

Overweight, Obesity, and Lifestyle Practices among Urban Market Adults in Douala, Cameroon: A Cross-Sectional Study with SDG Implications

Beauty Elee Chioma

Ulrich Herlick Zeuton Nguetack

Brenda Fon Akrukem

Precious Ubah Chioma

Happiness Amamchukwu Chidubem

Blessing Ubochi Ihuoma

Department of Medical and Biomedical Sciences, STEM Higher Institute of Health and Technological Sciences (STEM-HIHTS), Cameroon

Basil Kum Meh, PhD

Department of Medical and Biomedical Sciences, STEM Higher Institute of Health and Technological Sciences (STEM-HIHTS), Cameroon

Department of Animal Biology and Conservation,
Faculty of Science, University of Buea, Cameroon

Approved: 08 July 2026

Posted: 10 July 2026

Copyright 2026 Author(s)

Under Creative Commons CC-BY 4.0

OPEN ACCESS

Cite As:

Chioma, B.E., Nguetack, U.H.Z., Akrukem, B.F., Chioma, P.U., Chidubem, H.A., Ihuoma, B.U., & Meh, B.K. (2026). *Overweight, Obesity, and Lifestyle Practices among Urban Market Adults in Douala, Cameroon: A Cross-Sectional Study with SDG Implications*. ESI Preprints. <https://doi.org/10.19044/esipreprint.7.2026.p305>

Abstract

Background: Overweight and obesity represent a major public health crisis in urban sub-Saharan Africa. Cameroon records high urban overweight and obesity rates, yet empirical data specifically characterising lifestyle practices in high-risk urban commercial settings remain scarce.

Objective: To assess lifestyle modification practices and body mass index (BMI) categories among adults at Marché Tankho, Bonaberi, Douala, and to discuss implications for the Sustainable Development Goals (SDGs).

Materials and Methods: A descriptive cross-sectional study was conducted among 530 adults recruited by convenience sampling. Anthropometric measurements were obtained and BMI calculated per WHO

(2024) criteria. A structured, bilingual, pre-tested questionnaire assessed dietary habits, physical activity, and sedentary behaviour. Data were analysed using IBM SPSS v26.0 and presented as frequencies and percentages.

Results: Most respondents (38.9%) were aged 26–35 years; 71.5% were female; 47.5% had tertiary education. The combined overweight and obesity prevalence was 54.7% (overweight 42.1%; obesity 12.6%). Regular consumption of sugary drinks was reported by 70.9%, late-night eating by 64.7%, and fast food intake ≥ 3 –4 times per week by 39.4%. Although 78.1% reported regular exercise, sedentary behaviour was high: 42.3% sat for 4–6 hours daily and 53.8% used motorised transport for short distances. Only 36.0% demonstrated good overall dietary practices.

Conclusion: Overweight and obesity are highly prevalent at Marché Tankho, driven by a significant knowledge-practice gap in lifestyle modification. Multi-component, community-level interventions integrating nursing health promotion, physiotherapy-guided physical activity programming, and public health policy are urgently needed.

Keywords: Lifestyle modification; body mass index; Sustainable Development Goals; Cameroon; Bonaberi; non-communicable diseases; sedentary behaviour; physical activity

1. Introduction

The global epidemic of overweight and obesity constitutes one of the foremost public health challenges of the 21st century. As of 2023, an estimated 2.5 billion adults worldwide were overweight or obese (World Health Organization [WHO], 2024). Overweight is defined as a body mass index (BMI) of 25.0–29.9 kg/m² and obesity as a BMI ≥ 30.0 kg/m² (WHO, 2024; Clegg & Sheard, 2023). The global prevalence of obesity has more than doubled since 1990, with the steepest increases occurring in urban areas of low- and middle-income countries (LMICs) (GBD Obesity Collaborators, 2024). In Africa, adult overweight and obesity have roughly tripled since 2000, driven by a systemic nutritional transition associated with globalisation and inadequate food environment governance (Nature Editorial, 2025).

The physiological consequences of excess adiposity are well-established. Adipose tissue in states of excess overexpresses leptin, underexpresses adiponectin, and upregulates pro-inflammatory cytokines including tumour necrosis factor-alpha (TNF- α) and interleukin-6 (IL-6), establishing the physiological substrate for type 2 diabetes mellitus, hypertension, and cardiovascular disease (GBD Obesity Collaborators, 2024; Loos & Yeo, 2022). Excess body weight also increases axial loading on the

lumbar spine and weight-bearing joints, accelerating musculoskeletal deterioration (Lavie et al., 2018; Meh et al., 2023a).

Physical activity is the primary countermeasure against excess adiposity. Regular aerobic exercise (≥ 150 minutes per week) activates AMP-activated protein kinase (AMPK) in skeletal muscle, improving insulin sensitivity and reducing visceral adiposity (WHO, 2024; Zhu et al., 2024). Conversely, sedentary behaviour defined as ≤ 1.5 metabolic equivalents (METs) is an independent predictor of cardiometabolic disease risk (Zderic & Hamilton, 2023). Within 1–2 hours of sedentary onset, skeletal muscle lipoprotein lipase (LPL) activity is suppressed, reducing plasma triglyceride clearance independently of exercise habits (Zderic & Hamilton, 2023; Biswas et al., 2015).

In Cameroon, a systematic review reported a national overweight prevalence of 26.0% (95% CI: 17.6–35.3%) and an obesity prevalence of 15.1% (95% CI: 9.3–22.1%) among adults (Amougou et al., 2019). In Douala, a knowledge, attitude, and practice (KAP) study confirmed persistent gaps between obesity awareness and actual preventive behaviours (Dongmo et al., 2023). A prior study documented that 34.7% of healthcare workers in Douala were overweight and 32.0% were obese, with BMI significantly and independently associated with work-related musculoskeletal disorders (WRMSDs) ($p = 0.016$) (Meh et al., 2023a). A subsequent study further documented a 96.6% six-month low back pain (LBP) prevalence among healthcare professionals at the Bamenda Regional Hospital, with obesity independently associated with LBP burden (Meh et al., 2026). Commercial urban settings such as markets where adults are chronically exposed to energy-dense food, work long sedentary hours, and have limited access to structured physical activity represent high-risk settings that have received insufficient research attention in Cameroon.

The United Nations Sustainable Development Goals (SDGs) provide the normative framework for addressing the obesity epidemic: SDG 3.4 targets a one-third reduction in premature non-communicable disease (NCD) mortality by 2030; SDG 11.7 promotes accessible urban spaces enabling physical activity; SDG 2.1 targets universal access to nutritious food; and SDG 3.8 promotes universal health coverage (United Nations, 2015).

This study aimed to: (a) assess BMI categories among adults at Marché Tankho, Bonaberi, Douala; (b) characterise dietary habits, physical activity patterns, and sedentary behaviours; (c) determine the overall dietary adherence level; and (d) discuss findings in relation to the SDG agenda.

2. Materials and Methods

2.1 Study Design and Setting

A descriptive cross-sectional survey design was adopted, enabling simultaneous measurement and description of lifestyle practices and BMI categories at a single time point (Creswell, 2018). The study was conducted at Marché Tankho, Bonaberi, Douala, Littoral Region, Cameroon, a busy commercial hub characterised by a high concentration of traders, students, and artisans engaged in informal economic activities.

2.2 Study Population, Sample Size, and Sampling

The target population comprised all adults aged ≥ 18 years present at Marché Tankho during the data collection period. Sample size was estimated using the Cochran formula: $n = Z^2 p(1 - p)/d^2$, yielding a minimum of $n = 384$, adjusted upward by 10% for non-response to 425 (Cochran, 1977). A final sample of 530 participants was achieved through convenience sampling. Inclusion criteria: adults aged ≥ 18 years present at the market who provided written informed consent. Exclusion criteria: acute illness, pregnancy, or refusal to consent.

2.3 Data Collection Instruments and Procedures

A structured, bilingual (English/French), pre-tested questionnaire was administered face-to-face by the principal researcher. It covered: (a) socio-demographic characteristics; (b) anthropometric measurements; and (c) lifestyle practices. Content validity was established by expert panel review at STEM-HIHTS. Anthropometric measurements followed the WHO STEPS protocol: body weight was measured with a calibrated digital scale to the nearest 0.1 kg, and standing height with a portable stadiometer to the nearest 0.1 cm. BMI was calculated as weight (kg)/height (m²) and classified per WHO (2024) criteria: underweight (<18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obese (≥ 30.0 kg/m²) (WHO, 2024).

2.4 Data Analysis

Data were entered into Microsoft Excel 2019, cleaned, and analysed using IBM SPSS Statistics v26.0. Categorical variables were presented as frequencies and percentages. Overall dietary level (good, moderate, or poor) was classified from composite responses: $\geq 75\%$ of indicators met = good; 50–74% = moderate; $<50\%$ = poor. Results are presented in tables.

2.5 Ethical Considerations

Institutional approval was obtained from the Research and Ethics Committee of STEM-HIHTS, Douala. Administrative authorisation was

granted by the Chief of Marché Tankho. Written informed consent was obtained from all participants prior to data collection; participation was entirely voluntary and anonymous. All procedures complied with the Declaration of Helsinki (revised 2013).

3. Results

3.1 Socio-demographic Characteristics

A total of 530 adults participated (response rate: 100%). Table 1 presents the socio-demographic profile. The majority were aged 26–35 years (38.9%), female (71.5%), with secondary (45.1%) or tertiary education (47.5%). Most were single (54.0%). Unemployed individuals constituted the largest occupational group (42.8%), followed by students (24.0%) and traders (23.2%).

Table 1: Socio-demographic characteristics of study participants (N = 530)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–25	122	23.0
	26–35	206	38.9
	36–45	133	25.1
	46–55	67	12.6
	≥56	2	0.4
	Total	530	100.0
Sex	Male	151	28.5
	Female	379	71.5
	Total	530	100.0
Marital status	Single	286	54.0
	Married	239	45.1
	Divorced	5	0.9
	Widowed	0	0.0
	Total	530	100.0
Educational level	No formal education	2	0.4
	Primary	37	7.0
	Secondary	239	45.1
	Tertiary	252	47.5
	Total	530	100.0
Occupation	Student	127	24.0
	Trader	123	23.2
	Civil servant	32	6.0
	Artisan	17	3.2
	Unemployed	227	42.8
	Other	4	0.8
	Total	530	100.0

3.2 BMI Categories

Table 2 presents the BMI distribution. The combined overweight and obesity prevalence was 54.7%: 42.1% were overweight (BMI 25.0–29.9

kg/m²) and 12.6% were obese (BMI ≥ 30.0 kg/m²). Normal weight was documented in 43.6% and underweight in 1.7%.

Table 2: BMI categories of study participants (N = 530)

BMI Range (kg/m ²)	Category	Frequency (n)	Percentage (%)
<18.5	Underweight	9	1.7
18.5–24.9	Normal weight	231	43.6
25.0–29.9	Overweight	223	42.1
≥ 30.0	Obese	67	12.6
Total	—	530	100.0

BMI = body mass index; WHO (2024) classification criteria applied

3.3 Dietary Habits and Physical Activity Practices

Table 3 presents the lifestyle practice data. Regarding dietary habits, 31.5% ate three meals daily and 29.8% more than three. Fast food was consumed daily by 16.4% and 3–4 times per week by 23.0% (combined: 39.4%). The majority (70.9%) consumed sugary drinks regularly and 64.7% ate late at night. While 35.3% consumed fruits and vegetables daily, 30.9% did so only occasionally. A total of 78.1% reported regular physical activity, with walking the most common modality (54.9%). Despite this, sedentary behaviour was high: 42.3% sat for 4–6 hours per day, 20.2% for 7–9 hours, and 53.8% used motorised transport for short distances.

Table 3: Dietary habits and physical activity practices of study participants (N = 530)

Variable	Category	Frequency (n)	Percentage (%)
Meals per day	Once	46	8.7
	Twice	159	30.0
	Three times	167	31.5
	More than three	158	29.8
	Total	530	100.0
Fast food consumption	Daily	87	16.4
	3–4 times/week	122	23.0
	1–2 times/week	175	33.0
	Rarely	146	27.5
	Total	530	100.0
Fruit and vegetable intake	Daily	187	35.3
	3–4 times/week	175	33.0
	Occasionally	164	30.9
	Never	4	0.8
	Total	530	100.0
Consumes sugary drinks regularly	Yes	376	70.9
	No	154	29.1
	Total	530	100.0
Eats late at night	Yes	343	64.7
	No	187	35.3
	Total	530	100.0
Engages in regular exercise	Yes	414	78.1

	No	116	21.9
	Total	530	100.0
Most common physical activity†	Walking	291	54.9
	Running	130	24.5
	Sports activities	78	14.7
	Gym exercises	75	14.2
	Household chores	24	4.5
	None	32	6.0
Hours sitting/inactive per day	<4 hours	169	31.9
	4–6 hours	224	42.3
	7–9 hours	107	20.2
	>9 hours	30	5.7
	Total	530	100.0
Motorised transport for short distances	Yes	285	53.8
	No	245	46.2
	Total	530	100.0

†Multiple responses permitted for physical activity type; percentages may exceed 100%

3.4 Overall Dietary Level

Table 4 presents the overall dietary level. Only 36.0% of participants demonstrated good dietary practices. A total of 30.6% had moderate practices and 33.4% poor practices, confirming that nearly two-thirds of respondents were not adhering to evidence-based dietary recommendations.

Table 4: Overall dietary level of study participants (N = 530)

Dietary Level	Description	Frequency (n)	(%)
Good	Adherent to healthy practices ($\geq 75\%$ of dietary indicators)	191	36.0
Moderate	Partially adherent (50–74% of dietary indicators)	162	30.6
Poor	Non-adherent ($< 50\%$ of dietary indicators)	177	33.4
Total	—	530	100.0

Dietary level classified using a composite scoring rubric based on dietary habit responses

4. Discussion

This study provides original community-level evidence on BMI categories and lifestyle practices among adults at an urban commercial site in Douala, Cameroon. The findings are interpreted through three integrated analytical lenses: public health, physiotherapy, and physiology.

4.1 Socio-demographic Profile

The predominance of young adults aged 26–35 years (38.9%) and females (71.5%) is epidemiologically significant. Young working-age adults are the productive core of the Cameroonian economy; their disproportionate burden of overweight and obesity (54.7%) directly threatens labour productivity and SDG 8 (Decent Work and Economic Growth) (Bevan,

2015). Women in urban Cameroon bear an amplified risk, as documented in prior studies of urban Cameroonian populations (Assah et al., 2015). The fact that 47.5% of participants held tertiary education while 64.0% demonstrated poor or moderate dietary adherence confirms that knowledge alone does not translate into protective behavior, a fundamental challenge for public health communication strategies.

Physiologically, female sex is associated with specific adipose biology. Oestrogen activates receptors in subcutaneous adipocytes, promoting gluteo-femoral fat deposition; however, in environments of chronic positive energy balance, as documented here, oestrogenic protection is overwhelmed and fat distribution shifts toward visceral depots, generating hepatic insulin resistance and cardiometabolic risk (GBD Obesity Collaborators, 2024; Loos & Yeo, 2022). High unemployment (42.8%) further reduces purchasing power, channelling food selection toward energy-dense, nutrient-poor foods that cost less per calorie than fresh, unprocessed alternatives (Nature Editorial, 2025; Swinburn et al., 2011).

4.2 BMI Burden

The 54.7% combined overweight and obesity prevalence substantially exceeds the national urban Cameroonian average of 41.1% (Amougou et al., 2019) and the 34.1% reported in a 2022–2023 Douala community KAP study (Dongmo et al., 2023), and aligns with the 54.3% documented among community adults in Namibia (Ferreira et al., 2025), confirming a regional pattern of escalating urban excess weight. Globally, it has been estimated that 5 million NCD deaths in 2019 were attributable to excess adiposity, directly implicating this prevalence in SDG 3.4's unfinished agenda (GBD Obesity Collaborators, 2024).

Excess body weight mechanically increases compressive loading on the lumbar spine and lower limb joints; adipose-derived IL-6 and leptin simultaneously promote synovial inflammation and cartilage degradation (Lavie et al., 2018; Meh et al., 2023a). A cross-sectional study among 561 healthcare workers in five Douala referral hospitals documented that BMI was significantly and independently associated with WRMSDs ($p = 0.016$), with 90.2% of obese workers presenting with at least one WRMSD (Meh et al., 2023a). A separate community-level study further reported that 75.0% of nurses and laboratory technicians in Douala sat or stood for prolonged periods, with these postures the most prevalent WRMSD risk factors, and regular physical exercise was the most widely adopted coping strategy (74.2%) (Meh, 2023b). A subsequent study reported a 96.6% six-month LBP prevalence among healthcare professionals at the Bamenda Regional Hospital (Meh et al., 2026).

4.3 Sugar-Sweetened Beverages, Ultra-Processed Foods, and Fruit Deficiency

The 70.9% prevalence of regular sugar-sweetened beverage (SSB) consumption and 39.4% consuming fast food ≥ 3 –4 times per week are critical population-level dietary risk factors. SSBs exert their obesogenic effects primarily through hepatic fructose metabolism, driving unregulated *de novo* lipogenesis, hypertriglyceridaemia, and ectopic hepatic fat accumulation (Hu, 2022). Fructose neither suppresses ghrelin nor proportionally stimulates leptin, generating an ‘invisible’ caloric intake that bypasses hypothalamic satiety circuits and sustains positive energy balance (Mambrini et al., 2023). Ultra-processed foods activate Toll-like receptor 4 (TLR4) signalling, triggering NF- κ B-mediated ceramide synthesis and serine phosphorylation of insulin receptor substrate-1 (IRS-1), directly blocking skeletal muscle glucose uptake and establishing insulin resistance at the cellular level (Mambrini et al., 2023; Malik et al., 2013). The 30.9% of participants consuming fruits and vegetables only occasionally are deprived of dietary fibre and polyphenols that activate AMPK and improve postprandial glucose disposal (WHO, 2024).

4.4 Late-Night Eating

The 64.7% prevalence of late-night eating is a major, under-recognised dietary risk factor. In urban markets where traders and customers work extended hours into the evening, late-night eating is structurally embedded into occupational patterns, making it a collective environmental exposure rather than merely an individual behavioural choice. The circadian clock system, anchored in the suprachiasmatic nucleus (SCN) of the hypothalamus, governs the temporal alignment of energy intake and expenditure. Late eating induces circadian desynchronisation, significantly increasing hunger via elevated ghrelin-to-leptin ratio, reducing 24-hour resting energy expenditure, and upregulating adipogenic gene expression in adipose tissue (Peters et al., 2024; Vujovic et al., 2022). Concurrent evening cortisol elevation activates glucocorticoid receptors in adipocytes, stimulating LPL-mediated triglyceride uptake and inhibiting lipolysis, promoting visceral fat accumulation independently of total daily caloric intake (Peters et al., 2024).

4.5 Sedentary Behaviour

Despite 78.1% of participants reporting regular exercise, sedentary behaviour was pervasive: 42.3% sat for 4–6 hours daily, 20.2% for 7–9 hours, and 53.8% used motorised transport for short distances. This illustrates the ‘active couch potato’ paradox, the well-documented dissociation between meeting physical activity guidelines and

simultaneously exhibiting high sedentary time that independently elevates cardiometabolic risk (Owen et al., 2010). The physical infrastructure of Bonaberi characterised by heavy motorised traffic, limited walkways, and no dedicated pedestrian infrastructure structurally promotes motorised transport use, representing a direct SDG 11.7 gap. Prolonged sitting suppresses skeletal muscle LPL activity within 1–2 hours, reducing plasma triglyceride clearance and favouring adipose tissue lipid storage (Zderic & Hamilton, 2023; Biswas et al., 2015). Prior research among healthcare workers in Douala documented that prolonged sitting and standing were the most prevalent WRMSD risk factors, with 74.2% adopting regular physical exercise as the principal coping strategy (Meh, 2023b).

4.6 Integrated Recommendations

Nursing interventions: Nurses should systematically incorporate routine anthropometric screening (BMI, waist circumference) into every health encounter and lead structured health education sessions at Marché Tankho targeting SSB consumption, late-night eating, and sedentary transport habits. Given the high proportion of women (71.5%), sex-specific health promotion materials addressing the oestrogen-adiposity interaction should be developed. Community health nurses should advocate for and participate in market-based NCD screening outreaches aligned with SDG 3.8 (Ferraris & De Amicis, 2024; Peiris et al., 2023).

Physiotherapy interventions: Physiotherapists should deliver structured exercise prescription programmes targeting ≥ 150 –300 minutes per week of moderate-intensity aerobic exercise to activate AMPK-mediated lipid oxidation and restore insulin sensitivity (WHO, 2024; Zhu et al., 2024). Given the high sedentary time (68.2% sitting ≥ 4 hours daily), physiotherapists should implement ‘active break’ protocols, recommending 5-minute bouts of light walking every 30–45 minutes to interrupt sitting-induced LPL suppression (Zderic & Hamilton, 2023; Biswas et al., 2015). Physiotherapy-led group exercise classes at market settings during off-peak trading hours represent a cost-effective, community-embedded modality for reaching inactive individuals.

Public health interventions: Structural interventions should include: (a) fiscal measures targeting SSBs aligned with the WHO ‘3 by 35’ initiative (Nature Editorial, 2025); (b) active transport infrastructure (pedestrian walkways, cycle lanes) along principal market access routes in Bonaberi, directly addressing SDG 11.7 (United Nations, 2015); (c) regulation of street food and fast food vending at Marché Tankho to include affordable fruits, vegetables, and whole foods; (d) integration of community-based NCD prevention programmes at market sites into Cameroon’s Primary Health

Care strategy; and (e) establishment of market-based physical activity spaces accessible to traders, students, and community members (Nadal et al., 2024).

4.7 Limitations

The cross-sectional design precludes causal inference between lifestyle practices and BMI outcomes. Convenience sampling limits generalisability to other market settings or urban communities. Dietary and physical activity data were self-reported and subject to social desirability bias; objective instruments (accelerometry, 24-hour dietary recall, bioelectrical impedance analysis) were not employed. The absence of biochemical markers (fasting glucose, lipid profile, HbA1c) limits cardiometabolic risk characterisation beyond BMI. Despite these limitations, the large sample size ($n = 530$), rigorous anthropometric protocol, bilingual instrument, and multi-lens analytical approach strengthen the study's contribution.

Conclusion

Overweight and obesity are highly prevalent among adults at Marché Tankho, Bonaberi, Douala, with a combined excess-weight prevalence of 54.7%. The physiological drivers of this burden hepatic fructose-driven de novo lipogenesis from 70.9% SSB consumption, TLR4-mediated muscle insulin resistance from ultra-processed food intake, circadian adipogenesis from 64.7% late-night eating, and LPL-GLUT4 suppression from pervasive sedentary behaviour operate as a convergent multi-pathway assault on metabolic homeostasis. Only 36.0% of participants demonstrated good dietary practices, confirming a significant knowledge-practice gap that education alone cannot resolve. Evidence-based, multi-professional, community-level interventions integrating nursing-led health promotion and screening, physiotherapy-guided exercise prescription and active break protocols, and public health structural policies are urgently needed to address these epidemic and advance Cameroon's SDG 2030 commitments.

Acknowledgements

The authors express gratitude to all participants at Marché Tankho for their voluntary participation; to the Chief of Marché Tankho for administrative authorisation; to Dean of Studies Dr. Tasiki Desvarieux Ntobengwia; and to all staff and lecturers of STEM-HIITS, Douala.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research. The study was conducted as part of the undergraduate nursing training programme at STEM-HIHTS, Douala, Cameroon.

Declaration for Human Participants: Institutional approval was obtained from the Research and Ethics Committee of STEM-HIHTS, Douala. Administrative authorisation was granted by the Chief of Marché Tankho. Written informed consent was obtained from all participants. The study was conducted in accordance with the Declaration of Helsinki (revised 2013).

References:

1. Amougou, N., Cohen, E., Boetsch, G., Pasquet, P., & Said-Mohamed, R. (2019). Epidemiology of overweight and obesity in adults living in Cameroon: A systematic review and meta-analysis. *Obesity Reviews*, 20(7), 1126–1134. <https://doi.org/10.1111/obr.12860>
2. Assah, F. K., Ekelund, U., Brage, S., Mbanya, J. C., & Wareham, N. J. (2015). Patterns and correlates of objectively measured free-living physical activity in adults in rural and urban Cameroon. *Journal of Epidemiology and Community Health*, 69(7), 717–722. <https://doi.org/10.1136/jech-2014-205095>
3. Bevan, S. (2015). Economic impact of musculoskeletal disorders (MSDs) on work in Europe. *Best Practice & Research Clinical Rheumatology*, 29(3), 356–373. <https://doi.org/10.1016/j.berh.2015.08.002>
4. Biswas, A., Oh, P. I., Faulkner, G. E., Bajaj, R. R., Silver, M. A., Mitchell, M. S., & Alter, D. A. (2015). Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: A systematic review and meta-analysis. *Annals of Internal Medicine*, 162(2), 123–132. <https://doi.org/10.7326/M14-1651>
5. Clegg, M. E., & Sheard, C. (2023). BMI as a health metric: A critical review of its use, limitations, and alternatives. *Proceedings of the Nutrition Society*. <https://doi.org/10.1017/S0029665123003956>
6. Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley & Sons.
7. Creswell, J. W. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
8. Dongmo, R., Gonsu, K. H., Nzuobontane, S. E., & Fon, P. N. (2023). Knowledge, attitude, and practices regarding obesity among population of urban (Douala) and rural (Manjo) areas in Cameroon.

- International Journal of Chronic Diseases, 2023, 5616856. <https://doi.org/10.1155/2023/5616856>
9. Ferraris, C., & De Amicis, R. (2024). Nutritional counselling for lifestyle modification. *Frontiers in Nutrition*, 11, 1472316. <https://doi.org/10.3389/fnut.2024.1472316>
 10. Ferreira, L., Nashandi, N., & Amaambo, E. (2025). Prevalence of obesity among adults in Otjomuise community in Namibia. *Health SA Gesondheid*, 30, 3074. <https://doi.org/10.4102/hsag.v30i0.3074>
 11. GBD Obesity Collaborators. (2024). Global, regional, and national trends in overweight and obesity, 1990–2021: A systematic analysis for the Global Burden of Disease Study 2021. *The Lancet*, 403(10444), 2736–2781. [https://doi.org/10.1016/S0140-6736\(23\)02750-2](https://doi.org/10.1016/S0140-6736(23)02750-2)
 12. Hu, F. B. (2022). The role of sugar-sweetened beverages in the global epidemics of obesity and chronic diseases. *Nature Reviews Endocrinology*, 18(4), 233–244. <https://doi.org/10.1038/s41574-021-00627-6>
 13. Lavie, C. J., Laddu, D., Arena, R., Ortega, F. B., Alpert, M. A., & Kushner, R. F. (2018). Healthy weight and obesity prevention: JACC health promotion series. *Journal of the American College of Cardiology*, 72(13), 1506–1531. <https://doi.org/10.1016/j.jacc.2018.08.1030>
 14. Loos, R. J. F., & Yeo, G. S. H. (2022). The genetics of obesity: From discovery to biology. *Nature Reviews Genetics*, 23(2), 120–133. <https://doi.org/10.1038/s41576-021-00414-z>
 15. Malik, V. S., Pan, A., Willett, W. C., & Hu, F. B. (2013). Sugar-sweetened beverages and weight gain in children and adults: A systematic review and meta-analysis. *American Journal of Clinical Nutrition*, 98(4), 1084–1102. <https://doi.org/10.3945/ajcn.113.058362>
 16. Mambrini, S. P., Menichetti, F., Ravella, S., Pellizzari, M., De Amicis, R., Foppiani, A., Battezzati, A., Bertoli, S., & Leone, A. (2023). Ultra-processed food consumption and incidence of obesity and cardiometabolic risk factors in adults: A systematic review of prospective studies. *Nutrients*, 15(11), 2583. <https://doi.org/10.3390/nu15112583>
 17. Meh, B. K. (2023b). Prevalence and coping strategies of work-related musculoskeletal disorders among healthcare workers in Douala, Cameroon: A cross-sectional study. *London Journal of Medical Health Research*, 23(8), 11–25.
 18. Meh, B. K., Bopda, O. S. M., Ndongo, J. M., Buh, F. C., Lélé, C. E. B., Ayina, C. N. A., Ndemba, P. B. A., Sako, E. H., Bongue, B., & Mandengue, S. H. (2023a). Relation between body mass index, blood

- pressure, heart rate and work-related musculoskeletal disorders among healthcare workers in some reference hospitals in Douala, Cameroon. *Open Journal of Preventive Medicine*, 13(5), 109–131. <https://doi.org/10.4236/ojpm.2023.135011>
19. Meh, B. K., Sunjo, A. B., Amaka, S. R. C., Achuo, B. Z., Sih, M. P., & Akwa, G. M. (2026). Prevalence, risk factors and coping strategies of low back pain among healthcare professionals at the Bamenda Regional Hospital, Northwest Region, Cameroon. *Acta Scientiae et Intellectus in Medicina et Scientia*, 10(6), 10–18.
 20. Nadal, I. P., Angkurawaranon, C., Singh, A., Choksomngam, Y., Sadana, V., Kock, L., Wattanapisit, A., Wiwatkunupakarn, N., & Kinra, S. (2024). Effectiveness of behaviour change techniques in lifestyle interventions for non-communicable diseases: An umbrella review. *BMC Public Health*, 24, 3082. <https://doi.org/10.1186/s12889-024-20612-8>
 21. Nature Editorial. (2025). Too many Mr Bigs: Africa's obesity crisis comes into focus. *Nature*. <https://doi.org/10.1038/d44148-025-00292-1>
 22. Owen, N., Healy, G. N., Matthews, C. E., & Dunstan, D. W. (2010). Too much sitting: The population-health science of sedentary behavior. *Exercise and Sport Sciences Reviews*, 38(3), 105–113. <https://doi.org/10.1097/JES.0b013e3181e373a2>
 23. Peiris, C. L., Gallagher, A., Taylor, N. F., & McLean, S. (2023). Behaviour change techniques improve adherence to physical activity recommendations for adults with metabolic syndrome. *Patient Preference and Adherence*, 17, 689–697. <https://doi.org/10.2147/PPA.S395994>
 24. Peters, B., Vahlhaus, J., & Pivovarova-Ramich, O. (2024). Meal timing and its role in obesity and associated diseases. *Frontiers in Endocrinology*, 15, 1359772. <https://doi.org/10.3389/fendo.2024.1359772>
 25. Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The global obesity pandemic: Shaped by global drivers and local environments. *The Lancet*, 378(9793), 804–814. [https://doi.org/10.1016/S0140-6736\(11\)60813-1](https://doi.org/10.1016/S0140-6736(11)60813-1)
 26. United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. United Nations. <https://sdgs.un.org/2030agenda>
 27. Vujovic, N., Piber, M., Centofanti, S., Staff, J., Ricart, K., Casanova-Vallve, J., Weir, E. K., Scheer, F. A. J. L., & Czeisler, C. A. (2022). Late isocaloric eating increases hunger, decreases energy

- expenditure, and modifies metabolic pathways in adults with overweight and obesity. *Cell Metabolism*, 34(10), 1486–1498. <https://doi.org/10.1016/j.cmet.2022.09.007>
28. World Health Organization. (2024). Obesity and overweight: Fact sheet. WHO. <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
29. Zderic, T. W., & Hamilton, M. T. (2023). Physiology of sedentary behavior. *Physiological Reviews*, 103(4), 2561–2608. <https://doi.org/10.1152/physrev.00022.2022>
30. Zhu, S., Sinha, D., Kirk, M., Michalopoulou, M., Hajizadeh, A., Wren, G., Doody, P., Mackillop, L., Smith, R., Jebb, S. A., & Astbury, N. M. (2024). Effectiveness of behavioural interventions with motivational interviewing on physical activity outcomes in adults: Systematic review and meta-analysis. *BMJ*, 386, e078713. <https://doi.org/10.1136/bmj-2023-078713>