A. (2021). *Metode Kuantitatif*. Jakarta: Unisri Press.
- Sasmariato., & Nazirun. N. (2022). *Pengelolaan Gizi Olahraga Pada Atlet*. Malang: Ahlimedia Press.
- Seebogar B. (2011). *Nutrition Periodization for Athletes*. Chicago: James Bull
- Sepriani, R., & Rahman, R. K. (2019). Daya tahan aerobik pada atlet sekolah sepakbola usia 14-16 tahun. *Jurnal Menssana*, 4(1), 53–57. <https://doi.org/10.24036/jm.v4i1.34>
- Septiawan, M. R., & Noordia, A. (2019). Analisis kecukupan energi dan tingkat kelelahan atlet U–19 tahun pada klub sepakbola (Studi SSB Putra Minak Jinggo Banyuwangi). 7(2). Diakses melalui <https://ejournal.unesa.ac.id/index.php/jurnalkesehatanolahraga/article/view/27626>
- Setyawan, D. A. 2022. *Buku Ajar Statistika Kesehatan Analisis Bivariat Pada Hipotesis Penelitian*. Surakarta: Tahta Media Group.
- Setyawati, N., Dieny, F. F., Rahadiyanti, A., Fitranti, D. Y., & Tsani, A. F. A. (2020). Profil antropometri, ketersediaan energi dan kepadatan tulang pada atlet remaja putri berbagai cabang olahraga. *Jurnal Keolahragaan*, 8(1). <https://doi.org/10.21831/Jk.V8i1.30367>
- Shabrina, S., Akbar Ghozali, D., & Rahayu, D. (2022). Pengaruh persentase lemak tubuh terhadap kapasitas aerobik atlet sepak bola profesional. *Jurnal Sporta Saintika*, 7, 2579–5910. <https://doi.org/10.24036/Sporta>
- Simamora, R. S., & Kresnawati, P. (2021). Pemenuhan Pola Makan Gizi Seimbang Dalam Penanganan Stunting Pada. *Jurnal Bidang Ilmu Kesehatan*, 11(1). Diakses melalui <http://ejournal.urindo.ac.id/index.php/kesehatan> pada 24 Januari 2025
- Spragg, J., Leo, P., Giorgi, A., Gonzalez, B. M., & Swart, J. (2024). The intensity rather than the quantity of prior work determines the subsequent downward shift in the power duration relationship in professional cyclists. *European Journal of Sport Science*, 24(4), 449–457. <https://doi.org/10.1002/ejsc.12077>
- Stellingwerff, T., Morton, J. P., & Burke, L. M. (2019). A framework for periodized nutrition for athletics. *International Journal of Sport Nutrition and Exercise Metabolism*, 29(2), 141–151. <https://doi.org/10.1123/ijsnem.2018-0305>
- Supit, E. D., Mayulu, N., Bolang, A. S., & Kawengian, S. (2021). Aktivitas fisik dan status gizi mahasiswa saat pandemi COVID-19. *Jurnal Biomedik: JBM*, 13(2), 180-184. <https://doi.org/10.35790/jbm.13.2.2021.31763>
- Taguchi, M & Manore, MM. (2022). Reexamining the calculation of exercise energy expenditure in the energy availability equation of free living athletes. *Front. Sport Act. Living* 4:885631. Doi:10.3389/fspor.2022.885631
- Tashakkori, A.M. Johnson, R.B. Teddlie, C. B. (2020). *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in*

- the Social and Behavioral Sciences (Applied Social Research Methods). London: SAGE Publications.
- Triandari, S. T., Fatmawati, I., Maryusman, T., & Puspita, I. D. (2021). Hubungan pengetahuan terkait gizi, asupan karbohidrat, dan aktivitas fisik dengan kebugaran jasmani pada atlet cabang olahraga permainan. *Jurnal Ilmiah Kesehatan Masyarakat*, 13(4). <https://doi.org/10.52022/jikm.v13i4.219>
- Vionalita, G. (2020). *Modul Metodologi Penelitian Kuantitatif*. Jakarta: Universitas Esa Unggul.
- Vivian, H Heyward (1998). *The Physical Fitness Specialist Certification Manual, The Cooper Institute for Aerobics Research*. Dallas: Advance Fitness Assessment & Exercise Prescription.
- Wesley, B. (2021). *SPSS for Beginners in 45 Minutes a 2021 Quick Reference Guide to Research Methods. Data Analysis and Interpretation of Statistical Data*. England: Independently published.
- Widana, I. W., & Muliani, P. L. (2020). *Uji Persyaratan Analisis*. Jakarta: Penerbit Klik Media.
- Widyakarya Nasional Pangan dan Gizi (WNPG). (2012). Lembaga Ilmu Pengetahuan Jakarta
- Wijaya, O. G. M., Meiliana, M., & Lestari, Y. N. (2021). Pentingnya pengetahuan gizi untuk asupan makan yang optimal pada atlet sepak bola. *NUTRIZIONE (Nutrition Research and Development Journal)*, 01(01), 22–33. Diakses melalui <https://Journal.Unnes.Ac.Id/Sju/Index.Php/Nutrizione> pada 28 Desember 2024
- Wijayanti, R. D. P. (2021). *Metodologi Penelitian Kuantitatif*. Jakarta:Widyagama Press.
- World Health Organization. (2021). *Nutrition, overweight and obesity: Factsheet – Sustainable Development Goals: health targets (WHO/EURO:2021-2574-42330-58595)*. WHO Regional Office for Europe. https://www.euro.who.int/en/SDG_factsheets
- Yanti, R., Nova, M., & Rahmi, A. (2021). Asupan energi, asupan lemak, aktivitas fisik dan pengetahuan, berhubungan dengan gizi lebih pada remaja sma. *Jurnal Kesehatan Perintis*, 8, 45–53. <https://jurnal.stikesperintis.ac.id/index.php/JKP>
- Zambak, Ö., & Toktas, S. (2024). Effects of endurance trainings on aerobic performance in long distance runners. *International Journal of Education Technology and Scientific Researches*, 9(28), 483–492. <https://doi.org/10.35826/ijetsar.742>
- Zwaard, S. Van Der, Brocherie, F., & Jaspers, R. T. (2021). Under the Hood: Skeletal Muscle Determinants of Endurance Performance. *Frontiers in Sports and Active Living*, 3. <https://doi.org/10.3389/fspor.2021.719434>