Anusandhanvallari
Vol 2024, No.1
October 2024
ISSN 2229-3388

Greater Trunk but Comparable Arm Circumference Reductions With 16:8 Intermittent Fasting Versus 10% Caloric Restriction: An 8-Week Experimental Study in Indian Adults

[1]Dr. Sarita Tyagi, [2]Dr. Monika Wasuja, [3]Dr. Anil Vanaik

[1]Head and Professor, Department of Physical Education and Sports Sciences, University of Delhi

[2]Professor, Indira Gandhi Institute of Physical Education and Sports Sciences, University of Delhi,

[3]Professor, Department of Physical Education and Sports Sciences, University of Delhi

Corresponding Author: **Mukul**,

Research Scholar, Department of Physical Education and Sports Sciences, University of Delhi

Abstract: This study compared regional anthropometric responses to a 16:8 intermittent fasting (IF) protocol and a traditional 10% calorie-restricted diet (CRD) in Indian adults with elevated adiposity. Sixty participants were randomly allocated to IF (n = 30) or CRD (n = 30) for eight weeks. Waist, hip, chest, left bicep, and right bicep circumferences were assessed at baseline, four weeks, and eight weeks using a non-elastic anthropometric tape. A 2 × 3 mixed ANOVA tested Time, Group, and Time × Group effects. The IF group showed larger pre-to-post reductions in waist circumference (6.53 cm vs. 2.92 cm), hip circumference (6.62 cm vs. 2.71 cm), and chest circumference (5.12 cm vs. 2.37 cm). Significant Time × Group interactions were observed for waist, $F(1.019, 59.100) = 111.963$, $p < .001$, $\eta^2p = .659$; hip, $F(1.007, 58.394) = 132.671$, $p < .001$, $\eta^2p = .696$; and chest circumference, $F(1.006, 58.358) = 95.156$, $p < .001$, $\eta^2p = .621$. In contrast, the interaction was not significant for left bicep, $F(1.236, 71.674) = 1.455$, $p = .237$, $\eta^2p = .024$, or right bicep circumference, $F(1.257, 72.927) = 1.855$, $p = .176$, $\eta^2p = .031$. These findings indicate a regional pattern in which 16:8 IF produced substantially greater reductions at trunk sites while arm-girth changes were comparable between dietary strategies.

Keywords: Intermittent Fasting, Time-Restricted Feeding, Waist Circumference, Hip Circumference, Anthropometry, Caloric Restriction, Indian Adults

Introduction :-Excess adiposity remains a major public-health problem because its health implications depend not only on total body mass but also on the distribution of adipose tissue. Overweight and obesity are associated with cardiovascular disease, type 2 diabetes, musculoskeletal disorders, and several cancers (World Health Organization, 2021; Jensen et al., 2014). India has undergone the same nutritional transition, with greater availability of energy-dense foods and declining physical activity contributing to increasing obesity and metabolic risk (Misra & Khurana, 2008). This creates a need for practical weight-management strategies that can produce meaningful changes while remaining feasible in everyday life.

Anthropometric circumferences provide a practical way to examine changes that are not fully represented by scale weight alone. Waist circumference is widely used as an indicator of abdominal size and obesity-related risk, while hip, chest, and upper-arm circumferences help describe the regional pattern of body-size change. These measures are inexpensive, non-invasive, and easy to repeat in field settings. They should nevertheless be interpreted as external anthropometric measures rather than direct assessments of visceral fat, subcutaneous fat, or skeletal muscle.

Continuous caloric restriction remains a common approach to weight loss. Its principle is straightforward: a sustained reduction in energy intake should produce a negative energy balance. In practice, however, repeated portion estimation, food monitoring, and daily intake decisions can make adherence difficult (Freire, 2019).

Weight loss can also provoke compensatory increases in hunger and hormonal adaptations that favor regain (Sumithran et al., 2011). These difficulties have encouraged interest in strategies that alter the timing of eating rather than requiring continuous calorie monitoring.

Intermittent fasting (IF), particularly time-restricted feeding, follows this alternative model. The 16:8 protocol confines food intake to an eight-hour window and extends the daily fast to 16 hours. Its appeal lies in a simple temporal rule. Proposed explanations for its effects include spontaneous reduction in energy intake, prolonged periods of lower insulin exposure, greater reliance on stored fuels during fasting, and possible interaction with circadian metabolic rhythms (Gabel et al., 2018; Tinsley & La Bounty, 2015; Sutton et al., 2018).

Evidence comparing IF with continuous energy restriction remains mixed. Siles-Guerrero et al. (2024) found small short-term advantages for fasting-based strategies in weight and fat mass but generally similar waist and hip outcomes. Erdem et al. (2022) reported significant reductions in weight, waist circumference, and arm circumference across several intermittent-fasting regimens and an energy-restricted Mediterranean diet without clear superiority of fasting. Semnani-Azad et al. (2025) likewise concluded that intermittent fasting and continuous energy restriction usually produce broadly comparable weight-loss effects. These findings suggest that outcomes may depend on the fasting protocol, comparator diet, population, intervention duration, and measure selected.

Most comparative work emphasizes body weight, BMI, or total fat mass, and fewer studies examine several circumference sites together. A dietary intervention may therefore appear similar or different depending on whether the outcome reflects whole-body change or regional body dimensions. The present study examined waist, hip, chest, and bilateral bicep circumference responses during an eight-week comparison of 16:8 IF and a 10% calorie-restricted diet in Indian adults with elevated body fat. The primary objective was to determine whether trunk-circumference trajectories differed between dietary strategies, while bilateral bicep circumferences were examined as secondary regional outcomes. Body-fat-percentage findings from the same parent trial were reported separately; the current paper focuses on the regional anthropometric outcomes (Mukul et al., 2026).

Method

Participants :-Sixty adults from the National Capital Region of India were recruited through corporate offices, community centers, and fitness clubs using purposive sampling. Eligibility required an age of 18-60 years and body fat of at least 20% for males or 27% for females. Individuals with chronic metabolic diseases, eating disorders, or previous structured intermittent-fasting practice exceeding one month were excluded. After screening and informed consent, participants were randomly assigned with a computer-generated sequence to IF (n = 30; 14 females, 16 males) or CRD (n = 30; 15 females, 15 males).

Research Design :-An experimental pre-test, mid-test, and post-test control-group design was used. Circumference measurements were obtained at baseline (Week 0), after four weeks, and after eight weeks.

Intervention Protocols :-The IF group consumed all daily food within a consistent eight-hour window, most commonly 12:00 PM-8:00 PM, and fasted for the remaining 16 hours. Water, black coffee, and plain tea were permitted during fasting. No fixed calorie or macronutrient target was imposed during the eating window. Participants new to fasting could progress gradually from approximately 12 hours to the full 16-hour fast during the first week.

The CRD group maintained usual meal timing but followed a daily energy target set 10% below estimated maintenance requirements. Maintenance energy was estimated with the Mifflin-St Jeor equation using age, sex, height, weight, and physical activity. Participants received basic guidance on portions and food labels and had no time restriction on eating.

Measures :-Waist, hip, chest, left bicep, and right bicep circumferences were recorded in centimeters using a non-elastic, flexible anthropometric tape. The same measures were collected at all three assessment points under the study's standardized procedures.

Compliance Monitoring :-Weekly Google Meet sessions reinforced instructions and addressed difficulties. Periodic in-person follow-ups were provided when needed. Participants also self-reported daily adherence: the IF group recorded maintenance of fasting/eating windows and the CRD group maintained a simple food log.

Statistical Analysis :-Data were analyzed in SPSS. The principal analysis for each circumference outcome was a 2 (Group: IF vs. CRD) × 3 (Time: Pre, Mid, Post) mixed ANOVA. Mauchly's test assessed sphericity, and Greenhouse-Geisser corrected degrees of freedom were used when the assumption was violated. Partial eta squared (η^2p) quantified effect size, with approximately .01, .06, and .14 interpreted as small, medium, and large. Statistical significance was set at $p < .05$.

Results :-

Trunk Circumference Changes :-Waist circumference in the IF group decreased from 93.19 cm at pre-test to 90.25 cm at mid-test and 86.66 cm at post-test, a total reduction of 6.53 cm. The CRD group decreased from 100.84 cm to 99.59 cm and 97.92 cm, a reduction of 2.92 cm. There was a significant main effect of Time, $F(1.019, 59.100) = 770.435$, $p < .001$, $\eta^2p = .930$, and a large Time × Group interaction, $F(1.019, 59.100) = 111.963$, $p < .001$, $\eta^2p = .659$. The Group effect was also significant, $F(1, 58) = 9.694$, $p = .003$, $\eta^2p = .143$.

Hip circumference showed the same pattern. IF decreased from 103.69 cm to 100.86 cm and 97.07 cm, a 6.62 cm reduction, whereas CRD decreased from 107.45 cm to 106.32 cm and 104.74 cm, a 2.71 cm reduction. Time was significant, $F(1.007, 58.394) = 755.824$, $p < .001$, $\eta^2p = .929$, and the Time × Group interaction was large, $F(1.007, 58.394) = 132.671$, $p < .001$, $\eta^2p = .696$. The Group effect was significant, $F(1, 58) = 5.292$, $p = .025$, $\eta^2p = .084$.

Chest circumference declined from 93.04 cm to 90.78 cm and 87.92 cm in IF (5.12 cm total) and from 97.28 cm to 96.26 cm and 94.90 cm in CRD (2.37 cm total). Time was significant, $F(1.006, 58.358) = 708.920$, $p < .001$, $\eta^2p = .924$, as was the Time × Group interaction, $F(1.006, 58.358) = 95.156$, $p < .001$, $\eta^2p = .621$. The Group effect was significant, $F(1, 58) = 4.516$, $p = .038$, $\eta^2p = .072$. Thus, all three trunk measures showed substantially steeper reductions with IF.

Arm Circumference Changes :-Left bicep circumference decreased by approximately 0.64 cm in IF (31.60 to 30.95 cm) and 0.73 cm in CRD (31.91 to 31.18 cm). Time was significant, $F(1.236, 71.674) = 296.685$, $p < .001$, $\eta^2p = .836$, but the Time × Group interaction was not, $F(1.236, 71.674) = 1.455$, $p = .237$, $\eta^2p = .024$. The Group effect was also non-significant, $F(1, 58) = 0.085$, $p = .772$.

Right bicep circumference decreased by approximately 0.64 cm in IF (31.80 to 31.16 cm) and 0.74 cm in CRD (32.22 to 31.48 cm). Again, Time was significant, $F(1.257, 72.927) = 297.413$, $p < .001$, $\eta^2p = .837$, but the Time × Group interaction was not, $F(1.257, 72.927) = 1.855$, $p = .176$, $\eta^2p = .031$. The Group effect was non-significant, $F(1, 58) = 0.161$, $p = .690$. The parallel arm trajectories therefore contrasted with the clearly separated trunk trajectories.

Table 1. Estimated Marginal Means of Regional Circumferences by Group and Time Point

Measure	Group	Pre-test M (cm)	Mid-test M (cm)	Post-test M (cm)	Pre-Post Change (cm)
Waist	IF	93.19	90.25	86.66	-6.53
Waist	CRD	100.84	99.59	97.92	-2.92
Hip	IF	103.69	100.86	97.07	-6.62
Hip	CRD	107.45	106.32	104.74	-2.71
Chest	IF	93.04	90.78	87.92	-5.12
Chest	CRD	97.28	96.26	94.90	-2.37
Left bicep	IF	31.60	31.33	30.95	-0.64
Left bicep	CRD	31.91	31.64	31.18	-0.73
Right bicep	IF	31.80	31.53	31.16	-0.64
Right bicep	CRD	32.22	31.94	31.48	-0.74

Note. IF = intermittent fasting; CRD = calorie-restricted diet. Values are rounded from the estimated marginal means reported in the mixed ANOVA.

Table 2. Mixed ANOVA Summary for Regional Circumference Outcomes

Outcome	Effect	F	df	p	η^2p
Waist	Time	770.435	1.019, 59.100	< .001	.930
	Group	9.694	1, 58	.003	.143
	Time x Group	111.963	1.019, 59.100	< .001	.659
Hip	Time	755.824	1.007, 58.394	< .001	.929
	Group	5.292	1, 58	.025	.084
	Time x Group	132.671	1.007, 58.394	< .001	.696
Chest	Time	708.920	1.006, 58.358	< .001	.924
	Group	4.516	1, 58	.038	.072
	Time x Group	95.156	1.006, 58.358	< .001	.621

Left bicep	Time	296.685	1.236, 71.674	< .001	.836
	Group	0.085	1, 58	.772	.001
	Time x Group	1.455	1.236, 71.674	.237	.024
Right bicep	Time	297.413	1.257, 72.927	< .001	.837
	Group	0.161	1, 58	.690	.003
	Time x Group	1.855	1.257, 72.927	.176	.031

Note. Greenhouse-Geisser correction was applied to the repeated Time effects. η^2p = partial eta squared.

Discussion :-The central finding is that the comparative effect of 16:8 intermittent fasting was regional rather than uniform. Over eight weeks, IF produced substantially larger reductions in waist, hip, and chest circumferences than the 10% calorie-restricted diet. The Time × Group effect sizes for these outcomes were all large (η^2p = .621-.696). In contrast, left and right bicep circumferences changed modestly and similarly in both groups, with no significant interaction. The advantage of IF in this sample was therefore concentrated in trunk circumference measures rather than all measured body sites.

Waist circumference illustrates the difference most clearly: mean reduction was 6.53 cm with IF versus 2.92 cm with CRD. Hip circumference declined by 6.62 cm versus 2.71 cm, and chest circumference by 5.12 cm versus 2.37 cm. The significant interactions show that these differences involved the trajectory from baseline through Week 4 to Week 8, not merely different post-test values.

These results differ from some broader comparative evidence. Siles-Guerrero et al. (2024) reported generally similar waist and hip outcomes between fasting-based strategies and continuous caloric restriction, despite small short-term advantages for weight and fat mass. Erdem et al. (2022) also found reductions in waist and arm circumferences across intermittent-fasting approaches and an energy-restricted Mediterranean diet without superiority of fasting. The present findings should therefore be interpreted as specific to the intervention tested here: a 16-hour daily fast with an eight-hour eating window compared against a relatively modest 10% prescribed calorie deficit.

A possible explanation is a difference in the energy deficit actually achieved. The CRD group received an explicit 10% reduction target. The IF group received no calorie target, but restricting intake to eight hours may have removed eating opportunities and produced spontaneous energy reduction. Gabel et al. (2018) observed reduced energy intake during an eight-hour time-restricted feeding intervention without deliberate calorie counting. If a similar effect occurred here, the effective deficit in IF may have exceeded that of CRD. Because energy intake was not objectively quantified, this remains an explanation rather than a measured mechanism.

Fasting physiology may also have contributed. Longer daily fasting periods are associated with lower insulin exposure and greater mobilization of stored fuels, and meal timing may interact with circadian metabolism (Tinsley & La Bounty, 2015; Sutton et al., 2018). However, the present study did not measure insulin, glucose, substrate oxidation, or other biochemical pathways. It therefore cannot determine whether the circumference differences resulted from fasting-specific metabolism, greater energy deficit, adherence, or a combination of these factors.

The bicep results are important because they prevent the findings from being described as a generalized reduction in all circumferences. Both groups lost only about 0.6-0.7 cm at each arm, and the non-significant interactions

were accompanied by small interaction effect sizes. Because arm circumference measured with a tape reflects several tissues, these results should not be interpreted as direct evidence of muscle preservation. They show only that the strong between-group divergence found at waist, hip, and chest was absent at the upper arms.

The present analysis also complements, rather than duplicates, the previous body-fat report from the same trial (Mukul et al., 2026). Body fat percentage and serial circumferences answer different questions: the former estimates overall adiposity, whereas circumference measurements describe changes in external body dimensions at specific sites. The current results add a regional pattern to the parent study, with the largest comparative differences occurring at the trunk.

Several limitations should be acknowledged. The intervention lasted only eight weeks, so long-term maintenance cannot be inferred. Recruitment was purposive and limited to adults in the National Capital Region who met specified body-fat criteria. Adherence and dietary intake relied substantially on self-report, and actual energy intake was not objectively measured. Circumference measurements cannot identify the tissue responsible for change. The CRD group also began with descriptively higher trunk circumferences than the IF group; although mixed ANOVA tested differential change over time, replication with larger samples and baseline-adjusted models would strengthen inference. Finally, biochemical outcomes were not collected, so cardiometabolic effects cannot be inferred directly from the anthropometric changes.

Future research should extend follow-up, objectively quantify energy intake and expenditure, and use DXA or imaging methods to distinguish regional fat from lean tissue. Studies comparing early and late eight-hour eating windows and different magnitudes of continuous caloric restriction would help determine whether the regional pattern reflects time restriction itself or differences in achieved energy deficit and adherence.

Conclusion :-Eight weeks of 16:8 intermittent fasting produced significantly greater reductions in waist, hip, and chest circumferences than a 10% calorie-restricted diet in Indian adults with elevated adiposity. The Time × Group interactions for all three trunk outcomes were large, demonstrating clearly different trajectories of change. In contrast, left and right bicep circumferences decreased modestly and to a similar extent in both groups, with no significant interaction effects. The findings therefore support a regional interpretation rather than a uniform anthropometric advantage: under the conditions of this trial, 16:8 IF was associated with substantially greater reductions in trunk dimensions while arm-girth responses remained comparable. Because food intake, tissue-specific body composition, and biochemical markers were not directly quantified, the mechanisms underlying this pattern remain uncertain. Longer controlled studies with objective dietary monitoring and direct regional body-composition assessment are required to determine the durability and physiological basis of these effects.

References :-

[1] Chaix, A., Zarrinpar, A., Miu, P., & Panda, S. (2014). Time-restricted feeding is a preventative and therapeutic intervention against diverse nutritional challenges. Cell Metabolism, 20(6), 991-1005. https://doi.org/10.1016/j.cmet.2014.11.001

[2] Erdem, N. Z., Bayraktaroglu, E., Samanci, R. A., Gecgil-Demir, E., Tarakci, N. G., & Mert-Biberoglu, F. (2022). The effect of intermittent fasting diets on body weight and composition. Clinical Nutrition ESPEN, 51, 207-214. https://doi.org/10.1016/j.clnesp.2022.08.030

[3] Freire, R. (2019). Scientific evidence of diets for weight loss: Different macronutrient composition, intermittent fasting, and popular diets. Nutrition, 69, 110549. https://doi.org/10.1016/j.nut.2019.07.001

[4] Gabel, K., Hoddy, K. K., Haggerty, N., Song, J., Kroeger, C. M., Trepanowski, J. F., Panda, S., & Varady, K. A. (2018). Effects of 8-hour time restricted feeding on body weight and metabolic disease risk factors in obese adults: A pilot study. Nutrition and Healthy Aging, 4(4), 345-353. https://doi.org/10.3233/NHA-170036

[5] Jensen, M. D., Ryan, D. H., Apovian, C. M., Ard, J. D., Comuzzie, A. G., Donato, K. A., Hu, F. B., Hubbard, V. S., Jakicic, J. M., Kushner, R. F., Loria, C. M., Millen, B. E., Nonas, C. A., Pi-Sunyer, F. X., Stevens, J., Stevens, V. J., Wadden, T. A., Wolfe, B. M., & Yanovski, S. Z. (2014). 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults. Circulation, 129(25 Suppl. 2), S102-S138. https://doi.org/10.1161/01.cir.0000437739.71477.ee

[6] Misra, A., & Khurana, L. (2008). Obesity and the metabolic syndrome in developing countries. Journal of Clinical Endocrinology and Metabolism, 93(11 Suppl. 1), S9-S30. https://doi.org/10.1210/jc.2008-1595

[7] Mukul, Tyagi, S., Wasuja, M., & Vinaik, A. (2026). Superior reduction in body fat percentage through 16:8 intermittent fasting compared to 10% caloric restriction: An 8-week experimental study in Indian adults. Unnati International Journal of Multidisciplinary Scientific Research, 8(3), 1-7.

[8] Siles-Guerrero, L. M., Verdu, D., Belmonte-Herrero, T., & San Onofre-Bernat, N. (2024). Fasting-based strategies versus continuous caloric restriction for weight loss in overweight and obese adults: A systematic review and meta-analysis. Nutrients, 16(11), 1655. https://doi.org/10.3390/nu16111655

[9] Sumithran, P., Prendergast, L. A., Delbridge, E., Purcell, K., Shulkes, A., Kriketos, A., & Proietto, J. (2011). Long-term persistence of hormonal adaptations to weight loss. New England Journal of Medicine, 365(17), 1597-1604. https://doi.org/10.1056/NEJMoa1105816

[10] Sutton, E. F., Beyl, R., Early, K. S., Cefalu, W. T., Ravussin, E., & Peterson, C. M. (2018). Early time-restricted feeding improves insulin sensitivity, blood pressure, and oxidative stress even without weight loss in men with prediabetes. Cell Metabolism, 27(6), 1212-1221.e3. https://doi.org/10.1016/j.cmet.2018.04.010

[11] Tinsley, G. M., & La Bounty, P. M. (2015). Effects of intermittent fasting on body composition and clinical health markers in humans. Nutrition Reviews, 73(10), 661-674. https://doi.org/10.1093/nutrit/nuv041

[12] World Health Organization. (2021). Obesity and overweight [Fact sheet]. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight