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Eating attitudes among different types of sports in Hong Kong Athletes: A notably high prevalence of disordered eating observed among Wushu athletes

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Abstract

Introduction: Wushu, as a competitive sport, integrates both martial arts techniques and philosophical principles. It demands precision, discipline, and frequently strict weight management, which can impose particular challenges on athletes and increase their susceptibility to unhealthy eating behaviors. However, the current research on the prevalence of disordered eating behaviors (DEBs) among Wushu athletes is still limited.

Objective: To determine the prevalences of body dissatisfaction, distorted body image and DEBs among Hong Kong Chinese athletes across various sports disciplines and also explore the relationships between variables related to body image.

Subjects: 100 Hong Kong Chinese athletes.

Study design: A cross-sectional study.

Results: Our findings reveal that the prevalence of disordered eating among the Hong Kong Chinese athletes was 4.0%, based on EAT-26 scores (EAT-26 ≥ 20), which appears to be comparatively lower than global averages. Notably, Wushu athletes exhibited a 15.3% prevalence of being at risk for disordered eating, with 25% of females and 11% of males. Furthermore, within this group, Wushu athletes recorded the highest mean EAT-26 scores (10.92 ± 12.40; p = 0.046) and showed elevated scores across its subscales in comparison to participants from other sports disciplines. Wushu athletes also demonstrated notably elevated body dissatisfaction (BD) levels, with an average BD score of 1.23 ± 1.24, highlighting their desire to achieve a thinner physique. In comparison to other athletes, Wushu practitioners may face a higher risk of developing DEBs. The findings might highlight the need to introduce suitable educational strategies tailored to their requirements.

Level of Evidence: Level V, Descriptive Study.

1. INTRODUCTION

The global recognition and integration of Wushu as a competitive sport marks a significant milestone in its evolution from its traditional roots to an internationally acknowledged discipline. Originating in ancient China, Wushu embodies a rich cultural heritage that encompasses both martial arts techniques and philosophical principles. Over the years, it has transformed into a modern sporting activity, appealing to diverse audiences worldwide. Although Wushu is not currently included as an official Olympics sport, it is recognized as an official sport in the Asian Games and East Asian Games. Disordered eating among Wushu practitioners is a topic that warrants attention due to its implications on both physical performance and overall well-being. As a sport demanding precision, discipline, and often strict weight management, Wushu athletes may face unique pressures that could make them vulnerable to developing unhealthy eating habits. From restrictive diets aimed at achieving an optimal physique to excessive focus on body weight, the intense demands of Wushu can lead to behaviors that verge on or fully

embody disordered eating. Understanding and addressing these issues is essential for promoting healthier training environments that prioritize long-term athlete well-being. However, the existing research on the prevalence of disordered eating behaviors (DEBs) within the Wushu athletes remains notably limited.

For the reasons mentioned above, the aim of this study was to determine the prevalences of body dissatisfaction, distorted body image and disordered eating behaviors among Hong Kong Chinese athletes across various sports disciplines and also examine the associations between body image-related variables. It was hypothesized that athletes from sports emphasizing lean body mass and shape would report higher levels of DE than those in sports that do not emphasize such body types.

2. METHODS

2.1. Experimental design

A detailed description of the sample and recruitment is included in the prior report [1]. Briefly, the present study was a cross-sectional survey-based study. The inclusion and exclusion criteria for the participants were shown in Table 1.

Table 1
The inclusion and exclusion criteria for the participants

The inclusion criteria for the participants were the following:
(a) providing personal and parental/ guardian consent,
(b) able to complete the questionnaires, and
(c) a full-time or part time athletes under training at the HKSI.
The exclusion criteria for the participants were the following:
(a) not providing personal and parental consent,
(b) unable to provide information (i.e., complete the study's questionnaires), or
(c) having health-related problems or diagnosis (e.g., physical disabilities, diabetes mellitus, gastrointestinal diseases etc).

2.2. Participants

The current study included 100 athletes from 20 Tier A sports supported by HKSI. These sports include: Athletics, Badminton, Billiard Sports, Cycling, Equestrian, Fencing, Gymnastics, Karatedo, Rowing, Rugby Sevens, Sailing, Skating, Squash, Swimming, Table Tennis, Tennis, Tenpin Bowling, Triathlon, Windsurfing, and Wushu.

2.3. Questionnaires

The questionnaire was used to collect data between 22 Feb 2024 and 22 Apr 2024 in the HKSI, and it consisted of the following sections:

2.3.1. Socio-demographic characteristics of participants

It consisted of the demographic characteristics of participants included age, gender, year of birth, education level, type of sports as well as their regular training duration.

2.3.2. Body image, dieting methods and weight control behaviours

It consisted of questions about their diet methods and experiences in weight control. Moreover, subjects were asked to rate their self-perceived body image (BI), using a numerical scale response of 0 = worst to 9 = best. From a body shape measurement scale shown in Fig. 1, participants compared a set of seven drawings showing an increasing body fat percentage, they were asked to indicate which of the seven body figures on each scale best represented their current body figure, and then, with the same scale, asked to indicate their ideal body figure. From the body shape measurement scale, we assessed the next four variables: body percept, desired body image, body dissatisfaction (BD) and distorted body image (DBI).

Body percept

Body percept – the one participant considered to best represent their actual body image. From the body shape measurement scale (Fig. 1), a number from 1–7 represented the body fat percentage categories as shown in Table 2. This classification was used to describe the participants' body percept.

Table 2
Body fat percentages in the body figures in the body shape measurement scale and the assigned number

Body sharp	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Male	8% (6–10%)	12% (> 10% – 13.5%)	15% (> 13.5% – 17.5%)	20% (> 17.5% – 22.5%)	25% (> 22.5% – 27.5%)	30% (> 27.5% – 32.5%)	35% (> 32.5% – 37.5%)
Female	15% (12.5% – 17.5%)	20% (> 17.5% – 22.5%)	25% (> 22.5% – 27.5%)	30% (> 27.5% – 32.5%)	35% (> 32.5% – 37.5%)	40% (> 37.5% – 42.5%)	45% (42.5% – 47.5%)
Assigned number	1	2	3	4	5	6	7

Desired body image

The desired body image – the one the participants considered to best represent the body image they would like to have using the same scale shown in Fig. 1. This classification was used to describe the participants' desired body image.

Body dissatisfaction

To define the presence of body dissatisfaction (BD), the discrepancy between body percept and desired body image was calculated by using the assigned number from the selected figure in the Table 2. The result from the calculated discrepancy was classified in the following categories: <0 (negative value) = BD, wishing to be thicker; 0 = Absent BD (satisfied with their Body Image); >0 (positive value) = BD, wishing to be thinner (Fig. 2).

Distorted body image

Distorted body image (DBI) was assessed by using the body percept and the participant's body fat percentage. Both variables were classified according to the body fat percentage categories, and a number was assigned to each category: 1–7 (Table 2). Then, the difference between the number assigned to the body percept and the one assigned to their body fat percentage was calculated, leading to the following categories: <0 (negative value) = DBI, by underestimation, 0 = Absent DBI, > 0 (positive value) = DBI, by overestimation (Fig. 3).

2.3.3. Eating attitudes test

The third section consisted of questions about eating attitudes. The Eating Attitudes Test (EAT-26) [2], a 26-item measure of disordered eating attitudes and behaviours was employed in the questionnaire. In this study, the modified Chinese version 26 of the EAT-26 [3–4] was used and described in detail by Mak, K. K., & Lai, C. M. (2011) [5].

2.3.4. Anthropometric characteristics of participants

The anthropometric characteristics of participants included height, weight, BF% and percentage of lean body mass were recorded. The participants' standing heights were measured in bare feet to the nearest 0.1 cm with a tape fixed on a vertical wall. Their body weights were measured with light clothes to the nearest 0.1 kg using a bioelectrical impedance analysis (BIA) (InBody 720, Biospace, Korea). Moreover, body fat percentage and percentage of lean body mass were obtained by the BIA.

2.4. Statistical Analysis

Statistical analyses were performed using the Statistical Packages for Social Sciences (SPSS) version 31.0 (SPSS Inc., Chicago, IL, USA). For all analyses, the level of statistical significance was set at 0.05. Continuous variables were presented as means with standard deviation, while categorical variables were presented as frequencies and percentages. Data were analyzed using χ^2 analysis and one-way ANOVA.

3. RESULTS

3.1. Demographical and anthropometric data of all participants

The final analysis included a total of 100 HKSI athletes. The sampled athletes were predominantly male, accounting for 58% of participants, with the majority identified as Hong Kong Chinese residents (99%). Additionally, 62% were college graduates, and the average age of the group was 22.5 years, with a standard deviation of 4.66 years. The athletes participating in each sport type were as follows: Athletics (n = 7), Badminton (n = 1), Billiard Sports (n = 3), Cycling (n = 18), Fencing (n = 5), Gymnastics (n = 2), Karatedo (n = 1), Rowing (n = 4), Rugby Sevens (n = 4), Sailing (n = 2), Skating (n = 2), Squash (n = 13), Swimming (n = 6), Table Tennis (n = 3), Tennis (n = 1), Tenpin Bowling (n = 9), Triathlon (n = 5), Windsurfing (n = 1), and Wushu (n = 13). Consequently, they were divided into five main groups (Wushu n = 13, Squash n = 13, Cycling n = 18, Tenpin bowling n = 9 and Others n = 47) in the study. The comparisons were made between the five groups with results shown in Table 3.

Table 3
Demographic and anthropometric characteristics among different types of sports

Gender	Wushu (n = 13)	Squash (n = 13)	Cycling (n = 18)	Tenpin bowling (n = 9)	Others (n = 47)	p-value	Total (n = 100)
						0.062	
Female	30.7% (4)	46.1% (6)	44.4% (8)	100% (9)	51.0% (24)		42% (42)
Male	69.3% (9)	53.9% (7)	55.6% (10)	0% (0)	49.0% (23)		58% (58)
Age	19.77 ± 2.55	22.85 ± 3.80	22.67 ± 3.05	23.89 ± 5.82	22.81 ± 5.42	0.235	22.49 ± 4.66
Height (cm)	168.45 ± 5.63	169.29 ± 7.31	167.41 ± 7.31	175.39 ± 7.54	170.96 ± 8.43	0.111	170.2 ± 7.86
Weight (kg)	62.73 ± 8.65	63.01 ± 9.21	62.01 ± 8.57	72.27 ± 8.54	64.32 ± 9.59	0.082	62.24 ± 9.37
Body fat (%)	14.17 ± 5.16	15.34 ± 5.84	17.86 ± 4.53	16.12 ± 5.18	15.81 ± 6.23	0.486	15.93 ± 5.68
Lean body mass (kg)	53.99 ± 8.90	53.56 ± 10.11	52.81 ± 9.69	60.43 ± 6.12	54.50 ± 11.12	0.272	53.69 ± 10.21
BF% categories						0.072	
Athletes	61.5% (8)	61.5% (8)	38.8% (7)	0% (0)	68.0% (32)		55.0% (55)
Fitness	30.7% (4)	38.4% (5)	44.4% (8)	33.3% (3)	25.5% (12)		32.0% (32)
Average	7.6% (1)	0% (0)	16.6% (3)	66.7% (6)	12.7% (6)		13.0% (13)
Education						0.000***	
Secondary or below	15.4% (2)	7.7% (1)	72.2% (13)	66.7% (6)	34.1% (16)		38.0% (38)
Post-secondary or above	84.6% (11)	92.3% (12)	27.8% (5)	33.3% (3)	68.9% (31)		62.0% (62)
Mean training hours per	25.31 ± 3.91	22.20 ± 5.07	30.50 ± 9.37	23.22 ± 5.19	24.57 ± 6.29	0.005**	25.30 ± 6.91

Values are presented as mean and standard deviation for continuous or as number and percentage for categorical variables. P-value for independent sample t-test between male and female athletes for continuous and chi-square test for categorical variables. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

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Values are presented as mean and standard deviation for continuous or as number and percentage for categorical variables. P-value for independent sample t-test between male and female athletes for continuous and chi-square test for categorical variables. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

3.2. Dieting methods among athletes

Out of all the participants, 4 individuals, accounting for 4.0%, met the threshold for disordered eating, as indicated by an EAT-26 score of 20 or higher (Table 4) [1]. Among the different sports, Wushu athletes notably exhibited a 15.3% prevalence of being at risk for disordered eating, with 25% of females and 11% of males. Furthermore, within this group, Wushu participants exhibited the highest EAT-26 scores (10.92 ± 12.40) as well as the highest subscale scores across Dieting, Bulimia, and Social Pressure categories. Additionally, 46.1% reported that they had experimented with dieting methods, and 15.3% acknowledged engaging in weight loss behaviors in the past (Table 4). Some of them had resorted to aggressive weight control methods like the use of diet pills. The weight control methods and weight loss behaviours used by different groups were presented in Figs. 4 and 5, respectively.

Table 4
Eating behaviours among different types of sports

EAT-26 total scores (score/78)	**Wushu (n = 13)**	**Squash (n = 13)**	**Cycling (n = 18)**	**Tenpin bowling (n = 9)**	**Others (n = 47)**	**p-value**	**Total (n = 100)**
	10.92 ± 12.40 a	**5.23 ± 5.15 b**	**4.06 ± 4.18 b**	**2.56 ± 3.54 b**	**6.57 ± 6.98 a, b**	**0.046***	**6.15 ± 7.32**
EAT-26 sub-scores							
Dieting	5.62 ± 7.91	2.08 ± 3.84	1.78 ± 2.90	0.44 ± 1.33	2.94 ± 4.29	0.074	2.74 ± 4.62
Bulimia	1.77 ± 3.14	1.08 ± 1.44	0.89 ± 1.53	0.22 ± 0.67	1.36 ± 2.24	0.462	1.19 ± 2.09
Social pressure	2.23 ± 2.17	1.46 ± 2.18	0.67 ± 1.33	1.33 ± 2.96	1.49 ± 2.02	0.348	1.42 ± 2.06
EAT-26 score ≥ 20 (%)						0.199	
Yes	15.3% (2)	0% (0)	0% (0)	0% (0)	4.3% (2)		4.0% (4)
No	84.7% (11)	100% (13)	100% (13)	100% (9)	95.7% (45)		96.0% (96)
Dieting method						0.076	
Yes	46.1% (6)	23.0% (3)	22.2% (4)	11.1% (1)	51.1% (24)		39.0% (39)
No	53.9% (7)	77.0% (10)	77.8% (14)	99.9% (8)	48.9% (23)		61.0% (61)
Weight loss behaviours						0.270	
Yes	15.3% (2)	0% (0)	0% (0)	0% (0)	6.4% (3)		5.0% (5)
No	84.7% (11)	100% (13)	100% (13)	100% (9)	93.6% (44)		95.0% (95)

Values are presented as mean and standard deviation for continuous or as number and percentage for categorical variables. P-value for independent sample t-test between male and female athletes for continuous and chi-square test for categorical variables. * $p < 0.05$.

3.3. Analysis of participants’ characteristics among the body image-related scores

The analysis of self-perceived body image among the participants revealed a mean score of 6.18 ± 1.77 on a nine-point scale. Furthermore, comparative evaluations across the five groups indicated no statistically significant differences in self-perceived body image scores (Table 5).

Table 5
Body Image-related variables among different groups

Self-perceived body image	Wushu (n = 13)	Squash (n = 13)	Cycling (n = 18)	Tenpin bowling (n = 9)	Others (n = 47)	p-value	Total (n = 100)
	6.23 ± 2.09	**6.69 ± 1.32**	**6.17 ± 1.58**	**5.89 ± 2.37**	**6.09 ± 1.77**	**0.835**	**6.18 ± 1.77**
Body dissatisfaction; BD	1.23 ± 1.24	0.62 ± 0.96	0.56 ± 1.10	0.78 ± 1.39	0.89 ± 1.18	0.542	0.83 ± 1.16
Absent (BD = 0)	23.1% (3)	23.1% (3)	16.7% (3)	0% (0)	19.1% (9)		18% (18)
Present (BD > 0, wishing to be thinner)	69.2% (9)	61.5% (8)	66.6% (12)	77.8% (7)	70.2% (33)		69% (69)
Present (BD < 0, wishing to be thicker)	7.7% (1)	15.4% (2)	16.7% (3)	22.2% (2)	10.6% (5)		13% (13)
Distorted body image; DBI	0.69 ± 1.11	0.69 ± 0.86	0.06 ± 0.87	0.22 ± 0.83	0.72 ± 1.04	0.117	0.55 ± 1.00
Absent (DBI = 0)	46.2% (6)	30.8% (4)	44.4% (8)	33.3% (3)	34.0% (16)		37% (37)
Present (DBI > 0, by overestimation)	46.2% (6)	61.5% (8)	27.8% (5)	44.4% (4)	55.3% (26)		49% (49)
Present (DBI < 0, by underestimation)	7.7% (1)	7.7% (1)	27.8% (5)	22.2% (2)	10.6% (5)		14% (14)

Analysis of participants' characteristics among the body dissatisfaction Values are presented as mean and standard deviation for continuous or as number and percentage for categorical variables. P-value for one-way ANOVA analysis and Duncan test as post-hoc among the body dissatisfaction for continuous and chi-square test for categorical variables. * $p < 0.05$.

Regarding the body dissatisfaction (BD), approximately 70% of athletes wanted to be thinner, 18% were satisfied with their body shape, and only 13% of the athletes wanted to be larger (Table 5). Athletes that desired to be larger were considerably less likely to use dieting methods ($p < 0.05$). In the case of body image, it can be found that athletes satisfied with current body image (BD = 0) had significantly higher self-perceived body image ($p < 0.05$) (Supplement 1). Across different sport types, no statistically significant variations were observed in body dissatisfaction (BD) among the five groups. Nonetheless,

Wushu athletes exhibited a mean BD value exceeding 1 (BD = 1.23 ± 1.24), suggesting a notable inclination among these individuals to desire a thinner physique compared to their perceived body image by a margin of more than one figure on the body shape measurement scale, equating to approximately 5% less body fat.

Regarding the distorted body image (DBI), approximately 50% of athletes overestimated their body fat, 37% of athletes correctly estimated their body size and only 14% underestimated their body fat (Table 5). Athletes that desired to be thinner were considerably more likely to overestimate their body size, while athletes those desired to be thicker were considerably more likely to underestimate their body size ($p < 0.001$) (Supplement 2). Across different sport types, no statistically significant variations were observed in DBI among the five groups.

4. DISCUSSION

4.1. Overall prevalence rate of DE among HK athletes

The findings of this study indicate that the prevalence of disordered eating (DE) among Hong Kong Chinese athletes stands at 4.0%, with rates of 1.7% observed in male athletes and 7.1% in female athletes. These figures are much lower compared to the prevalence rates reported in previous meta-analyses, which estimate DE among male at 16.8–17% and among female at 24.1–30% [6, 7]. The noticeable difference between their research findings and ours could stem from cultural variations, as their participants predominantly came from Western and Western Asian regions. A detailed explanation was outlined in the previous study [1].

4.2. The characteristics of body-related variables among Wushu athletes

Wushu athletes demonstrated the highest scores on the EAT-26 test (10.92 ± 12.40; $p = 0.046$), as well as elevated scores across its subscales, including Dieting, Bulimia, and Social Pressure, when compared to athletes from other sports disciplines. Among Wushu athletes, 15.3% (25% of female and 11% of male) were identified as being at risk of DE based on EAT-26 scores (EAT-26 ≥ 20), which was quite similar to the findings of meta-analysis studies done by Alfalahi, M., et al. (2022) [6] and López-Gil, J. F., et al. (2023) [7]. Moreover, Wushu athletes demonstrated notably positive values of body dissatisfaction, with BD = 1.23 ± 1.24, reflecting a strong desire to achieve a slimmer physique, including a reduction of approximately 5% in body fat. Numerous studies have indicated that athletes involved in aesthetic and weight-regulated sports face increased risks of DE [8, 9], yet limited evidence exists to suggest such risks in martial arts sports. Indeed, like aesthetic sports, the winner of wushu is determined by judging an individual or team performance using a complex set of rules. Appearance is a critical element in judging among Wushu athletes. Like aesthetic sports such as ballet, dance, diving, figure skating, and gymnastics [10], Wushu may also be considered as "lean sports" due to their belief that lower body weight leads to more favorable assessments [11]. In alignment with this trend, Wushu athletes in our

study showed the lowest body fat percentages and the highest prevalence of weight-control behaviors compared to other groups. This tendency may reflect the pressure placed on body shape among Wushu athletes. Interestingly, despite their inclination toward a leaner physique and minimal body fat, Wushu athletes did not exhibit significant differences in self-perceived body image (BI) and distorted body image scores relative to other groups. This finding suggests their aspirations for slimness might be tied primarily to external performance standards rather than internalized body image distortions. Additionally, Wushu athletes typically begin sport-specific training at a very young age, often around 9 or 10 years old. Prior research indicates that the younger athletes commence training for a particular sport, the higher their risk of developing eating disorders (EDs) [12, 13]. Indeed, many Australian sporting organizations, including the Australian Institute of Sport (AIS) and the Australian Football League (AFL), discourage the practice of tracking body fat percentages in junior athletes. They raise concerns about potential risks including disordered eating, mental health challenges, and unrealistic expectations regarding body composition. Instead, these organizations emphasize prioritizing overall health and wellbeing, encouraging a focus on performance and development rather than strict body fat objectives.

4.3. Strengths and limitations

The primary strengths of this study lie in its distinction as the first investigation conducted in Hong Kong to examine the prevalence of disordered eating among local Chinese athletes. Additionally, the study captured data from approximately 10% of the target population within the HKSI. Despite these notable strengths, several limitations should be acknowledged.

Firstly, the study design did not incorporate control groups, such as non-athletes, and relied solely on comparisons with findings from previous research, which limits the robustness of contextual insights. Secondly, the body shape measurement scale used in this research was insufficiently tailored for assessing body fat percentage distribution among athletes. The tool employed lacked standardization and validation for detecting distorted body image perceptions among this specific population. Furthermore, the scale was not designed to accommodate individuals at the extreme ends of the body shape spectrum, rendering it less suitable for very lean athletes. An additional methodological concern involves the sequencing of figures on the measurement scale; presenting the smallest figure at the outset may have triggered an anchoring effect, thereby biasing participants' responses. Implementing random ordering of figures within the scale could enhance its reliability and utility by minimizing such cognitive biases.

5. CONCLUSION

The study highlighted the notably high prevalence of disordered eating among Hong Kong Wushu athletes, when compared to athletes from other sports disciplines. This suggests that Wushu athletes may be more susceptible to disordered eating behaviors compared to other sport types. To address this concern, suitable educational interventions should be implemented to emphasize the importance and practicalities of nurturing both a healthy body and mind among them.

Declarations

Authorship: Leo C.M. Cheung: Conceptualization, Methodology, Software, Validation, Investigation, Data Curation, Writing - Original Draft.

James W.H. Sze, Frankie P.L. Siu, Sophia L.Y. Li, Gabriel T.K. Pun, Jade T.Y. Lau: Investigation, Reviewing and Editing.

John O'Reilly, Margaret J. Kuo: Supervision.

Clinical trial number: Not applicable.

Consent to Publish declaration: not applicable.

Ethics Approval: Statements confirming that the Hong Kong Sports Institute and the Research Ethics committee of HKU SPACE approved the study.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Conflict of interest: The authors declare no conflicts of interest.

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Figures

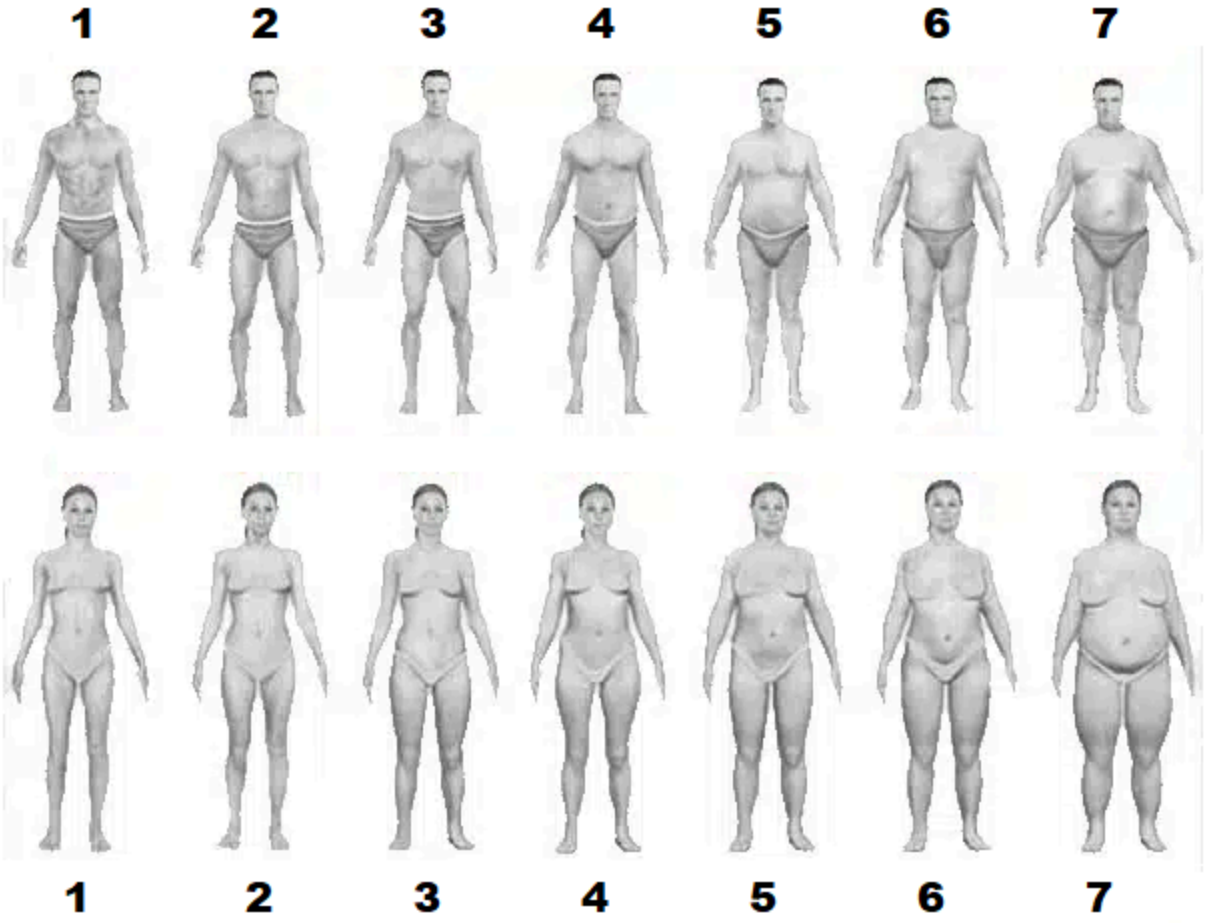


Figure 1

Body shape measurement scale

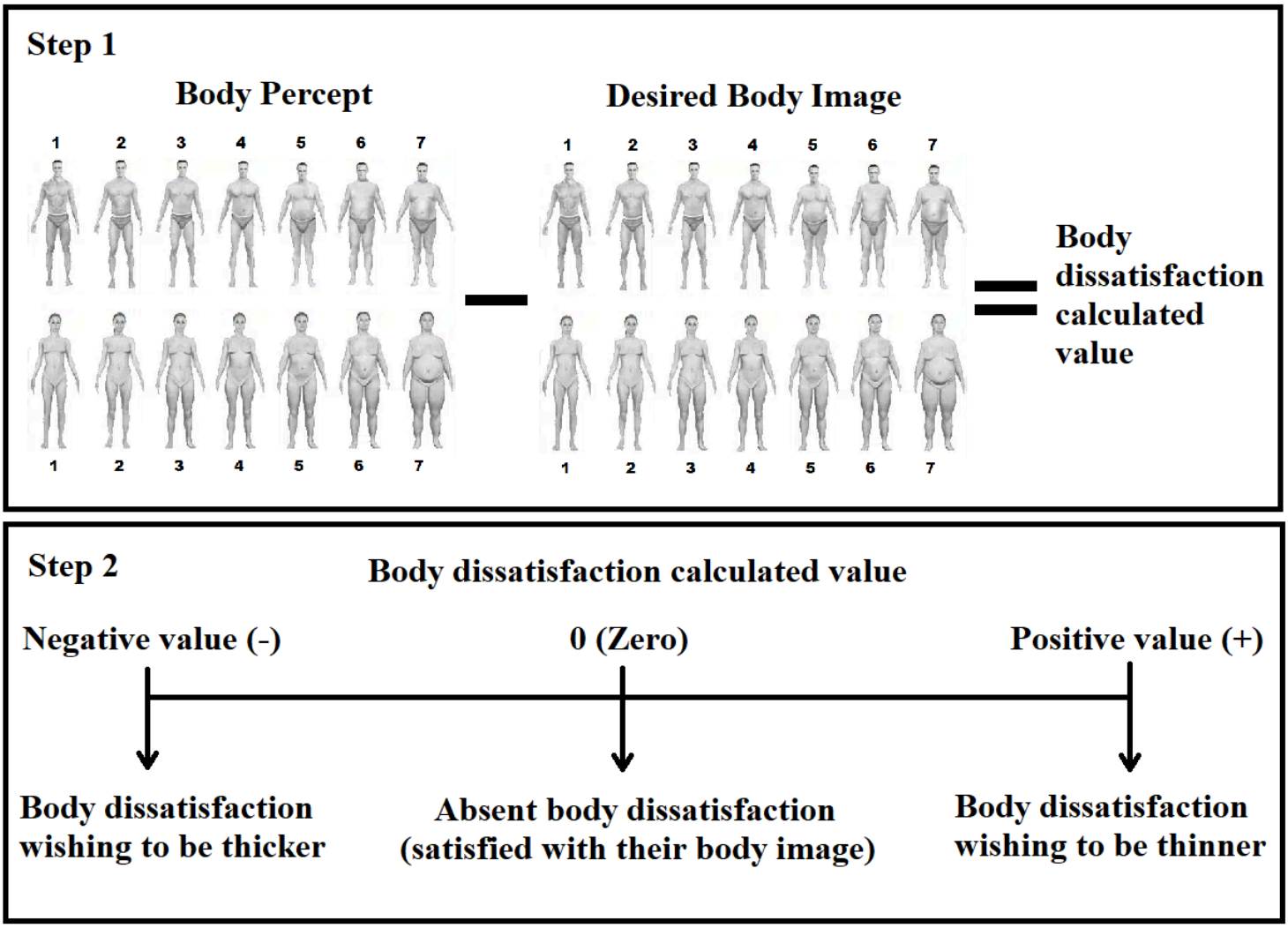


Figure 2

Body dissatisfaction assessment

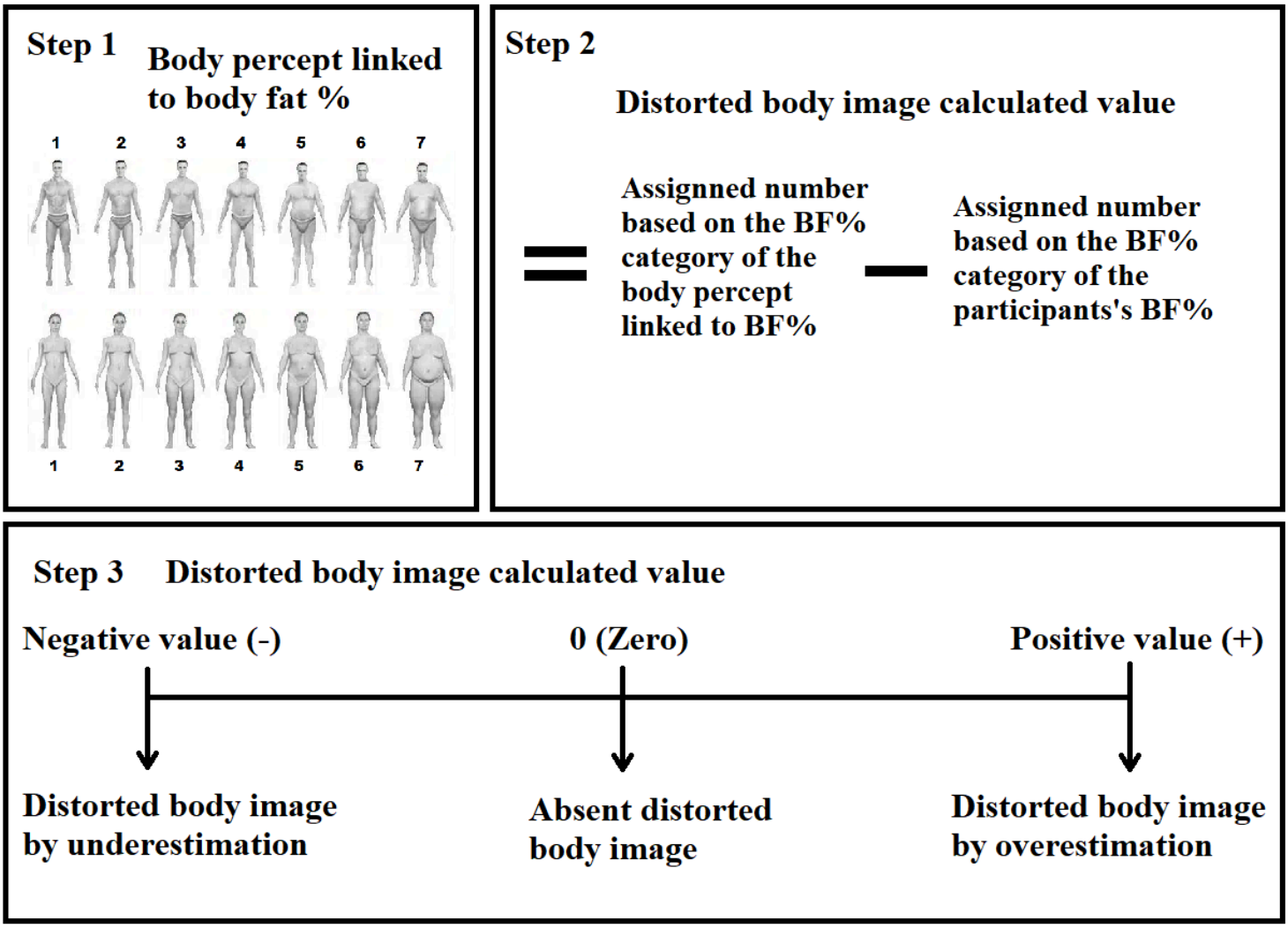


Figure 3

Distorted body image assessment

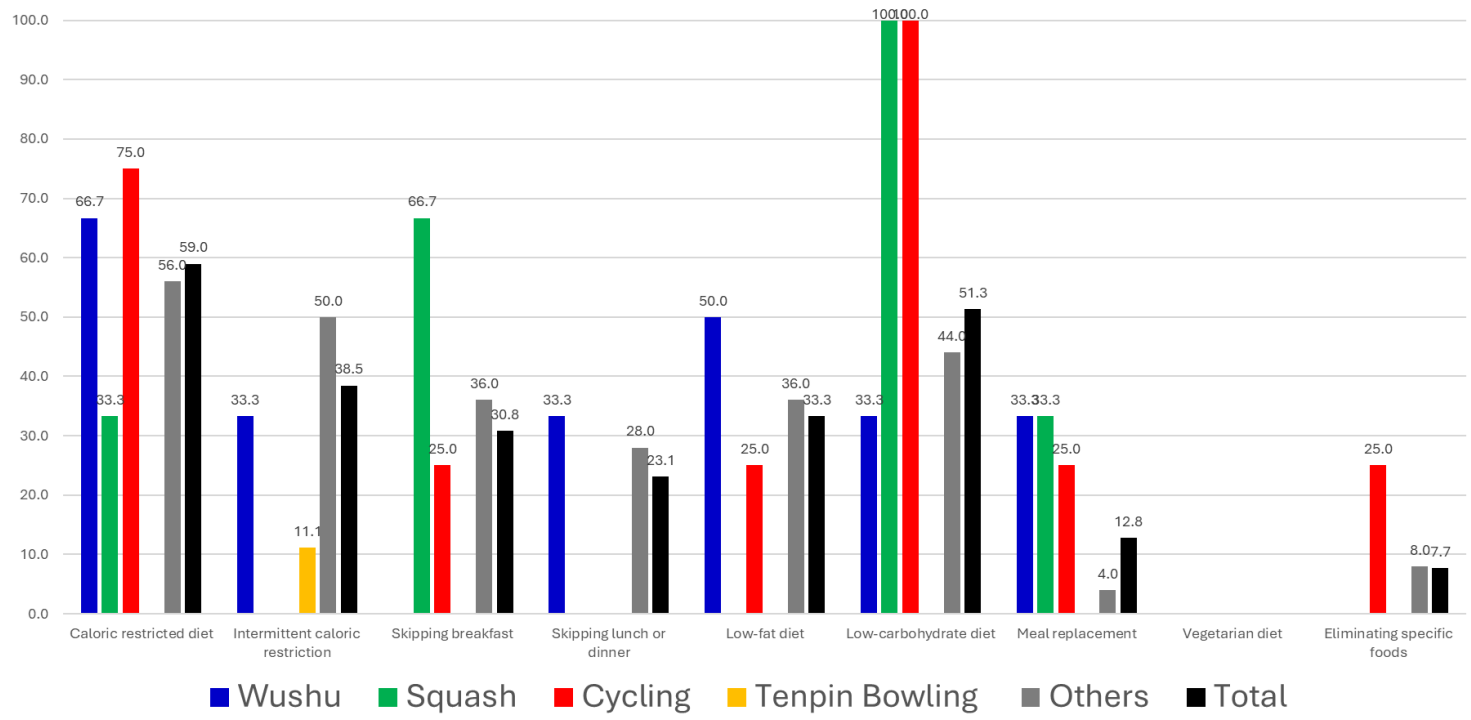


Figure 4

Weight control methods used by different types of sports

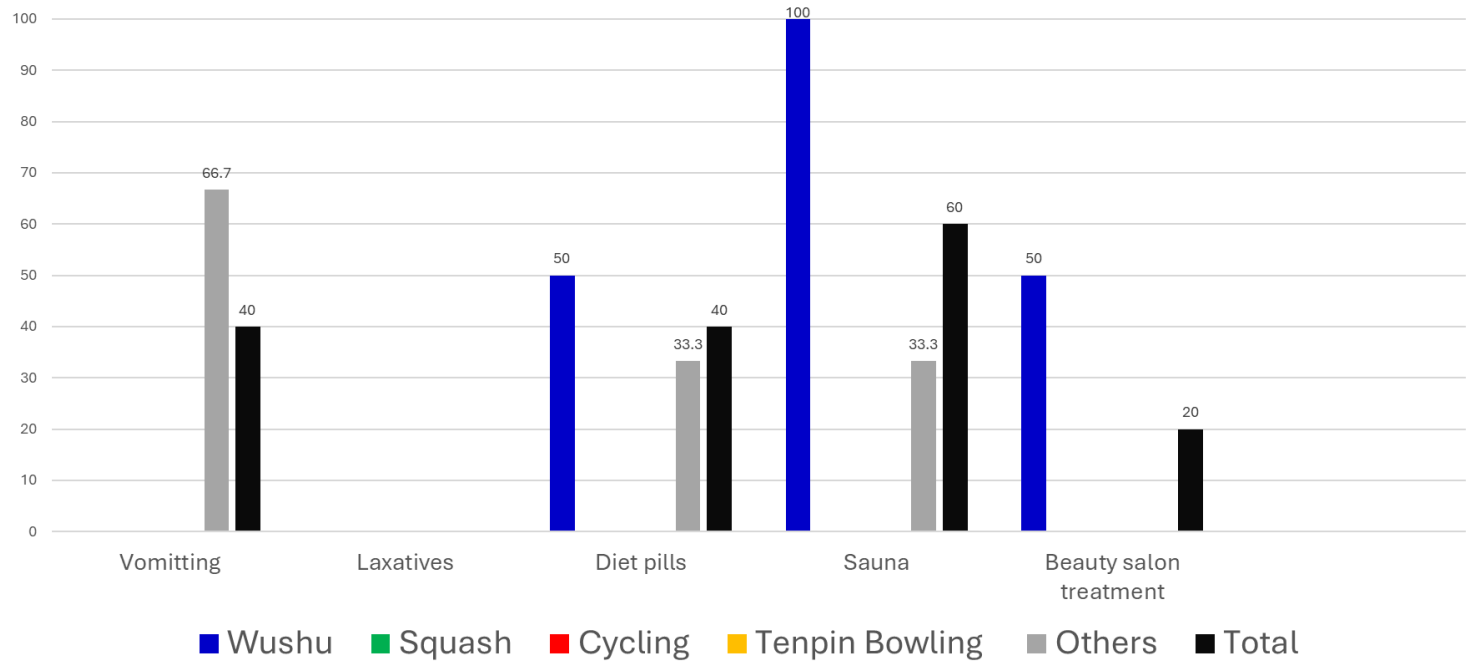


Figure 5

Weight loss behaviours used by different types of sports

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- Supplement12.docx