

Article

Perceived Body Image towards Disordered Eating Behaviors and Supplement Use: A Study of Mauritian Gym-Goers

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Abstract: Purpose: Individuals with body image distortions tend to develop an obsession with calorie intake and weight, leading to compounded coping strategies such as modified eating behaviors, supplement use, and excessive exercise. In the local context, little is known about the equation connecting body image to improper eating behaviors and other potential coping mechanisms. This study primarily aims at critically identifying the nexus between features of disordered eating behavior including supplement use, and body image. Methodology: A probabilistic randomized sample of 305 gym members was assessed based on their level of body satisfaction and its influence on their eating habits and supplement use through a structured survey. Findings: Only 37% of the participants were satisfied with their body image. The results concurred with the notion of a poor body image influencing body esteem ($\chi^2(10) = 137.21, p < 0.05$; Cramer V = 0.474). While exercise motivated the use of supplements, a significant relationship was also observed between disordered eating habits and supplement use ($\chi^2(4) = 48.63, p < 0.05$; Cramer V = 0.399). A predictive model was successfully drawn inclusive of the disordered eating behaviors dimensions as a potent predictor of body image ($\chi^2(56) = 397.12, p < 0.001$). Implications: This study presents an in-depth analysis of the magnitude of disordered eating behaviors with respect to individuals in the local fitness industry, and the need for professional support programs toward the re-alignment of body image in an effort to curtail the development of eating disorders in Mauritian gym-goers.

Keywords: body image; disordered eating behaviors; supplement use; coping strategies; exercise



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1. Introduction

Body ideal, defined as the standards set by the media or society about the ‘perfect body’ [1], has been the driving force of most marketing agencies. From the fashion industry to the food industry, the obsession with the body ideal has rendered adults more body-conscious [2,3]. The failure to match the media’s portrayal of the body ideal increases the risk of developing a distorted body image, as well as affects body satisfaction [4,5].

1.1. Perceived Body Image and Body Ideal

The concept of body image consists of feelings, perceptions, and thoughts that an individual has about body size [6]. Defined as the subjective mental representation an individual has of his body shape and appearance [7,8], body image can either be negative or positive. Negative body image is closely related to body dissatisfaction and the desire to either become thinner or larger [9,10]. The development of body image is said to be influenced by the cultural attitudes related to appearance, body shape, and attractiveness [11], while the inability to match the media’s portrayal of a ‘body ideal’ puts the individual at an increased risk of developing a distorted body image [4,5]. Unfortunately, a significant dissociation between perceived body image and body ideal can damage the individual’s self-concept, accentuate body dissatisfaction, and induce disordered eating behaviors such as laxative use or vomiting, ultimately leading to the obsessive pursuit of weight loss to

match the body ideal [12–14]. Previous studies explain how poor body image can influence self-esteem which consequently results in low body-esteem, the latter characterizing the self-conceptualization of one's body with respect to feelings and self-evaluation [15,16].

Interestingly, self-objectification also seems to have an impact on body image development [17]. Objectification refers to the process by which “girls and women are typically acculturated to internalize an observer's perspective as a primary view of their physical selves” [18]. Gender-based differences also seem to affect this development, i.e., girls are more prone to develop body image distortion than boys are; this gap increases as they grow older [19]. Similar to global trends, a study conducted in Mauritius related to body image confirmed these differences between gender, i.e., female adolescents display more symptoms of body image distortion than their male counterparts [20]. This contrast is thought to be attributed to patriarchal-based socialization, where girls are made to believe that their worth depends on their physical appearance [21,22]. Girls from an early age are pressured to acquire the body ideal to match the standards set by society [23]. Unfortunately, females seem to be consistently dissatisfied with their body shape or weight throughout their adulthood, and this tends to persist until they are too old to diet [24]. Researchers claim that the objectification of individuals based on their looks perpetuates the adoption of observers' perspectives, such that individuals internalize these opinions leading to body dissatisfaction, excessive weight monitoring, and maladaptive weight control practices inclusive of restricted eating patterns and excessive exercise. [17,18,25]. Gross, et al. [26] confirmed this trend through reports of gendered-body dissatisfaction, with an 80% likelihood of being dissatisfied with one's body shape attributed to females, as opposed to 63% of males. Non-traditional relationships, especially including male homosexual couples, are likely to be objectified, potentially amplifying their vulnerability to body dissatisfaction [27]. Body image distortion is also linked to low self-esteem, disordered eating patterns, or even depression [27,28].

1.2. Exercise to Bridge the Gap between Body Image and Body Ideal

More recently, trends such as ‘fitspiration’ and ‘fitspo’ have been observed on social platforms, promoting exercise addiction to achieve the body ideal. While regular exercises have been associated with several benefits both physically and psychologically [29], the compulsive need to exercise correlates with negative body image, as well as the desire to acquire the body ideal [30]. This trend is seen specifically in females due to constant social comparison and the obsessive concern for others' perception of their body shape [31]. It has been observed that 41% of the participants show improved body image when they train with weights [32], while Bhurtun and Jeewon [33]'s study demonstrates that almost 80% of Mauritian adolescents exercise to lose weight to achieve the body ideal. It is also noted that if individuals engage in regular workouts, they are more satisfied with their bodies [34]; this is supported by a significant relationship between exercise and assessment of physical appearance in South-African students [35].

People with body image distortion and low self-esteem experience intense sensations of guilt or deprivation when they are unable to exercise [36]. Additionally, due to the difference in body ideals for men and women, the expectations after working out are different. For instance, men feel being larger is more desirable while women report that being thinner is ideal [37,38]. As noted earlier, working out regularly is beneficial for one's overall well-being, but the downside of excessive workouts only to satisfy body image distortion cannot be mitigated [39].

The obsession with the body ideal has reached alarming levels. In total, 86.7% of Mauritian adolescents reflecting body image distortion want to lose weight because of body shape dissatisfaction [33]; meanwhile, 74.5% of Mauritian adolescents, including those with a low body mass index (BMI), experience body dissatisfaction, engage in meal restrictions and resort to excessive physical activities in an attempt to achieve the body ideal [40]. The link between the body ideal and a low BMI has been observed particularly in females (89.9%) [41]. Nonetheless, men are not immune to the body ideal since the

process of objectification is no longer restricted to females. A shift has been noted whereby men are also scrutinized and pressured to adopt the body ideal [42]; this is exemplified by men engaged in bodybuilding activities, who upon objectification, are led towards the development of body distortion as well as maladaptive eating patterns or supplement use [18,43].

1.3. Adoption of Disordered Eating Behavior to Achieve the Body Ideal

Disordered eating patterns, adopted as unhealthy weight control practices, can lead to eating disorders, depression, substance use disorder (SUD), or rigid personality traits [44,45]. In many cases, the repercussions can be life-threatening, as reported by Crow, et al. [46], whereby almost 10% of the mortality rate among individuals in the age range of 8 to 25 years is caused by eating disorders. Unfortunately, in the local context, disordered eating behavior has been heavily side-tracked and is often undiagnosed or misinterpreted as normal dieting. Society, through social acceptance, plays a significant role in the onset of disordered eating behaviors. Individuals are encouraged to achieve the body ideal to be socially appreciated and valued [47]. Furthermore, the media, through social platforms such as Instagram, or Facebook, not only perpetuate unhealthy eating practices such as intermittent fasting [48], but also encourages body shaming based on one's morphological characteristics [49]. Body dissatisfaction, mediated by body image distortion, causes more distress than eating restrictions [50] and is associated with several eating disorders such as Anorexia Nervosa (AN) or Muscle Dysmorphic Disorder (MDD) [51]. Feeling fat is a common occurrence for anorexic patients and is accompanied by inhibitory emotions, along with distress and a negative body image [52].

Individuals engaged in excessive exercise to appease the feelings of body dissatisfaction often resort to disordered eating behaviors through the adoption of various dietary regimes [53–55]. Similar connections between exercise addiction and disordered eating behaviors have been denoted in individuals diagnosed with restrictive AN [55,56] and Binge-Eating Disorder (BED) [57]. Canonically, MDD is intricately linked to an obsessive-compulsive training routine [58], with anorexics leaning towards hyperactivity, i.e., their daily routine includes excessive exercise along with restricted eating [59]. AN is quite common among female athletes because it is part of the lightweight pre-requisite [60].

1.4. Supplement Use as the Fast Route to Body Ideal

Disordered eating behaviors and the use of supplements such as fat burners and steroids are intertwined. Supplements usually refer to workout products consumed to enhance performance, promote muscle mass, as well as prevent deficiencies encountered as part of dieting [61,62]. The dependence on such supplements has restorative effects on appearance and body shape as observed in dissatisfied female bodybuilders [63,64]. This is further substantiated by Ruano and Teixeira [65], illustrating this prominent use of supplements among young male gym members with the main objective of gaining muscle. Supplements such as protein shakes, isotonic drinks, multivitamins and anabolic androgenic steroids (AAS) have been shown to positively influence appetite [66,67], while fat burners contribute to weight loss [63]. However, individuals tend to misuse AAS, especially when a drive for muscularity is the desired outcome [68]. Abuse of AAS has also been associated with disordered eating behaviors [69,70]. Hence, an increased preference for a muscular and hairless body among men precipitates exercise and supplement use to enhance their physical build [71]. J Morrison, et al. [72] reported that gym subscribers are more exposed to the use of supplements, as noted by the majority of members taking supplements at least five times per week; meanwhile, bodybuilders rely extensively on AAS. This growing use of supplements among gym-goers can be linked to the urgency of either gaining muscle mass or losing weight, circling back to body image [73,74].

In the past decade, Mauritius has witnessed a rise in the number of gym memberships, especially among students given the tailored packages from almost all gyms to attract the younger population. The keen interest in fitness among Mauritian youngsters can be

explained by Kowalski and Leonard [75]’s claims regarding ‘lacking muscular development’; supporting the notion of gaining muscle mass through exercise and fitness practices. Furthermore, trends of metrosexuality alongside the strong desire to achieve a ‘beach body’, given that Mauritius fits perfectly into the tropical geographical context and dubbed as a ‘paradise island’, has catalyzed the process of fitness engagement and its accompanying coping mechanisms. With disordered eating behaviors not given due attention in the local context, this study aims to explore the possible link between negative body image, disordered eating, and supplement use; meanwhile, features mediating negative body image and the potential to resort to excessive exercise will also be explored as secondary objectives among gym members in Mauritius. The sociocultural theory has long been used to conceptualize incongruence between the body ideal and body image, as well as the deflective mechanisms, such as disordered eating behaviors, to conform to the societal and media portrayal of the body ideal [76,77]. Hence, the present study will be founded on the sociocultural theory and will be extended to encompass features of the self-determination theory; this, in essence relies on personal engagement tied to goal orientations [78,79], to further characterize the need for exercise that is accompanied by supplement use to bridge the gap between body image and body ideal. The extended sociocultural theory will be used to address the following core components; this study, therefore, (i) examines the potential mismatch between body ideal and body image in the Mauritian population, (ii) perceives how body image directionally affects body esteem, and (iii) discovers how poor body image recruits deflective mechanisms, namely exercise and disordered eating habits, including supplement use.

2. Materials and Methods

2.1. Participants

A cross-sectional survey was carried out over a period of six months (October to March 2019). The district of Flacq was chosen, considering the sudden surge of fitness centers in the eastern region of Mauritius in the last 5 years and its associated subscribers’ population. Six registered gym centers from the Flacq district were selected at random from an established list of 20 centers, and each was contacted regarding the number of registered subscribers in their centers. The criteria for drawing the list of the gym centers were mainly registered commercial outlets that have been in operation for a minimum of one year, and this excluded fitness centers which were exclusive to hotels. The inclusion criteria for the participants in the study was as follows: both males and females in the age range of 18 to 45 years; people with an active gym membership dating at least 6 months; and participants focusing on body shaping, taking supplements, and attending fitness centers in the eastern region. The particular age range of 18 to 45 years was deemed apt as studies show a decreasing tendency in body image concerns as age increases [80]. The particular choice of exercise at the gym was motivated by the fact that appearance-related justifications, to engage in physical activity, have been associated with disrupted eating behaviors and body esteem [81]. Most importantly, supplement use has long been associated with concepts of body image and dissatisfaction, the latter fueled by the need to enhance appearance or other physical attributes [71,82,83]. Hence, the main exclusion criteria for this study were gym users outside of the defined age range; individuals who were engaged in health and wellness programs, such as yoga, as the primary purpose to exercise; and those who were inclined towards the use of banned-substances, such as steroids.

Consequently, a purposive approach and cluster sampling strategy were used, whereby 330 questionnaires were equally distributed across the six gym centers. Based on the total approximation of subscribers from all the registered gyms in that particular region (Table 1), the sample size of 289 participants was calculated, accounting for a 95% confidence interval and a 5% margin of error. The sample size was inflated by approximately 20% to buffer against discrepancies in response rate and partially filled questionnaires. Questionnaires were self-administered. Respondents were given the opportunity to voluntarily withdraw

from the study at any time. A total of 305 responses was collected from all the participating gyms, with a resulting response rate of 92.4%.

Table 1. Number of active gym members in the district of Flacq.

No	Gym Centre Name	Address	Number of Active Members
1	Leo's Gym	Ecroignard	250 *
2	Life Fitness Gym	Central Flacq	200 *
3	Espace Sante Fitness and Medical Center	Boulet Rouge	250 *
4	Gym Tonic	Bel Air	100 *
5	Win's Gym	Central Flacq	250 *
6	Army Gym	Bramsthan	100 *
TOTAL:			1150 *

* Number of registered participants as of March 2019.

2.2. Research Instrument Design and Validation

Questionnaire items were formulated based on the existing pool of literature and documented, validated scales related to the main variables. Even though Mauritian Creole is known to be the national language of Mauritius, English is the accepted official language with its prominent use in all relevant documentation [84]. Hence, the questionnaire was administered in English. Databases were screened for original articles using keywords such as body image, disordered eating behaviors, and supplement use. The internal consistency and reliability of the instrument were tested to ensure that the data collected could be further processed quantitatively. Addressing the core variable of supplement use, the questions, although focusing on the generic perception of supplement use, might have been interpreted differently, dispersing the measures across other dimensions such as peer pressure, the legal aspects of supplements, and performance; this, therefore, impacted the consistency of this section. This could have been further accentuated by the potential interpretation of some items from the scale-like format (#2, #4, and #5) as 'negative' statements, observations that were not highlighted at the pilot testing stage. The pre-test of the instrument was undertaken in one gym, with a total of 25 respondents who did not contribute to the final data collection part. Inputs collected from the participants were highly supportive of the instrument, leading to the administration of the final survey. The socio-demographic data of each of the individuals were included and measured in the first section of the questionnaire with the addition of items such as income (if any), regular gym member, duration of gym membership, other physical activities practiced, and estimated weight and height. Data were collected within the gym centers, mostly prior to the participants' workout, while a few did fill the questionnaire post workout.

2.2.1. Body Image

Body dissatisfaction was investigated using a modified version of the Stunkard, et al. [85]'s figure rating scale. Incongruity between body image and body ideal denoted body dissatisfaction. Items focusing on weight control practice were based on a 3-point Likert rating profile (1 = *Never* to 3 = *Often*). A high mean value showed a higher adoption of the concerned weight control practice. The last segment in this section consisted of 13 questions taken from the Sociocultural Attitudes Towards Appearance Questionnaire-3 Revised Edition (SATAQ-3R) [86], rated on a 5-point Likert profile (1 = *Strongly Disagree* to 5 = *Strongly Agree*). A high mean score would be indicative of a high level of body dissatisfaction and internalization of body ideals, as per their complementary questions. An adapted version of the SATAQ-3R was used for its ability to investigate the constructs of body image and eating disturbances, as well as their convergence [87]. Several studies have also shown that the internalization of sociocultural attitudes toward appearance leads to body dissatisfaction [88–95]. The scale used showed good internal reliability ($\alpha = 0.852$), as supported by Pallant [96].

2.2.2. Eating Behaviors

This section consisted of questions adapted from Fairburn C. G., et al. [97]’s Eating Disorder examination questionnaire (EDE-Q 6.0). The items from the adapted scale assessed eating habits over the past 28 days. As per the EDE-Q 6.0 rating profile, the first section, a 5-point Likert scale (0 = *Never* to 4 = *Always*, translating to 0 = 0 days, 1 = 1–7 days, 2 = 8–14 days, 3 = 15–21 days, and 4 = 22–28 days), measured the frequency of eating behaviors in the participants. A high mean score was indicative of heightened disordered eating patterns. The second section was also based on a 5-point Likert rating (0 = *Not at all*, 1 = *minimally*, 2 = *mildly*, 3 = *moderately*, and 4 = *Markedly*), which assessed the severity of shape and weight in the participants’ lives. A high mean score denoted the negative impact of weight perception on participants. Hence, the same rating profile was transposed from the original instrument. The scale used to assess eating behaviors showed good internal reliability ($\alpha = 0.871$). Based on the scoring rules of the EDE-Q 6.0, the scale was divided into three different subscales assessing “Restraint ($\alpha = 0.650$), Shape Concern ($\alpha = 0.846$), and Weight Concern ($\alpha = 0.610$)”. To obtain the score of each subscale, the ratings of items were added and the sum was divided by the total number of items in the subscale.

2.2.3. Supplement Use

This section investigated the attitudes towards and frequency of supplement use. Questions were partly adapted from Goston and Correia [67]’s self-developed questionnaire; it was developed and adapted for the purpose of this study based on the Dietary Supplement Questionnaire and Knapik et al. [98]’s systematic review and meta-analysis regarding the Prevalence of Dietary Supplement Use by Athletes. The scale-like items consisted of 9 questions and item #9 was further divided into 5 subparts; items were measured on a 5-point Likert rating (1 = *Strongly Disagree* to 5 = *Strongly Agree*). Higher mean scores for items (#1 and #3) denoted a positive attitude towards supplement use, while lower mean values for items (#2, #4, and #5) reflected the perceived benefit of using supplements. Interestingly, the alpha coefficient for the scale-like items addressing the variable supplement use was only moderate ($\alpha = 0.667$). The single-item questions in this particular section, assessing supplement use, may potentially account for this mean value, corroborating with Gliem and Gliem [99]. Item #4 of the likert-type questions related mainly to the risk associated to supplement use, as opposed to the other items which addressed the need and pressure associated with supplement use; this, upon consideration as one construct, resulted in a good internal consistency measure ($\alpha = 0.766$).

2.3. Statistical Analyses

Descriptive measures were used to characterize the sample according to the dimensions being investigated. Nominal data were expressed as percentages and computed ordinal data as weighted means. Statistical levels were capped at $p < 0.05$. Normality of data were tested using the Shapiro–Wilk test, with a cut-off value at $p < 0.05$, designating deviation from a normal distribution. The Mann-Whitney U test was used to draw a comparative analysis across gender, with respect to body esteem, while Spearman’s correlational analysis examined the bi-directionality between body image satisfaction and body esteem. A Wilcoxon signed-rank test was carried out to examine the difference between perceived self and body ideal. Chi-square tests were used to analyze the statistical significance between exercise and the subscales of the Eating Disorder Examination scale. A binary logistic regression was undertaken to assess the relationship between exercise and supplement use, and correlational analysis was used to investigate the bi-directional relationship between dimensions of disordered eating behavior and supplement use. All statistical measures were computed on SPSS V22.0.

2.4. Ethical Consideration

Each participant was briefed prior to the start of the survey with respect to the confidential management of the collected data. The survey was accompanied by a cover

page, whereby participation consent was sought. Information was kept anonymous at all times and the ethical standards were respected. Ethical requirements were reviewed by the Postgraduate Dissertation Committee, School of Health Sciences, University of Technology, Mauritius.

3. Results

3.1. Demographic Profile of Gym-Goers in Mauritius

The 18–35 years age group (48%) appeared to be the norm age subscribing to fitness centers (Table 2). Out of all participants, 28.5% were students, as opposed to a majority of 62.3% who were employed. Interestingly, 67.5% of the gym members admitted to being gym regulars, while gym membership terms were scattered across the temporal spectrum. The mean estimated BMI of the participants was 26.1 and 23.3 for males and females, respectively; this highlighted a ‘healthy’ female population versus the surveyed males, the latter inclining more towards the overweight category as per the healthy BMI range (18.5–24.9) [100].

Table 2. Participants’ characteristics and gym subscription status.

Characteristics	Male		Female		Total	
	<i>n</i>	%	<i>N</i>	%	<i>N</i>	%
Age						
18–25 years	63	45.4	81	47.9	144	47.2
26–35 years	58	42.6	73	43.2	131	43
36–45 years	8	5.9	7	4.1	15	4.9
More than 45 years	7	5.1	8	4.8	15	4.9
Occupational Status						
Student	27	19.9	60	35.5	87	28.5
Employee	62	45.6	82	48.5	144	47.2
Self-Employed	28	20.6	18	10.7	46	15.1
Others	19	13.9	9	5.3	28	9.2
Income (If applicable)						
<Rs 10,000	9	6.6	12	7.1	21	6.9
Rs 10,000–Rs 20,000	38	27.9	45	26.6	83	27.2
>Rs 20,000	43	31.6	54	32	95	31.1
None	46	33.9	58	34.3	106	34.8
Regular Gym Member						
Yes	107	78.7	99	58.6	206	67.5
No	29	21.3	70	41.4	99	32.5
Duration of Membership						
<1 year	23	16.9	45	26.6	68	22.3
1–5 years	36	26.5	51	30.2	87	28.5
>5 years	52	38.2	9	5.3	61	20
Others	25	18.4	64	37.9	89	29.2
BMI (kg/m ²)	26.12		23.25			

n represents the frequency over the actual sample size. % represents the percentage across each domain and is based on the overall sample taken.

3.2. Comparative Analysis of Body Image vs. Ideal across Mauritian Gym-Goers

With reference to the Figure Rating Scale, panels C and D represented a healthy status, 34.8% of the participants associated themselves with Panel D, and the majority (51.8%) of participants wanted to achieve the body ideal represented by Panel C, the latter portraying a slimmer morphology (Supplementary data: Figure S1). This potentially demonstrated incongruence between body image and body ideal, and is indicative of body dissatisfaction. Interestingly, 6.9% of the participants were more attracted to a plump figure (Panel E

and F; Supplementary data: Figure S1), unknowingly being categorized as overweight. Respondents who perceived a particular body image as attractive would ideally prefer to have the same body shape, i.e., their body ideal. A significant strong relationship was observed between body image and body ideal ($\chi^2(4) = 459.4, p < 0.05$; Cramer V = 0.849), suggestive of an influential effect of the body ideal on shaping the body image. Furthermore, a Wilcoxon signed-rank test showed that perceived body image significantly differed from body ideal ($Z = -5.82, p < 0.05$; median value 4 vs. 3), further characterizing dissatisfaction with respect to current body shape.

3.3. Impact of Body Image Satisfaction on Body Esteem

Only 29.6% of females and 27.9% of males were satisfied with their body morphology, while a marginal 8% were 'proud' of their bodies. A gender-based difference was observed with respect to the perception of being overweight, supported by a higher prevalence among females (26% versus 4.4%). Males were more likely to experience muscle dysmorphia (42.6%) as they reported not being muscular enough, as opposed to females (13%). The item, 'Does your weight affect the way you feel about yourself?', showed that the majority of the participants had poor body esteem (73.8%); this is characteristic of dimorphic properties, as a higher proportion of females versus males (84% vs. 61%) exhibited poor body esteem ($U = 9930, p < 0.05$). A significant relationship between body image satisfaction and body esteem ($\chi^2(10) = 137.21, p < 0.001$; Cramer V = 0.474) was depicted; variables were inversely related, such that an increase in body satisfaction significantly decreased poor body esteem ($r_s = -0.412, p < 0.001$).

Most of the participants agreed that being athletic or physically fit enhances one's external appearance, as characterized by attractiveness ($\bar{X} \pm SD, 3.68 \pm 1.18$), and were in agreement that being athletic was more desirable ($\bar{X} \pm SD, 3.57 \pm 1.13$) (Table 3). In total, 83.1% of participants who were not satisfied with their bodies were also of the opinion that physically fit people were more attractive. While participants agreed that being physically fit was more attractive, it did not particularly imply that they were happier ($\bar{X} \pm SD, 2.13 \pm 1.04$) or more successful ($\bar{X} \pm SD, 2.07 \pm 1.02$). Interestingly, self-body shaming through the perception of being 'better looking' when slim, as opposed to being overweight, was not observed across the sample investigated ($\bar{X} \pm SD, 2.80 \pm 1.22$). The participants agreed that social media had minimal influence on their body esteem, as determined by the inability of social media to act as pressure points to address their body morphology through weight loss ($\bar{X} \pm SD, 2.74 \pm 1.41$) and exercise ($\bar{X} \pm SD, 2.79 \pm 1.41$). However, a strong agreement was noted in the media's portrayal of body ideal and participants' perception of an 'athletic' figure.

3.4. Deflective Mechanisms of Body Image: Supplement Use and Exercise

Most participants (96%) responded positively to exercise, and were classified based on their weekly frequency of exercise as the following: 20% once, 16% twice, 31% thrice and 29% exercised more than three times a week; the latter categorized as obsessive exercisers [101,102]. Given the study's emphasis on muscle-strengthening activities of moderate or greater intensity, the frequency focus was upon two or more days a week, as per the Center for Disease Control and Prevention. Additionally, as the study also takes into account disordered eating patterns, the obsessive need for exercise was observed to be more than four times a week for patients of AN [103,104]; training frequency which was also observed in Performance-Enhancing Substance (PES) users [105], hence substantiating the mapping of obsessive exercisers against individuals with disorders eating patterns. This practice was more prominent in males than in females (44.9% vs. 16.0%), in 52.2% of young adults (26 to 35 years), and in participants who had possessed a gym membership for more than 5 years (47.5%). Examining the relationship between body esteem and exercise showed that 47.8% of participants who exercised either felt 'overweight, underweight or not muscular enough', in comparison to only 36.1% who were either 'satisfied' or 'proud' of their body. However, no prominent relationship was established between body esteem

and exercise ($\chi^2(2) = 0.769, p > 0.05$; Cramer V = 0.049), potentially implying the role of body esteem as a reinforcer rather than a pre-requisite to exercise.

Table 3. Body image as perceived by the Mauritian gym-goers.

Item No.	Items	Mean (\bar{X})	S.D	Agreement (%)	Disagreement (%)
1	I wish I looked as athletic as the people portrayed in media.	3.57	1.13	60.7	18.4
2	I wish I looked as athletic as sports stars.	3.50	1.2	56.1	24.6
3	I compare my body to the bodies of people who appear in magazines/movies/on social media.	3.27	1.23	49.2	28.9
4	Clothes look better on people who are thin.	2.70	1.20	31.1	49.2
5	Clothes look better on people who have an athletic body.	3.42	1.23	54.4	24.3
6	Attractive people are more popular than unattractive ones	2.69	1.33	33.7	54.4
7	People who are thin look better than overweight ones.	2.80	1.22	33.8	46.6
8	People who have an athletic body are better looking.	3.63	1.23	65.9	26.6
9	Physically fit people are more attractive.	3.68	1.18	68.8	19
10	Good looking people are more successful.	2.07	1.02	9.6	71.8
11	Attractive people are happier.	2.13	1.04	11.2	67.2
12	I feel pressured from celebrities on social media, TV, or magazines to lose weight	2.74	1.41	25.9	48.2
13	I feel pressured from celebrities on social media, TV, or magazines to exercise	2.79	1.41	28.5	44.9

Data presented as the mean based on a 5-point Likert scale (1 = Strongly disagree to 5 = strongly agree). Questions adapted from the Sociocultural Attitudes Towards Appearance Questionnaire-3 Revised Edition (SATAQ-3R) by Thompson, van den Berg, Roehrig, Guarda and Heinberg [87]; S.D = standard deviation.

In total, 75% of participants admitted to using supplements, 97.2% of which were accounted for by those aged under 35 years. A number of justifications were given for the initiation of supplements, with 47.4% agreeing to the increase in performance with supplements use (Table 4). The need to use supplements was assessed through a weighted mean of the likert-type items, excluding item #4, which related mainly to the potential use of illicit substances; this reported a subscore of 2.97 ± 1.2 . Partial correlations and construct validity were tested through the Kaiser–Meyer–Olkin test for sample adequacy, and Bartlett’s test of sphericity yielded positive results ($KMO > 0.5$; $\chi^2(6) = 737, p < 0.001$), confirming the consolidation of the items under one variable; items were extracted as one component through the exploratory factor analysis using varimax rotation, with an extracted eigenvalue of 2.74 and 68.46% explained variance. It is noteworthy to mention that male supplement users were slightly higher than females (52.2% versus 47.8%), while the need to use supplements was significantly higher for males ($U = 5028.5, p < 0.001$). The mid-aged group, i.e., 26–35 years old, felt a significant need to use supplements among the different age groups sampled ($\chi^2(3) = 22.24, p < 0.05$); while, interestingly, the 36–45 years old bracket did not report any use of supplements. As expected from the population, only 36% of supplement users consulted a professional, such as a qualified trainer or a nutritionist, for the proper prescription of their supplements; males dominated that category (69.4%). Data endorsed self-prescription as a common practice among female supplement users. Of interest, 62.1% of the overall participants who claimed to exercise at least three days a week were in agreement that exercise increases the need for supplements. This was further reinforced by the relationship between the perceived increased use of supplements and the resulting exercise regimen ($\chi^2(4) = 78.123, p < 0.05$; Cramer V = 0.520), validating the dependence on supplements among obsessive exercisers. However, the relationship between exercise intensity and supplement use was not investigated in such depth that the variation in exercise intensity could be mapped against the dependence level on supplements. Additionally, the duration of membership was not found to be a mediating factor with respect to supplement use, as reported through the Kruskal Wallis H test ($\chi^2(2) = 2.204, p = 0.332$; mean rank score = 112.65, 109.38, and 102.62 for < 1 year, 1 to 5 years and > 5 years respectively).

Table 4. Attitudes towards Supplement Use.

Item No.	Items	Mean (\bar{X})	S.D	Agreement (%)	Disagreement (%)
1	The more supplements I take, the better I will perform.	3.21	1.35	47.4	31.2
2	I feel under pressure to use supplements.	2.90	1.34	34.2	38.4
3	Exercise increases the need for supplements.	3.25	1.30	38.7	28.4
4	There is a risk of consuming a banned substance when taking a supplement.	2.90	1.28	42.6	42.9
5	I feel pressured to take supplements because my friends/opponents do.	2.53	2.04	23.5	61.2

Data presented as the mean based on a 5-point Likert scale (1 = Strongly disagree to 5 = strongly agree); S.D = standard deviation.

3.5. Associating Disordered Eating with Deflective Mechanisms of Body Image

Disordered eating habits were assessed through items related to unhealthy weight control and practices, such as an unbalanced diet or starvation, engaged in by participants in the last 4 weeks. In total, 29.4% of males, versus only 12.4% of females, deliberately limited their food intake to influence their shape or weight. While 88% of participants desired a flat stomach as their body morphology, only 23% practiced unhealthy habits, such as skipping meals for a whole day, to achieve this objective (Table 5). When respondents were asked about their shape or weight affecting their performance, most responded negatively (77%), while the remainder varied, along with a minimal to mild concern for body morphology on performance (1.82 ± 1.21).

Items compressed under the associated variable were tested for relevance through the Kaiser–Meyer–Olkin test for sample adequacy, and Bartlett’s test of sphericity. KMO values exceeded the cut-off value of 0.5, typically representing a good model based on the variance explained by the tested dimension, and p -values < 0.001 were recorded for the Bartlett test of sphericity confirming construct validity (Supplementary data: Table S1). The information gathered from the respondents also showed a certain level of restraint applied to eating habits, which may also be related to their concerns about their weight and shape. This was validated by the significant correlational effect exerted on restraint, such that an increase in weight ($r_s = 0.5$) and shape ($r_s = 0.52$) concerns induce more restraints on eating habits (Table 6). Interestingly, gender-specific correlations were identified between both shape and weight concerns, versus supplement use in females, while restraint and supplement use negatively correlated, specifically in males. Aligning with the concept of morphological concerns and restraint, the latter also negatively correlated with exercise ($r_s = -0.12$), suggestive of the adoption of physical activity to address morphological issues ($\chi^2(17) = 30.17, p < 0.05$; Cramer V = 0.336). In contrast, morphological concerns alone were not related to initiation or sustenance of exercise, as demonstrated by the absence of a relationship between exercise and shape ($\chi^2(20) = 30, p > 0.05$; Cramer V = 0.340), or weight ($\chi^2(39) = 46.01, p > 0.05$; Cramer V = 0.531) concern.

Most importantly, a regression model drawn between the independent variables, i.e., disordered eating habits, shape, and weight restraints, demonstrated their potency as predictors against the dependent variable (i) body image ($\chi^2(56) = 397.12, p < 0.001$, with an 75.7% explained variation in the dependent variable) and (ii) body esteem ($\chi^2(56) = 426.99, p < 0.001$, with an 85.4% explained variation in the dependent variable); this clearly depicts the impact of the deflective mechanisms of disordered eating behaviors on body image and body esteem.

Extreme measures, such as the use of laxatives and purging, were insignificant among the participants, with more than 96% reporting the absence of such activities in the frequency range of 0–6 days. The adoption of exercise (89.5%) as a weight control practice was prominent among the participants. Aside from the strategies related to eating habits, participants also resorted to popular weight control alternatives, including calorie intake count (73.7%), diet pills (53.8%), crash diet (54.5%), and liquid formula diet (50.2%), to

address their body image. Interestingly, approximately the same percentage of females answered that they binge ate (14.2%) and compulsively exercised (13.6%) for at least 10 days in the last four weeks.

Table 5. Eating Disorder Examination.

Item No.	Items	Mean (X̄)	S.D	A (%)	D (%)
RESTRAINT					
1	Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight?	2.20	1.28	39.7	26.2
2	Have you tried to exclude any food that you like from your diet in order to influence your shape or weight?	2.02	1.35	36	30.2
3	Have you tried setting rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight?	2.35	2.77	45.6	28.5
4	Have you had skipped food for a whole day to influence your shape or weight?	0.73	1.15	8.5	77
	Subscale Score	1.82	1.23		
SHAPE CONCERN					
5	Have you had a definite desire to have a totally flat stomach?	2.59	1.34	48.6	17.7
6	Have you felt fat?	1.93	1.25	29.2	34.1
7	Has your shape influenced how you think about (judge) yourself as a person?	1.59	1.30	26.9	52.8
8	How dissatisfied have you been with your shape?	1.76	1.27	36.7	48.2
9	How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, while undressing or taking a bath or shower)?	1.62	1.26	29.3	51.1
10	How uncomfortable have you felt about others seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	1.64	1.39	30.2	47.2
	Subscale Score	1.86	0.98		
WEIGHT CONCERN					
11	Have you had a strong desire to lose weight?	2.15	1.56	42.3	34.1
12	Has your weight influenced how you think about (judge) yourself as a person?	1.57	1.32	26.2	52.5
13	How much would it have upset you if you had been asked to weigh yourself once a week (no more, or less often) for the next four weeks?	1.72	1.34	33.1	41.6
14	How dissatisfied have you been with your weight?	1.79	2.08	9.5	54.4
	Subscale Score	1.81	1.09		

A = Agreement; D = Disagreement; S.D = standard deviation Data for restraint presented as the mean based on a 5-point Likert scale (0 = never to 4 = always); shape and weight concern (0 = not at all to 4 = markedly). Subscales were computed based on the weighted means of the items and presented as mean ± SEM.

Table 6. Assessing the dimensional effect of eating habits on exercise and supplement use.

Dimensions	Restraint	Shape Concerns	Weight Concerns	Exercise	Supplement Use
Restraint	1.000	0.522 **	0.500 **	−0.122 *	−0.274 **
Shape concerns	0.522 **	1.000	0.901 **	−0.022	−0.191 **
Weight concerns	0.500 **	0.901 **	1.000	−0.047	−0.178 **
Exercise	−0.122 *	−0.022	−0.047	1.000	−0.035
Supplement Use	−0.274 **	−0.191 **	−0.178 **	−0.035	1.000

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

4. Discussion

4.1. Impact of Body Ideal on Body Satisfaction

The internalization of the body ideal has escalated since the introduction of social media platforms [106,107]. The incongruence noted between perceptions of current body

image and body ideal, in the Figure Rating Scale (Supplementary data: Figure S1), was indicative of body dissatisfaction [108]. This was supported by the fact that Panel C (Supplementary data: Figure S1) was the preferred body ideal among Mauritian participants; suggesting that body shaping was perceived as healthier or more appealing and conforming to Clark and Tiggemann [109], and Yardimci, et al. [110]'s analysis of how shape and weight seem to perpetuate body dissatisfaction, rather than BMI. Hence, body image perception was shaped with reference to the body ideal.

Our findings demonstrated that female participants experienced weight dissatisfaction even when their weight was in accordance with the World Health Organization [100]'s healthy weight range. Similar reports by Behrens, et al. [111], through their novel experimental measure of weight bias, showed that patients suffering from AN favored a lower and/or healthy BMI. Weight bias is closely associated with disordered eating behaviors, motivated by the drive for thinness [112]; meanwhile, the control exerted by weight stigma extends to BMI as well as other health behaviors, such as disordered eating patterns, sleep disturbances and/or alcohol use [113]. For male participants, dissatisfaction was experienced through muscle dysmorphia [42], as illustrated by Sandgren, et al. [114]; despite the fact that the majority of male participants were in the overweight range, the feeling of being too small or not muscular enough was still observed. Thus, negative body image, driven by the inability to meet the body ideal, prompted body dissatisfaction [115]; cascading into the adoption of deflection mechanism, such as restrictive eating habits and exercise to reduce this dissonance [116]. Poor body esteem, experienced mostly by female participants, could be paired with socialization and objectification; this is where women, not conforming to the societal perception of the body ideal, are body shamed. Calogero and Thompson [117] concur that females are not only socialized to be ashamed of the natural changes their bodies undergo through puberty, but are also conditioned to see themselves as objects to be evaluated, aligning with studies by Fredrickson and Roberts [18]. This also taps into the notion of gender-mediated socialization, fueling the internalization of the body ideal as the basic standard of beauty [118,119].

The present data, demonstrating the comparison drawn between the gym-goers' perception of body image against the athletic version of media portrayal, can be justified by the conditioning effect observed in people to assess their self-worth against others [120]. Herrick and Duncan [121] support the present findings and demonstrate that participants were conditioned to evaluate their worth based on body ideals. Lamarche et al. [122] postulated that, in a gym center, everything is comparable; from body build to hairstyle, further illuminating the influential nature of body image comparison among athletic individuals. Accordingly, most studies of body dissatisfaction point towards the theory of social comparison, whereby individuals experience higher levels of body dissatisfaction after going through media platforms and mediums [123]. Findings revealed that gym-goers were in agreement that clothes look better on people with an athletic build; therefore, the inability to wear well-fitted clothes seems to accentuate the incongruence between one's body image and the body ideal, furthering body dissatisfaction [124]. This is further supported by Frith and Gleeson [125], whereby the majority of female participants agreed to the fact that clothing primarily serves to hide the features they dislike about their body, while emphasizes on features they like. Hence, clothing is used as a medium for regulating how the body is perceived and presented to others [126]. The present study did not examine the differential effects of media variants, i.e., traditional versus social media, given the spectrum of age groups targeted and their negative outcomes on body image [127,128]. However, both variants can potentially differ in the magnitude of adverse effects, as reported by the augmentation of body dissatisfaction through social media, particularly by Instagram compared to traditional media [129]. In addition, given the surge of social media platforms, as well as social evolution, body dissatisfaction has been more prominently observed on those platforms [130].

While participants expressed the consensus that being physically fit was desirable and wished they looked like their body ideal, a general disagreement was noted in regard to the

concept that being physically fit is synonymous with being more successful or happier. Our present data align with studies by Meacham [131], dissociating concepts of success, such as educational achievements, from physicality and happiness, particularly among men [132].

4.2. Deflective Mechanisms of Body Image: Exercise, Restrictive Eating Habits, and Supplement Use

Rather than acting as a pre-requisite to exercise, body image was seen as a potential reinforcer to the practice of exercise. The origins of the relationship between exercise and body image can be traced back to Landers and Arent [133]'s study of physical activity and mental health. Indeed, exercise is commonly adopted as a practical coping mechanism to alleviate the effects of poor body image [134,135]. Consistent with the present finding, Hausenblas and Fallon [136]'s study shows that when placed in an exercise intervention, participants reported better body image compared to non-exercising participants.

Similarly, the adoption of eating restraints, determined to be prominent among participants with weight and shape concerns, act as coping mechanisms against the effects of poor body image [137]. However, the combination of restrictive eating, alongside shape and weight concerns, is indicative of the restrictive type of AN, as well as the Avoidant/Restrictive Food Intake Disorder as per the DSM-5 [138]. Providing further support, Tabri, et al. [139] claim that the concerns regarding shape and weight contribute to the perpetuation of restrictive eating habits. Nonetheless, the espousal of restrictive eating to assuage the discrepancy between the body image and the body ideal has been common practice [140]

An increase in exercise routines and restraints in eating habits was noted to compensate for increases in weight or shape. Tiggemann and Williamson [141] address this need to exercise as the need to improve body shape and control weight. Individuals with body morphology issues often resort to exercise to regulate their body esteem, while applying eating restraints to mitigate the 'feeling fat' syndrome [142]; these are features reported in the current study with respect to the Mauritian population. Additionally, as per the present reports, approximately the same number of women binged ate and compulsively exercised. Hence, it can be assumed that binge-eating precipitated a pattern of obsessive exercise, potentially as a result of the guilt and shame feelings associated with bingeing [143]. Similarly, DeFeciani [144] attributed this synthesis of restrictive eating, exercise, and body image to an obsession with weight and calorie restriction.

This study effectively revealed that the use of supplements across the majority of gym-goers correlates with an increase in exercise regimen; these findings aligned with reports by [62,72]. Supplement consumption was based on self-prescription rather than under controlled advice from a nutritionist or qualified trainer, a practice which is thought to be a common occurrence across physically active individuals or mediated by peer consultations and advice. While Tarn, et al. [145] postulate that the self-prescription of dietary supplements is prominent because of the distrust gym-goers have for dietitians and whether they have adequate knowledge of supplements, Locquet, et al. [146] attribute the phenomenon of self-prescription to peer influence. Hence, this study cautiously attributes the self-prescription behavior to the presence of a social circle sharing information and collectively reviewing the efficacy of certain supplements among their peers.

Subsequently, this practice of self-prescription could also find support in the theory of social influence, whereby social media influencers market the use of various supplements that do not necessarily benefit the individual [147,148]. Unfortunately, in an attempt to acquire a certain muscular build or body shape, Mauritian gym-goers are turning to over-the-counter supplement products that may potentially contribute to the development of undesirable side effects, such as cardiovascular problems and weight gain in the form of water retention; these culminate in a further delay in achieving their objectives of the body ideal [149]. Interestingly, while the use of supplements was associated with exercise, no prominent link was reported between body image and supplement use. Hence, even though an indulgence in exercise and restraints in eating habits were observed as deflective mechanisms for body image distortion, the use of supplements was not. This result could

be justified by Goston and Toulson Davisson Correia [150]'s study, whereby supplement use was observed to mainly complement their exercise routine.

5. Conclusions

Consistent with the existing findings, an incongruity between perceived body image and body ideal was indicative of body dissatisfaction, as well as body image distortion, which was more accentuated in males given the deviation from the normal BMI range. The adoption of deflection mechanisms, such as restrictive eating, exercise, and the unsupervised use of supplements, was a common strategy to address body image distortion, pointing toward the need to achieve a body ideal among Mauritian gym-goers (Figure 1). Altogether, this study not only adds noteworthy support to existing studies, but provides significant pointers to identify the possible markers of body image distortion; these are most evident in the practice of self-prescription and restrictive eating among gym members. Accordingly, it is critical to accentuate the need for remedial actions to educate the Mauritian population on body image distortion to avoid critical issues pertaining to detrimental eating habits that complement the exercise regimen.

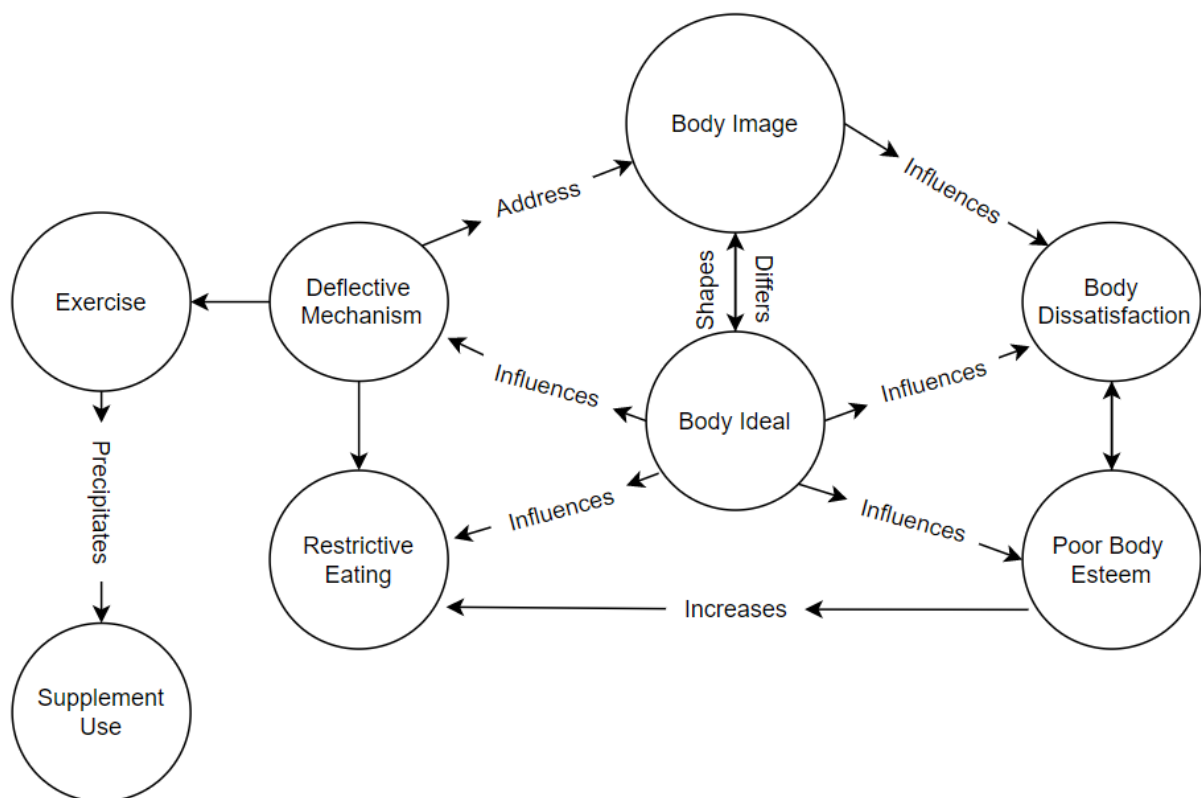


Figure 1. Conceptual model connecting body ideal, body image, and deflection mechanisms. A strong inter-relationship was drawn between body ideal and body image, such that the latter is pressured by the idealization factor; meanwhile, resorting towards deflection mechanisms, such as exercise and supplement use; motivated by the body ideal as a restorative effect of body image.

6. Limitations and Future Directions

Given the emergence of body image disorders and the associated disordered eating habits in the male population, the Figure Rating Scale used in the study did not appropriately incorporate muscularity as a possibility. The figures might have had a different significance for males where figure panels, indicating an overweight silhouette, were possibly perceived as being more toned and athletic; however, the use of such instruments successfully extracted individualized and unbiased perceptive information related to body image and the body ideal. The Figure Rating Scale was adequate for depicting discrepancies

when it comes to body shape and body fat, which is the prime cause of body dissatisfaction [151]; meanwhile, body size and weight have long been used as indicators of body image [152,153]. Past studies have reported the weak ability of men to appropriately choose images reporting their current body morphology when it came to muscularity, as opposed to body fat [154]. Meanwhile, body concerns appear to change over the developmental timeline, with newly assigned roles transitioning from a sense of belonging and courtship during young adulthood, to new priorities during the parenting phase when healthy bodies are favored over muscular ones [83,151]. Within the realm of body composition, the present assessment of BMI was based on a self-reference, with an estimated height and weight; meanwhile, the actual body composition, in terms of ratio of muscle mass to adipose tissue, could have a more significant implication for perception, especially if participants were a priori aware of these indicators. Body dissatisfaction has been closely linked to obesity [155], which includes morphological features such as ‘hanging skin’ and ‘love handles’; these are features that move away from body attractiveness, characterized by muscularity, waist to hip ratio or even waist to bust ratio, through the younger-generation’s lens [156,157]. With the emergence of new tools, such as the Silhouette Rating Scale [158], the Body Image Matrix of Thinness and Muscularity—Male Bodies (BIMTM-MB) [159], research on body image disorders, with respect to male participants, should be exclusively undertaken for a better understanding of body image distortion and its causative factors; the latter was not the focus of the present study.

In terms of participants, gym-goers assigned to health and wellness programs were not included in the study, given the primary objectives of connecting body image, exercise, and supplement use as a subset of the disordered eating habits; this aligned with the notion that individuals using supplements, for either muscle hypertrophy or weight loss, were inclined towards aesthetic factors and therefore body image. [160,161]. This was also in line with fitness trends prevailing across the globe, with high-intensity interval training and strength training leading as the primary choice of exercise and weight loss being the common objective observed in many countries; meanwhile, disciplines such as Pilates, Yoga and Tai Chi, among others, are low in popularity [162,163]. However, given the gradual rise in the adoption levels of body–mind wellness programs such as Yoga, and their relevance in addressing positive body image [164] and eating disorders [165], future research may involve a study sample that has transitioned from classical strength conditioning and weight loss programs to body–mind programs as a remedial measure, to enhance body image and normalize eating habits.

Although the construct of body esteem was not comprehensively covered, the results obtained provide a relatively adequate picture of the perception of Mauritians in regard to body esteem. The aspect of inclusivity, in relation to sexual orientation, a critical component of modern societies, could have a significant impact on body image and the core variables measured in this study. In recent years, studies probing into sexual orientation, body ideals, and disordered eating [161], lesbians’ and bisexuals’ experience of body image [166], sexual orientation and body image disturbance [167], and body dissatisfaction and supplement use among gay men [168], have drawn significant attention towards the impact of sexual orientation on body image concerns. Given that sexual orientation is a subject whereby individuals still struggle to come out of the closet in an island destination such as Mauritius, it would be interesting to probe into this conservative aspect of sexual orientation and body image in the local context. Since the study was carried out in only one region of Mauritius, which is classified as rural, the representativeness of the study could be improved by using a mixed urban and rural stratum, to generalize the findings in the Mauritian population. However, no major differences would be expected, given the dynamicity and relatively low commute time between rural to urban regions, and the presence of infrastructural developments and facilities which are on par with urban regions. Culturally, with Mauritius being multi-plural and heavily influenced by westernized countries, disparities with respect to body image and body ideals across ethnicity and culture are not expected to be significant, similar to reports by Bakhshi [169]. Generic terms, such as body ideal or body image, could

have been differently interpreted by respondents, while aspects of supplement use and an understanding of the actual definition as part of a daily routine, or sporadically, to address certain conditions, could have been misconstrued. Lastly, the timing of data collection, as a critical component of any research study, was standardized for most of the participants as the participants provided their responses prior to their workouts. However, a few participants did complete the survey post workout, which, at present, would not have had a significant impact on the final output.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/psych5010009/s1>, Figure S1: Self-assessment of (i) current body image and (ii) body ideal among Mauritian gym-goers; Table S1: Sample Adequacy and construct validity of adapted EDE-Q instrument.

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