

# BMI Changes among Marching Artists

## A Longitudinal Study

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In a series of longitudinal analyses, we examined body mass index (BMI) of drum and bugle corps performers at the beginning (Time 1) and end (Time 2) of a competitive season and again at a 1-year follow-up (Time 3). Utilizing an archival database, BMI data were recorded for 501 marching arts performers, representing four World-Class drum and bugle corps. Significant reductions in BMI were found between Time 1 and Time 2 for performers in all sections (i.e., brass, percussion, and color guard). Archival data from 92 performers, representing three World-Class drum and bugle units, revealed BMI significantly increased from Time 2 to Time 3. In an effort to identify possible personal influences on the changes in BMI found between Times 2 and 3, 50 performers from one drum and bugle corps provided archival data on a measure of performers' athletic identity (i.e., the strength and exclusivity of one's identification with the athlete role) along with BMI. Correlational analyses revealed that performers' athletic identity negatively related to BMI change from Time 1 and Time 3 and Times 2 and 3 (i.e., stronger athletic identity, lower BMI change). Practical implications are discussed. *Med Probl Perform Art* 2013; 28(4):236–241.

According to the most recent epidemiological data collected by the United States Center for Disease Control and Prevention, 35.7% of US adults and 18.4% of US adolescents (aged 12–19) are classified as obese (BMI $\geq$ 30).<sup>1</sup> Obesity among young adults in the US has been and continues to be a serious medical problem. Previous research suggests that most college students are not meeting dietary and physical activity guidelines, which contributes greatly to this problem.<sup>2,3</sup> Several initiatives have been forwarded (e.g., Let's Move! launched by First Lady Michelle Obama; the National Football League's Play 60 Challenge, etc.) to help combat obesity in young people. One factor that has been linked to young adults' participation in physical activity is the importance they place on sport and exercise or how strongly they identify themselves as athletes.<sup>4</sup> For

young adults who may not typically identify themselves as athletic, increasing engagement in regular exercise becomes more challenging. To help meet this challenge, it appears imperative to encourage participation in physical activities that are congruent with the interests of the individual.

One subgroup of young adults not commonly associated with being athletic or possessing a strong athletic identity is performing artists. For example, Brandfonbrener noted, "for many musicians exercise is not a priority."<sup>5(p34)</sup> Compared with students from other college majors, students majoring in music tend to have a stronger personal identity with their major.<sup>6</sup> As such, music majors spend considerable time outside their courses with rehearsals and other major-related commitments that often make it difficult to find time to exercise.<sup>5</sup> While several researchers<sup>7–9</sup> have found playing musical instruments is physically taxing and increases risks for numerous musculoskeletal and other physical injuries, many rehearsal activities require sitting for long periods of time and other sedentary experiences that diminish performers' overall health and fitness. As such, establishing an exercise and conditioning program has been recommended for all musicians to promote general well-being as well as help prevent performance-related injuries<sup>5</sup> and facilitate performance success.<sup>10</sup>

While many musical activities are perceived to be limited in terms of physicality (i.e., playing in an orchestra or concert band), others such as participation in the marching arts (i.e., marching band, drum and bugle corps, indoor marching percussion ensembles and color guards, etc.) are physically active. Each year, hundreds of thousands of adolescents and young adults participate in marching arts activities in the US, and this activity is growing in popularity around the world. There have been several studies that have investigated the physical energy expended by performers in marching bands, with mixed results with regard to the extent to which participating in the marching arts constitutes adequate physical activity to promote health and well-being.

One such study investigated the expended energy cost of adolescents involved in marching band by comparing the relative oxygen intake at rest to five 3-minute stages of treadmill marching with their instruments, without their instruments, and while playing their instruments.<sup>11</sup> Results indicated participation in marching band met the criteria for moderate activity in adolescents and markedly contributed to overall physical activity.<sup>11</sup> In a 2-year case study of a female high school color guard performer (i.e., flag bearer and/or dancer), Gidding and Falkner<sup>12</sup> found partic-

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ipation in marching band (along with monitoring caloric intake to maintain body weight and a healthier diet) resulted in a decrease in BMI from 31 to 27 kg/m<sup>2</sup>, increased muscularity in the upper extremities and torso, and a decrease in blood pressure and cardiovascular risk status.

According to the *Compendium of Physical Activities*,<sup>13</sup> marching band is considered a physical activity of moderate intensity. However, Strand and Sommer<sup>14</sup> found marching band performers who carried heavier (i.e., ≥5 lbs) instruments obtained moderately intense physical activity for 9.5 minutes daily; and those carrying lighter instruments (i.e., <5 lbs.) obtained moderately intense physical activity for 8.3 minutes daily. Thus, they concluded that marching band did not meet recommendations set forth by the President's Council on Physical Fitness and Sports of 30 minutes of daily moderate intensity physical activity.

Previous research studies of marching artists have focused primarily on adolescents and young adults participating in marching bands who rehearsed approximately 6 hrs a week or less,<sup>14</sup> but there is very little research concerning marching arts activities that demand considerably more practice time.<sup>15</sup> In the context of the marching arts, arguably no activity demands more physicality than in the competitive units that comprise Drum Corps International (DCI), the sanctioning body for the world's top junior drum and bugle corps (hereafter referred to as drum corps). Drum corps are competitive units of adolescent and young adult marching musicians consisting of instrumentalists (brass players and percussionists) and color guard performers (dancers who interpret the music through movement and manipulation of various apparatuses—flags, rifles, etc.) who perform difficult and physically demanding marching performances for field competitions, parades, and festivals.<sup>16</sup> Participating units work to perfect a 10- to 12-minute visual/music program that is the subject of approximately 25 to 40 competitions during a national summer tour. Performers begin daily rehearsals in May, typically rehearsing up to 12 hrs/day. An 8-week national tour begins in mid-June and ends in mid-August. While on tour, rehearsals typically occur in 4-hr blocks. On days with a competition, units typically rehearse for 4 to 8 hrs (one or two rehearsal blocks), and on days without a competition, units will usually complete two to three rehearsal blocks. Rehearsal times often vary depending on travel demands (i.e., travel time from rehearsal site to performance venue, and from performance venue to next destination city). The musical programs performed are complex and demanding, typically requiring performers to play music while executing intricate marching maneuvers and choreography at speeds that can exceed 200 beats/min.

## CURRENT INVESTIGATIONS

In a series of longitudinal analyses, we sought to begin examining BMI of drum corps performers at the beginning, end, and between competitive seasons, as well as drum corps performers athletic identity (i.e., the degree to

which these performers self-identified as “athletes” and the importance of athletic participation in their lives) and the degree to which athletic identity is related to reductions and maintenance of BMI.

First, we examined BMI of performers representing four DCI world-class units at the beginning (Time 1) and end (Time 2) of a competitive season. We also investigated possible differences in degree of reduction in BMI by performing section (i.e., brass, percussion, and color guard) and instrument type (i.e., trumpet, mellophone, baritone/euphonium, tuba, marching snare drum, marching bass drum, marching multi-tenor drum, stationary front percussion ensemble) and color guard (e.g., auxiliary equipment spinners/tossers and dancers). Specifically, we addressed the following research questions (RQ):

*RQ 1.1: What are the BMI WHO classifications (i.e., underweight to obese) for performers participating in DCI-sanctioned world-class junior drum corps at the beginning and end of the competitive season? The nature of this question was exploratory. As no prior research has examined BMI of marching arts performers, no specific hypotheses were forwarded.*

*RQ 1.2: Are there changes in BMI for world-class drum corps performers from Time 1 to Time 2?*

*Hypothesis 1.2.1: Significant reduction in BMI will be found between Time 1 and Time 2.*

Drum corps is a physical activity that requires several hours of intense daily rehearsal, and thus, we reasoned performers would significantly decrease their BMI from the beginning to the end of a competitive season.

*RQ 1.3: Are there significant differences in BMI from Time 1 to Time 2 for all sections and instruments?*

*Hypothesis 1.3.1: Significant reduction in BMI will be found between Time 1 and Time 2 for each section.*

*Hypothesis 1.3.2: Significant reduction in BMI will be found between Time 1 and Time 2 for each instrument type.*

Past research has suggested that for high school marching bands, only specific sections may receive enough physical benefit from participation to meet standard health requirements for daily physical activity.<sup>14</sup> In contradiction to this past finding, we reasoned the increased intensity of physical activity required for drum corps performers would result in a significant reduction in BMI for performers in all sections and playing all instrument types.

Next, we sought to examine maintenance of BMI from one competitive season to the next. Specifically, we addressed the following research questions:

*RQ 2: Are there changes in BMI for world-class drum corps performers across three time periods: prior to the 2011 competitive season (Time 1), end of the 2011 competitive season (Time 2), and prior to the 2012 competitive season (Time 3)?*

*Hypothesis 2.1: Significant increase in BMI will be found between Time 2 and Time 3.*

**TABLE 1.** Median BMI at Time 1 and Time 2 by Section and Instrument Type

Section/Instrument	No.	BMI		$\chi^2$
		Time 1	Time 2	
Brass	264	23.86	22.97	121.81‡
Trumpet	81	23.44	22.14	42.05‡
Mellophone	54	22.29	22.18	11.79†
Baritone	55	24.36	23.60	19.80‡
Euphonium	28	24.45	23.13	20.57‡
Tuba	46	25.67	24.35	29.46‡
Percussion	112	23.43	22.34	45.34‡
Snare	31	22.29	21.71	23.52‡
Bass	18	24.25	22.07	14.22‡
Multi-tenor	21	23.48	22.15	5.76*
Front ensemble (pit)	42	23.59	23.05	7.81†
Color guard	114	23.92	22.35	52.47‡

Total no. = 490 (section and instruments data were not available for 11 participants).

\* $p < 0.02$ ; † $p < 0.005$ ; ‡ $p < 0.001$ .

*Hypothesis 2.2: No significant difference will be found between Time 1 and Time 3*

As the physical demands of a season remit, it was reasoned that performers' BMI would increase between Time 2 and Time 3. Similar to the rationale for Hypothesis 2.1, we reasoned that as performers acclimated to their normal physical routines following a competitive season, their returning BMI at the start of the next season would be comparable to that of their BMI from the beginning of the previous season.

Finally, we sought to begin to address the influences for our findings from analyses of the first two research questions. Specifically, we were interested in examining drum corps performers' athletic identity. Drum corps performers are comprised mostly of music and performing arts college majors.<sup>16</sup> While drum corps is a highly physically demanding activity, we were unsure as to the degree to which drum corps participants endorsed an athletic identity. We also wished to explore the possible relation between performers' athletic identity and maintenance of BMI across time. Specifically we addressed the following research questions:

*RQ 3.1: What is the degree of athletic identity endorsed by drum corps performers?*

*Hypothesis 3.1.1: Mean scores on athletic identity would be more similar to non-athlete norms than athlete norms.*

*RQ 3.2: Is there a relationship between performers' athletic identity and BMI changes across time?*

*Hypothesis 3.2.1: Athletic identity will be negatively related to BMI changes between Time 1 and Time 2.*

*Hypothesis 3.2.2: Athletic identity will be negatively related to BMI changes between Time 1 and Time 3.*

*Hypothesis 3.2.3: Athletic identity will be negatively related to BMI changes between Time 2 and Time 3.*

We reasoned that performers rating higher on a measure of athletic identity would have smaller changes in BMI from the beginning to the end of a competitive season (i.e., they would be more likely to be physically fit at the beginning, thus their BMI would not change as much as performers' less physically fit at the beginning of the season). Similarly, it was reasoned that performers higher on athletic identity would be more likely to maintain BMI from one season to the next and thus have smaller changes in BMI.

### Study Context and Data Source

Data were gathered from a data archive maintained by the Drum Corps Medical Project (DCMP). Four DCI world-class drum corps supplied data to this archive, and medical professionals associated with the individual units collected all data. Not all units, nor participants in all units, completed every measure used in this series of analyses. The authors were limited to the data available in the data archive. As an archival research project, this study was reviewed and approved by the lead investigator's Institutional Review Board for Human Subjects.

## METHODS

### Participants

Archival data from 501 drum and bugle corps performers, representing four DCI world-class units, were used for this study. Table 1 details the performers' section and instrument demographics. The mean age of participants was 19.8 yrs (range 18–21), which is similar to the mean age of 19.4 yrs for all DCI world-class drum corps.<sup>15</sup> No significant differences in BMI or age were found among participating units. Of the four drum corps, two units consisted of all male members, resulting in 387 males and 103 females who participated in this study (gender data were not available for 11 participants). The inclusion of two all-male drum corps resulted in a greater proportion of males—79% males for participants in this study—compared to the DCI average of 60% males.<sup>16</sup> No racial or ethnic data were available.

Data from 501 performers, representing four DCI units, were utilized to assess RQs 1.1 and 1.2. Due to attrition and addition of new members from the 2011 and 2012 competitive seasons, BMI data from 92 participants were available to assess RQ 2. Finally, one competitive unit collected data on athletic identity of members in addition to BMI at the three time periods. With attrition and addition of new performers from 2011 and 2012, BMI and athletic identity data were available for 50 performers to assess RQs 3.1 and 3.2.

### Procedure

All data were originally collected as part of performance enhancement programs within each corps and maintained in a secure data archive. All potential participants agreed to

allow their non-identifying information to be archived for future research, and the organization responsible for maintaining the archive granted permission to the authors to access the data. BMI and other instrumentation data (described below) were recorded by medical personnel from the participating units and added to a data archive maintained by the DCOMP for performers at the beginning of the competitive season (May 2011) and again 10 weeks later at the end of the competitive season (August 2011) and finally at the beginning of the next competitive season (May 2012). A longitudinal design was employed by this study, and all quantitative data were analyzed using IBM SPSS, version 20 statistical software (IBM SPSS, Armonk, NY).

### Measures and Instrumentation

**BMI (RQs 1, 2, and 3):** Heights and weights of performers were recorded by medical personnel from the participating units and added to a data archive maintained by the DCOMP. BMI was calculated in metric as weight in kilograms divided by height in meters squared (i.e.,  $BMI = kg/m^2$ ).

**BMI Change (RQ 3):** Three BMI change variables were created to express BMI changes between the pairwise comparisons. BMI change 1 expresses the difference in BMI from Time 1 to Time 2 (i.e., Time 2 BMI – Time 1 BMI); BMI change 2 expresses the difference in BMI from Time 1 to Time 3 (i.e., Time 3 BMI – Time 1 BMI); and BMI change 3 expresses the difference between BMI at Time 2 to Time 3 (i.e., Time 3 BMI – Time 2 BMI).

**Athletic Identity (RQ 3):** The Athletic Identity Measurement Scale (AIMS)<sup>17</sup> is a seven-item, self-report instrument that uses a 7-point Likert-type scale with possible responses ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The AIMS is designed to measure the strength and exclusivity of one's identification with the athlete role. Items (e.g., "I consider myself an athlete" or "Sport is an important part of my life") rate the extent to which respondents agree with statements assessing cognitive, affective, and behavioral aspects of athletic identity. Higher AIMS scores denote a stronger and more exclusive identification with the athletic role. Cronbach's alpha coefficient was 0.76 for the current sample, consistent with internal consistency estimates for the AIMS in previous studies.<sup>18</sup>

### Data Analyses

The BMI data at each time interval slightly violated the assumption of normality of distribution needed for parametric analyses (e.g., ANOVA), and thus nonparametric statistical analyses (e.g., Friedman test and Wilcoxon signed ranks test) were used. AIMS scores and BMI maintenance variables were normally distributed; thus bivariate correlations between AIMS scores and the three BMI change variables were analyzed using Pearson product-moment correlation coefficients (Pearson's  $r$ ).

**TABLE 2.** World Health Organization (WHO) BMI Classification Rates by Time

WHO BMI Classification	Time	No.	%
Underweight (<18.5)	Time 1	8	2
	Time 2	11	2
Normal (18.5–24.99)	Time 1	307	61
	Time 2	375	75
Overweight (25–29.99)	Time 1	136	27
	Time 2	98	20
Obese ( $\geq 30$ )	Time 1	50	10
	Time 2	17	3

Total no. = 501.

## RESULTS

**RQ 1.1:** *What are the BMI classification rates for performers participating in DCI world-class, junior drum corps at the beginning and end of the competitive season?*

The percentages of participants' WHO BMI classifications at Time 1 and Time 2 are presented in Table 2.

**RQ 1.2 and 1.3:** *Are there changes in BMI for world-class drum corps performers from Time 1 to Time 2?*

A Friedman test was used as a nonparametric alternative to a one-way ANOVA with repeated measures. There was a statistically significant difference (i.e., reduction) in the total samples' BMI from Time 1 to Time 2:  $\chi^2(1) = 223.14, p < 0.001$ . Similarly, significant reductions from Time 1 to Time 2 in BMIs were found for all sections and instrument types (see Table 1).

**RQ 2:** *Are there changes in BMI for world-class drum corps performers across three time periods: prior to 2011 competitive season (Time 1), end of 2011 competitive season (Time 2), and prior to 2012 competitive season (Time 3)?*

Again, a Friedman test was used as a nonparametric alternative to a one-way ANOVA with repeated measures. There was a statistically significant difference in BMI depending on time of measurement (BMI at Time 1, Time 2, and Time 3):  $\chi^2(2) = 53.53, p < 0.001$ . Post-hoc analysis with Wilcoxon signed-rank tests were conducted with a Bonferroni correction applied, resulting in a significance level set at  $p < 0.017$ . Median (interquartile range) BMI for Time 1, Time 2, and Time 3 were 23.48 (21.46 to 25.51), 22.60 (20.63 to 24.21), and 23.70 (21.65 to 26.00), respectively. Significant reductions in BMI were found between Time 1 and Time 2 ( $Z = -5.77, p < 0.0001$ ); and significant increases in BMI were found between Time 2 and Time 3 ( $Z = 6.11, p < 0.0001$ ). There was not a significant difference between Time 1 and Time 3 ( $Z = 2.23, p = 0.026$ ).

**RQ 3.1:** *What is the degree of athletic identity endorsed by drum corps performers?*

**TABLE 3.** Summary of Intercorrelations, Means, and Standard Deviations for Scores on the AIMS and the Three Measures of BMI Change (in kg/m<sup>2</sup>)

Measure	1	2	3	4	Mean	SD
1. AIMS	—				22.34	7.33
2. BMI Change 1	0.06	—			-1.04	1.74
3. BMI Change 2	-0.30*	0.48†	—		-0.14	2.43
4. BMI Change 3	-0.38†	-0.26	-0.72†	—	0.90	2.21

Total no. = 50. \*  $p < .05$ ; † $p < .001$ .

Note: Possible range for the AIMS is 7-49 with higher score more indicative of stronger athletic identity. Three BMI change variables were created to express BMI changes between the pairwise comparisons. BMI Change 1 expresses the difference in BMI from Time 1 to Time 2 (i.e., Time 2 BMI – Time 1 BMI); BMI Change 2 expresses the difference in BMI from Time 1 to Time 3 (i.e., Time 3 BMI – Time 1 BMI); and BMI Change 3 expresses the difference between Time 2 to Time 3 (i.e., Time 3 BMI – Time 2 BMI). The range for BMI Change 1 was -5.92 to 2.23 kg/m<sup>2</sup>; range for BMI Change 2 was -12.18 to 4.69 kg/m<sup>2</sup>; and range for BMI Change 3 was -7.14 to 7.24 kg/m<sup>2</sup>.

Descriptive statistics for the AIMS and the three measures of BMI change are presented in Table 3 along with the results of the correlational analyses. Based on the norms of the AIMS, the mean score of 22.34 is in the 30th percentile of a male, non-athlete norm (and between the 50th and 55th percentiles of the female, non-athlete norm) and is less than the 5th percentile of the male (and female) athlete norm.

**RQ 3.2:** *Is there a relationship between performers' athletic identity and BMI changes across time?*

No significant relationship between AIMS and BMI Change 1 was found, suggesting that one's athletic identity did not significantly contribute to BMI changes during the season (i.e., performers, regardless of athletic identity, had reductions in BMI from the beginning to the end of the competitive season). However, AIMS scores were significantly, and negatively, related to BMI Changes 2 and 3, suggesting those with a stronger athletic identity are less likely to have BMI rebound following the competitive season.

## DISCUSSION

The first aim of this study was to examine WHO classifications and possible changes in young adult performing artists' BMI as a result of participating in an intense marching music activity. Relative to available epidemiological data of adolescent and young adult US males, participants in our sample had a considerably smaller rate of obesity (10% while not in their competitive season) and were, on average, in the "normal" range of BMI (based on WHO classifications). However, while not actively participating in drum corps, 37% of performers were classified as "overweight" or "obese" compared with 23% being classified as "overweight" or "obese" at the end of the competitive season. We found significant reductions in BMI between the beginning and end of a competitive season, and a significant rebound of BMI to that of approximately the Time 1 BMI by the beginning the next competitive season (Time 3).

Unlike previous researchers<sup>14</sup> who have speculated that participation in marching arts does not meet the recommen-

dations for daily exercise, our results suggest participating in a DCI world-class drum corps more than meets the recommendations set forth by the President's Council on Physical Fitness and Sports. The BMI reduction found as a result of drum corps participation occurred whether or not performers identified themselves as athletes. Encouraging participation in the more traditional sports and exercise regimens has not provided the necessary answer to the obesity epidemic among adolescents and young adults. The marching arts are not often thought of as an athletic activity. This study demonstrates that participation in drum corps clearly qualifies as an athletic activity and provides another option for physical fitness in adolescents and young adults who may not otherwise identify themselves as athletes.

While many youth may not have the opportunity to participate in a world class DCI marching ensemble, they typically do have the opportunity to participate in marching band and other marching arts activities at their own local high school, college, and community. Thus, the marching arts can be viewed as another way to "get kids moving" in Mrs. Obama's terms. Future research should explore the health impact of increased participation in marching arts and other non-traditional physical activities at the scholastic and collegiate levels.

Unfortunately, the maintenance of these BMI reductions is difficult after the competitive season concludes. The most obvious reason for this rebound effect is that performers are no longer required to engage in intense physical activity for 8 to 12 hrs/day. This finding is consistent with previous investigations showing that even among people who start physical activity programs, adherence is often quite low.<sup>19</sup> Our findings suggest that the performers' degree of athletic identity greatly influences BMI changes. Another way to interpret these results is that performers' intrinsic motivation to exercise predicts engagement in physical activities, even when not required to do so. Intrinsic motivation (i.e., doing something because it is personally enjoyable) is a better predictor of long-term positive behavior change than extrinsic motivation (i.e., doing something in order to get a reward).<sup>20</sup>

Thus, in order to facilitate the maintenance of BMI reductions for these performers after completing their drum corps participation, finding ways to promote intrinsic motivation for exercise appears necessary. Motives focused on enjoyment, competence, and social interactions have been found to be significant predictors of exercise adherence.<sup>21</sup> While in the drum corps season, the performers in our study participated in an activity they enjoy, are competent, and are engaged with other peer performers—thus, their motivation to participate was high. The challenge, it appears, is to facilitate experiences during the off-season, and after one's competitive days have ended, that mimic the motives experienced during the competitive season: for example, linking exercise to outcomes that are personally valued (i.e., get in shape to facilitate better musical performance) and exercising with peers who share similar interests and goals.

Intervention research is needed to examine whether facilitating off-season (and end of competitive career) exercise programs that link physical activity to salient personal and professional goals, and encourage social interaction, can help.<sup>21</sup> BMI is only one measure of physical health, and future research is needed that incorporates more diverse measures of physical fitness, particularly among people not typically interested in traditional sport/exercise participation (both within the performing arts and other activities).

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