

Urban–Rural Disparities in Weightlifting Infrastructure and Training Methodologies: Evidence from the Malwa Region of Punjab, India

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Abstract

Objective: The present study examined urban–rural differences in access to weightlifting-related facilities and training methodologies among young adults engaged in weightlifting or structured strength training in the Malwa region of Punjab, India. It further examined whether residential location remained a significant predictor of these outcomes after accounting for age, gender, and training experience. **Methods:** An explanatory cross-sectional design was employed within the quantitative component of a broader mixed-methods investigation. A stratified sample of 200 participants aged 18–25 years was drawn from Bathinda, Patiala, Sangrur, Moga, and Ludhiana. Participants included 100 urban and 100 rural respondents, with equal representation of males and females. All participants had at least 6 months of continuous weightlifting or structured strength training experience. Facility Access and Training Method were assessed on continuous five-point Likert-type measures. Independent-samples *t* tests, effect-size estimates, one-way ANOVA, and multiple linear regression were used. **Results:** Urban participants reported substantially greater Facility Access ($M = 4.47$, $SD = 0.50$) than rural participants ($M = 2.50$, $SD = 0.50$), $t(198) = 27.75$, $p < .001$, Cohen's $d = 3.92$. Training Method scores were similarly higher in urban participants ($M = 4.09$, $SD = 0.70$) than rural participants ($M = 2.10$, $SD \approx 0.70$), $t(198) = 20.08$, $p < .001$, $d = 2.84$. Urban residence independently predicted Facility Access ($B = 1.98$, $p < .001$; $R^2 = .799$) and Training Method ($B = 2.00$, $p < .001$; $R^2 = .831$). Gender, age, and training experience were not significant predictors in either model. District-level ANOVA revealed no meaningful differences across the five districts. **Conclusion:** The findings indicate a pronounced urban–rural structural disparity in access to contemporary weightlifting infrastructure and systematic training practices. Residential context was substantially more influential than individual demographic characteristics within the sampled population. The results support targeted development of rural coaching, equipment, sports-science services, and standardized training systems.

Keywords: urbanization; weightlifting; strength training; rural–urban disparities; training methodology; sports infrastructure; Punjab; India

1. Introduction

Weightlifting is a highly technical strength sport in which performance is dependent on the integration of maximal force production, explosive power, technical proficiency, movement coordination, and appropriate training prescription. Contemporary strength training extends beyond the possession of physical strength and increasingly incorporates systematic

programming, individualized exercise selection, progressive overload, monitoring, recovery planning, and professional supervision. The quality of the environment in which athletes train may therefore become an important determinant of how effectively these principles are implemented.

Urbanization is not simply a demographic process. It also transforms the physical, economic, institutional, and cultural environments available to individuals. In the context of sport and physical activity, the built environment influences opportunities for participation through the availability and quality of facilities, accessibility, social conditions, and supporting services. Høyer-Kruse et al. (2024) emphasized that opportunities for physical activity arise from an interaction between built and social environments rather than from isolated environmental characteristics. Similarly, evidence from urban Asia indicates that supportive built environments and recreational infrastructure are consistently associated with opportunities for physical activity (Topothai et al., 2025).

These issues are particularly important in Punjab, where physical culture has historically been associated with agricultural labour, wrestling, *akhadas*, indigenous strength practices, and community-based forms of physical development. The thesis from which the present article is derived conceptualizes urbanization as a transition in which traditional physical-culture spaces increasingly coexist with commercial gyms, specialized sports academies, standardized equipment, professional coaching, and sports-science support.

A major consequence of this transition may be unequal access to contemporary weightlifting infrastructure. Urban environments generally provide denser concentrations of commercial gyms, specialist equipment, qualified coaches, and organized sporting services, whereas rural communities may depend more heavily on basic equipment, informal coaching, and traditional strength-training practices. The present thesis specifically identifies limited empirical evidence concerning the allocation of weightlifting-specific resources between urban and rural communities in Punjab's Malwa region.

The distinction is important because general physical activity should not be equated with access to specialized weightlifting. Rural populations can engage in considerable physical labour, agriculture, wrestling, and other forms of exertion while simultaneously lacking access to the equipment, technical instruction, and systematic programming required for contemporary Olympic-style weightlifting. Indeed, population-level evidence from Punjab has suggested that urban–rural differences in overall physical activity are not necessarily pronounced (Tripathy et al., 2016). The present investigation therefore focuses specifically on the institutional and methodological dimensions of weightlifting rather than making claims about general physical activity.

Training methodology represents a second important dimension of this transition. Contemporary resistance-training practice is increasingly characterized by deliberate manipulation of training load, volume, frequency, exercise selection, progression, and recovery. A systematic review and Bayesian network meta-analysis by Currier et al. (2023) demonstrated that resistance-training prescriptions produce meaningful improvements in strength and hypertrophy, with prescription variables contributing to differential outcomes. McLeod et al. (2024) likewise synthesized evidence showing that resistance-training prescription variables are important determinants of skeletal-muscle and strength adaptations. Accordingly, athletes with greater exposure to systematic programming may have access to a

qualitatively different training environment from those whose preparation is primarily informal.

Supervision is another component of contemporary training organization. Experimental evidence has shown that direct supervision can contribute to improved strength-training outcomes, while subsequent evidence has continued to support the value of structured oversight during resistance exercise. Mazzetti et al. (2000) reported enhanced progression in supervised resistance training, and Coleman et al. (2023) found beneficial muscular adaptations associated with supervision among resistance-trained participants. The influence of coaching is therefore relevant not only from an educational perspective but also from a performance-development perspective.

The present study addresses the resulting empirical gap by comparing urban and rural young adults engaged in weightlifting or structured strength training in five districts of the Malwa region of Punjab. The article focuses specifically on two linked outcomes: access to weightlifting facilities and the adoption of contemporary training methodologies. The study further examines whether these differences remain significant after controlling for age, gender, and training experience.

2. Methodology

2.1 Research design

The investigation employed an explanatory cross-sectional design as part of a broader mixed-methods study examining the effects of urbanization on weightlifting practices. Urban–rural residential location was treated as the principal explanatory variable, while Facility Access and Training Method constituted the principal outcomes for this article. The methodological framework was designed to capture variation in the physical and organizational conditions surrounding weightlifting participation.

2.2 Participants and sampling

The sample consisted of 200 participants recruited from five districts in the Malwa region of Punjab: Bathinda, Patiala, Sangrur, Moga, and Ludhiana. A stratified sampling procedure was used to achieve balanced representation across location and gender. There were 100 urban and 100 rural participants and 100 males and 100 females. Each district contributed 40 participants, comprising 20 urban and 20 rural respondents. Within the location groups, gender representation was also balanced.

Participants were 18–25 years old and had at least six months of continuous experience in weightlifting or structured strength training. Individuals who participated exclusively in activities such as yoga, aerobics, recreational games, or team sports were excluded.

The overall sample had a mean age of 21.60 years ($SD = 2.25$) and mean training experience of 23.64 months ($SD = 11.42$). Urban and rural participants were closely matched in age and experience.

2.3 Measures

The study used structured questionnaires to assess participants' experiences of the weightlifting environment. Four domains were included in the parent study: Facility Access, Training Method, Digital Media, and Social Inclusivity. For the present article, only the first two

domains were treated as primary outcomes. Each was measured on a continuous five-point Likert scale.

Facility Access represented perceived access to appropriate fitness facilities, specialized equipment, professional coaching, and related weightlifting resources.

Training Method represented exposure to systematic and contemporary training practices, including structured programming, periodization, performance monitoring, nutritional planning, recovery procedures, and competition-oriented preparation.

2.4 Data analysis

Data were analysed using IBM SPSS Statistics version 26.0. Descriptive statistics were calculated for demographic and outcome variables. Independent-samples *t* tests were used to compare urban and rural groups. Cohen's *d* was reported as an index of practical significance. 95% confidence intervals were considered when interpreting mean differences.

Multiple linear regression was used to determine whether urban residence remained a significant predictor after accounting for gender, age, and training experience. A one-way ANOVA examined whether outcomes differed across Bathinda, Ludhiana, Moga, Patiala, and Sangrur. Statistical significance was set at $p < .05$. The thesis reports that the assumptions required for the comparative analyses were considered satisfactory.

3. Analysis of Data and Results

3.1 Demographic profile

The sample comprised 200 young adults actively engaged in weightlifting or structured strength training. The mean age was 21.60 years, and the mean training experience was 23.64 months. Urban and rural participants were highly comparable in demographic profile, reducing the likelihood that major age or experience differences explained the observed location-based differences.

Table 1: Demographic characteristics of participants

Group	n	Age M $\pm$ SD	Experience (months) M $\pm$ SD
Overall	200	21.60 $\pm$ 2.25	23.64 $\pm$ 11.42
Rural	100	21.65 $\pm$ 2.23	23.65 $\pm$ 11.61
Urban	100	21.54 $\pm$ 2.28	23.62 $\pm$ 11.27

3.2 Urban–rural differences in Facility Access

Urban participants reported substantially greater Facility Access than rural participants. The rural group recorded a mean score of 2.50 (*SD* approximately 0.50), whereas the urban group recorded a mean of approximately 4.47 (*SD* = 0.50). The mean difference was 1.97 points, with a 95% confidence interval of [1.83, 2.11]. The independent-samples test was statistically significant, $t(198) = 27.75$, $p < .001$, with Cohen's $d = 3.92$.

The magnitude of the effect indicates that this was not merely a statistically detectable difference but a very large practical disparity in access to the weightlifting environment.

Table 2: Urban–rural comparison of Facility Access

Group	M	SD	Mean difference	t	df	p	Cohen's d
Rural	2.50	0.50					
Urban	4.47	0.50	1.97	27.75	198	< .001	3.92

3.3 Urban–rural differences in Training Method

A similarly pronounced difference was observed for Training Method. Rural respondents reported a mean score of 2.10, while urban respondents recorded a mean of 4.09. The difference of 1.99 scale points was statistically significant, $t(198) = 20.08$, $p < .001$, with a Cohen's d of 2.84 and a 95% confidence interval of [1.79, 2.19].

The result indicates substantially greater exposure to systematic and contemporary training methodologies among urban respondents.

Table 3: Urban–rural comparison of Training Method

Group	M	SD	Mean difference	t	df	p	Cohen's d
Rural	2.10	≈0.70					
Urban	4.09	0.70	1.99	20.08	198	< .001	2.84

3.4 District-level analysis

One-way ANOVA indicated no statistically meaningful differences among Bathinda, Ludhiana, Moga, Patiala, and Sangrur for either Facility Access or Training Method. Facility Access produced $F(4, 195) = 0.006$, $p = 1.000$, while Training Method produced $F(4, 195) = 0.020$, $p = .999$. Partial eta-squared values were below .001 in both analyses.

This finding suggests that location was more meaningfully divided by the urban–rural distinction than by district identity.

3.5 Multiple regression predicting Facility Access

The regression model predicting Facility Access from urban residence, gender, age, and training experience was statistically significant, $F(4, 195) = 193.93$, $R^2 = .799$. Urban residence was a significant positive predictor ($B = 1.98$, $SE = 0.07$, 95% CI [1.84, 2.12], $t = 27.75$, $p < .001$). Gender ($B = 0.04$, $p = .597$), age ($B = 0.10$, $p = .212$), and experience ($B = -0.01$, $p = .340$) were not significant.

Thus, urban residence was strongly and independently associated with Facility Access even after adjustment for individual characteristics.

3.6 Multiple regression predicting Training Method

The Training Method model was also statistically significant, $F(4, 195) = 239.76$, $R^2 = .831$. Urban residence significantly predicted Training Method ($B = 2.00$, $SE = 0.07$, 95% CI [1.86, 2.14], $t = 27.81$, $p < .001$). Gender ($B = 0.04$, $p = .568$), age ($B = 0.11$, $p = .189$), and training experience ($B = 0.02$, $p = .163$) were not statistically significant.

Table 4: Multiple regression predicting Facility Access and Training Method

Outcome	Predictor	B	95% CI	t	p	R ²
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Facility Access	Urban	1.98	[1.84, 2.12]	27.75	<.001	.799
	Male	0.04	[-0.10, 0.18]	0.53	.597	
	Age	0.10	[-0.06, 0.26]	1.25	.212	
	Experience	-0.01	[-0.05, 0.03]	-0.96	.340	
Training Method	Urban	2.00	[1.86, 2.14]	27.81	<.001	.831
	Male	0.04	[-0.10, 0.18]	0.57	.568	
	Age	0.11	[-0.05, 0.27]	1.32	.189	
	Experience	0.02	[-0.02, 0.06]	1.40	.163	

4. Discussion

The principal finding of this study was the exceptionally large urban–rural disparity in access to weightlifting infrastructure. Urban participants reported scores almost two points higher than rural participants, and the corresponding effect size was very large. This indicates that the geographical context in which young weightlifters train is strongly associated with the availability and accessibility of contemporary weightlifting resources.

This result is consistent with evidence emphasizing the relationship between physical environments and opportunities for physical activity. Høyer-Kruse et al. (2024) argued that built and social environments interact to structure opportunities for activity, while Topothai et al. (2025) identified supportive built environments as an important correlate of physical activity across urban Asian settings. The present findings extend that reasoning from general physical activity to the specialized domain of weightlifting. The key issue is therefore not simply whether individuals have opportunities to be physically active, but whether they have access to a specialized environment capable of supporting technically demanding strength training.

The distinction is especially relevant to Punjab. The historical presence of agricultural labour and traditional strength practices means that rural communities should not be characterized as physically inactive. The current findings instead indicate a difference in access to institutionalized weightlifting resources. This interpretation is supported by the broader Punjab evidence reported in the thesis, in which urban–rural differences in general physical activity were not necessarily pronounced (Tripathy et al., 2016). The present study therefore identifies an infrastructure-specific inequality rather than an inherent urban advantage in physical activity.

The second major finding concerned Training Method. Urban respondents reported substantially higher scores than rural respondents, with an effect size of 2.84. The regression analysis strengthened this conclusion by showing that urban residence remained a significant predictor after controlling for age, gender, and training experience. This suggests that the observed difference cannot readily be explained by the demographic composition of the two groups.

Contemporary resistance-training evidence provides an important context for interpreting this finding. Currier et al. (2023) synthesized evidence demonstrating that resistance-training prescription variables influence improvements in strength and hypertrophy, emphasizing the importance of systematically organized programs. McLeod et al. (2024) similarly showed that training prescription variables have meaningful relationships with muscle mass, strength, and

physical function. From this perspective, higher Training Method scores among urban participants can be interpreted as evidence of greater exposure to structured training systems rather than simply greater motivation.

The findings concerning supervision are also informative. Mazzetti et al. (2000) demonstrated benefits associated with direct supervision during resistance training, while Coleman et al. (2023) reported positive effects of supervision on muscular adaptations among resistance-trained individuals. Accordingly, access to qualified coaches, performance monitoring, and individualized programming may represent mechanisms through which urban training environments become more systematic.

However, the results should not be interpreted as demonstrating that traditional rural training is inherently ineffective. Rural strength practices may incorporate forms of experiential knowledge that are not captured by the five-point instrument used in this study. The present analysis assesses relative exposure to structured contemporary methodologies, not the intrinsic value of traditional practices.

An important additional finding was the absence of meaningful district-level differences. Bathinda, Ludhiana, Moga, Patiala, and Sangrur displayed almost identical statistical patterns. This indicates that the central distinction is spatially broad across the sampled Malwa region rather than being concentrated in one particularly advantaged or disadvantaged district. In practical terms, interventions should therefore be designed around the urban–rural infrastructure divide rather than solely around district-level differences.

The lack of significant effects for age, gender, and training experience in either primary regression model further emphasizes the structural nature of the findings. Among established participants, residence was much more strongly associated with access and training-method scores than were the individual characteristics included in the models.

Nevertheless, causal interpretation must be avoided. Because the study is cross-sectional, the coefficients describe associations rather than longitudinal effects. The findings cannot establish that urbanization itself caused the observed differences. It is possible that a combination of infrastructure, institutional investment, socioeconomic conditions, coach availability, and other unmeasured factors contributes to the relationship. The thesis itself appropriately cautions against interpreting the regression coefficients as proof of causation.

5. Conclusion

The study demonstrates substantial urban–rural differences in the contemporary weightlifting environment of the Malwa region of Punjab. Urban participants reported considerably greater access to facilities and markedly greater exposure to systematic training methodologies. The magnitude of these differences was large, and urban residence remained the dominant predictor after adjustment for age, gender, and training experience.

The findings indicate that the modernization of weightlifting is unevenly distributed geographically. The central challenge in rural settings does not necessarily appear to be a lack of interest in strength training, but rather lower access to the institutional, technical, and human resources required for contemporary performance development.

Rural weightlifting development should therefore prioritize specialized facilities, standardized equipment, qualified coaches, structured programming, performance-monitoring systems, and

sports-science support. Such investments could help reduce the spatial inequality identified in the present study while preserving valuable elements of Punjab's existing physical-culture traditions.

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