What role does diet and physical activity play in the development of predisposing factors of Metabolic Syndrome (MetS) in college-aged students?

By: Amanda Dent
What is MetS?

Third Report of the National Cholesterol Education Program Adult Treatment Panel (ATP-III)\textsuperscript{13}

World Health Organization (WHO)\textsuperscript{13}

International Diabetes Foundation (IDF)\textsuperscript{13}
College student dietary behavior

“Students living on campus are more likely than students living in off-campus residences or at home to eat the same foods on a daily basis.”

**Residence Halls:**

✓ Students living on campus (i.e. dormitories) have access to many fried and fast food options

✓ A lack of variety in diets was reported by students living on campus; 76% reported eating the same foods day after day

**Greek Life:**

✓ Students in fraternities/sororities generally have the best nutrient and food group intakes
  - Students pay a flat fee for meals and housing
  - House cooks prepare and serve family-style meals
“Environmental lifestyle changes of college students such as all-you-can-eat dining halls, easy access to junk food, high alcohol consumption and altered sleeping patterns have contributed significantly to freshman weight gain.”

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8. Source: [Coburn et al., 2006]
“Against current dietary recommendations, college students typically consume a diet lacking in fruits, vegetables, and dairy products and high in fat, sodium, and sugar.”

Apartment Living:

✓ Students who purchase individual ingredients instead of the finished product in a meal are likely to view vegetables, fruits and meats as too expensive.

✓ Students sharing an apartment with roommates have insufficient refrigerator space for storing perishable food items; may lack knowledge and skills in preparing these foods.

- Fruits
- Vegetables
- Lean Meats
- Low-Fat Dairy
College student dietary behavior

“It has been observed that increased knowledge in nutrition does not necessarily mean changes to diet and healthy lifestyles.”

Upper vs. Lower classmen

- Few differences in dietary intake exist between lower and upperclassmen

Controversy?

Gender

- Men typically consume more fiber than women
- In one study, women (61.3%) were more likely than men (41.7%) to avoid fat intake
- Stress-related overconsumption has been primarily linked to lack of emotional support in women

Ethnicity

- Eating breakfast more regularly, higher cohabitation rate with one’s parents, and lower usage of fast food were three significant positive lifestyle factors identified in a sample of Japanese college students in comparison to their American counterparts
Fast Food Consumption

- 95.1% of lower-level and 91.9% of upper-level students reported typically eating meals at fast-food restaurants 6 to 8 times weekly

- In 1991, students reported eating at fast food restaurants 2.1 times weekly
  - More fast food restaurants are now located near or on campus

Menu choices, cost, and convenience are related to the number of meals eaten in fast food restaurants
“Various factors determine college student’s selection of food such as shortage of time, convenience, cost, taste, health, physical and social environment and weight control.”

<table>
<thead>
<tr>
<th>Factors influencing food choices among lower and upper-level students</th>
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<tbody>
<tr>
<td><strong>Factor</strong></td>
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<tr>
<td>Convenience *</td>
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<tr>
<td>Taste</td>
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<td>Cost</td>
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<td>Health</td>
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<td>Weight control (gain, loss, maintenance)</td>
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<td>Family/Friends</td>
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* Increased concern in regards to fast food consumption
“Evidence also suggests that consumption of foods from fast food restaurants, which typically serve foods high in total and saturated fat, has doubled during the past 30 years.”\textsuperscript{27}

“During the first 3 to 4 months of college, students gain an average of 1.5 to 6.8 pounds, with the proportion of overweight or obese students as much as doubling by the end of the first semester.”\textsuperscript{22}
PA Recommendations

“The 2000 Dietary Guidelines for Americans (DGA) indicate adults should be performing moderate activity at least 30 minutes daily or most days of the week and participate in activities to strengthen muscles and flexibility.”

The American College of Sports Medicine (ACSM) recommends that adults in the U.S. accumulate 20 to 30 minutes or more of moderate-intensity PA, on most or preferably all days of the week; ACSM also recommends that adults perform resistance or weight training of all major muscle groups weekly, along with flexibility training a minimum of 2 to 3 days per week.

NOTE: About ½ of students typically meet ACSM recommendations for the quantity and quality of exercise, and almost ½ typically meet the PA recommendation of the DGA.
College student physical activity (PA) behavior

“It is well known that PA plays a protective role against obesity, as well as its importance in the regulatory system controlling storage, distribution and utilization of calories.”

Residence Halls:

- More lower-level than upper-level students live in dormitories and may frequent on campus recreation centers more often.

- Physical inactivity increases with advancing age, especially during adolescence and early adulthood.

Greek Life

- One study suggests students living in fraternity/sorority housing tend to participate in significantly more vigorous PA or organized intramural sports than those who do not.
College student physical activity (PA) behavior

“Studies show that PA habits established in college are likely to be maintained for a long time.”

NOTE: Researchers found 81.3% of those who were physically inactive as college seniors maintained a sedentary lifestyle.

Overweight/Obesity

✓ Overweight participants were more likely to report complete physical inactivity (46%) than were normal weight participants (37%).
  ▪ Those reporting physical inactivity had higher average BMIs (23.3 vs. 22.9).

Biochemical Results

✓ Levels of circulating lipids and lipoproteins are influenced to a large degree by behavioral factors such as exercise.
College student physical activity (PA) behavior

Upper vs. Lower classmen

✓ A higher percentage of lower-level (45.6%) than upper-level (28.6%) students reported typically walking more than 31 minutes per day

  ▪ Do lower-level students typically take classes in more locations than upper-level students?

✓ Some research suggests that upper-level students (i.e. juniors/seniors) spend substantially less time walking and participating in vigorous activities, compared to lower-level students

“Exercise patterns during freshman and senior years did not meet the recommended guidelines for nearly 1/3 of students, which is consistent with college students nationwide.”
So what about collegiate athletes?

Athletes
✓ College athletes are assumed to have higher levels of fitness than their nonathlete counterparts which should typically play them at a lower risk for MetS

- Football Players
  - Large body mass provides a competitive advantage, but the extent to which body mass is made up of fat may have serious health consequences
  - In one study, the prevalence of MetS among collegiate football players was present in 49% of offensive and defensive linemen

- Marching band
  - 45% of participants were overweight/obese

“Given the rigorous training that athletes often have to do under extreme weather conditions, it is important that they are in peak physical shape for optimal performance.”
Benefits of PA

“Physical inactivity is considered a global health concern and long-term insufficient PA is a prevalent and preventable leading risk factor for chronic disease and death.”

✓ Regular exercise plays a protective role against obesity; serves an important role in the regulation of storage, distribution and utilization of calories

**NOTE:** The energy expenditure of PA is dependent on the duration, intensity, and frequency of PA; the interaction of these 3 factors determines the overall effects of PA on health.

✓ Regular exercise promotes cardiovascular fitness and muscle tone, enhances body density and helps maintain a desirable body weight by promoting fat loss while maintaining or increasing lean-tissue mass
Obesity prevalence in college students

“Obesity is considered to be one of the most urgent public health problems and numerous studies have emphasized that obesity is a leading preventable cause of morbidity and mortality.”

- The transitional period between adolescence and young adulthood appears to be a period of increased risk for the development of obesity
  \(^{12,22}\)

- As many as 35% of college students are classified as either overweight or obese
  \(^{15,18,20,24}\)

- Obesity rates have increased most rapidly among 18 to 29 year old
  \(^{14,23,24}\)

  NOTE: The age range of more than 10 million full-time college students in the U.S.
  \(^{24}\)

- Demographics associated with being overweight or obese were:
  - Living off campus
  - Being older
  - Being male
  - Hispanic or African American vs. Caucasian
  \(^{27}\)
Why is obesity a concern?

- Obesity is not an easily reversible condition; those who develop obesity as young adults are at increased risk of obesity throughout adulthood \(^2,^{21,25}\)

- **Overweight students are almost 2 times more likely to experience at least one component of MetS than normal weight students\(^7,^{30}\)**

- Being overweight is also linked to the development of other chronic diseases such as:
  - Type II Diabetes Mellitus\(^{15,21}\)
  - Hypertension\(^{21}\)
  - Dyslipidemia\(^{21}\)
  - Cardiovascular Disease\(^{15}\)
  - Gallbladder disease\(^{21}\)
  - Cancer\(^{15,21}\)

- 280,000 premature deaths annually can be attributed to just obesity\(^1\)

- Obesity is expected to become the leading cause of preventable deaths in the U.S. in the near future\(^1\)
“Several studies have revealed that behavior leading to disease precursors often becomes established in childhood and adolescence, even though the clinical phases of disease generally become apparent in middle age or later in life.”

[28]
The role of overweight/obesity in anthropometric & biochemical results

Compared with normal weight students, overweight students had\textsuperscript{15}:

- Greater waist circumference (WC)
- Higher blood pressure
- Increased fasting & 2 hr glucose
- Increased total cholesterol (CHL) levels
  - LDL
  - VLDL
- Increased triacylglycerol levels
- Increased leptin levels
Biochemical Results

Dietary Behavior

Levels of circulating lipids and lipoproteins are influenced to a large degree by dietary factors such as:

- Consumption of saturated fats
- Consumption of alcohol

Gender

Males typically exhibit significantly lower levels of HDL than females from adolescence through menopause.

Residence

Triglyceride (TG) levels and the ratio of total CHL to HDL significantly higher in those who lived off campus.

Physical Activity

A high level of PA has been associated with a high HDL concentration, and low level of serum TGs, apolipoprotein B and insulin (in males).

Both men and women who are physically active have high higher concentrations of HDL than sedentary individuals.
Biochemical Results

Body Fat Distribution: Abdominal

✓ Plasma c-reactive protein (CRP) concentrations are significantly associated with body fat as well as with specific components of metabolic syndrome including:
  - Systolic BP
  - Fasting plasma concentrations of insulin
  - TGs
  - HDL-cholesterol

✓ Abdominal obesity was the component that was responsible for much of the difference in concentrations of CRP.

✓ Hypertension is closely linked to abdominal obesity, which has been identified as the most important indicator of cardiometabolic risk.

✓ WC alone has been reported to predict insulin resistance with greater accuracy than the ATP-III MetS construct.
Study Design Limitations

- Small sample size modest\(^1,13\)

- Several research studies used a **cross-sectional design**\(^5,20,27,30\)
  - Cannot be used to imply a causal relationship between PA and food choice variables\(^20\)
  - Do not track behaviors over time
  - Do not assess how the college environment influences the individual’s normal behaviors\(^5\)

- Multiple studies used a **convenience sample**\(^3,5,12\)
  - Sample might’ve been biased toward those who were more health conscious and thus more likely to participate\(^5\)

- Unequal gender and/or race group representation\(^8,11,13,21,27,30\)

- Approximately ¼ of participants in one research study refused blood drawing\(^12\)
Dietary/PA Limitations

- **Self-reported** dietary recall used in numerous research studies\(^4,5,18,23,27,30\)
  - Not representative of participants’ usual dietary patterns\(^4\)

- Lack of standardized instrument to measure PA has resulted in limited capacity to make comparative inferences across different samples of students\(^30\)

- Exercise was often self-reported via questionnaire\(^25,20,30\)
  - Participants tend to overestimate the amount of their exercise\(^25\)
Obesity limitations

✓ Some research suggests that BMI may be a poor indicator of body fatness in:
  ▪ Racial/ethnic minorities
  ▪ College aged athletes and non-athletes
  ▪ Individuals with a large body build

**NOTE:** Body composition measures may be a better alternative

✓ For college students aged 19 years and younger, it may be more appropriate to define overweight and obesity using the CDC criteria for children and adolescents (i.e. overweight as ≥ 85th BMI percentile and obesity as ≥95th BMI percentile for age and sex)

✓ Many studies relied on the calculation of BMI from participants self-reported measurements of height and weight
Future Research

“Colleges and universities are an important setting for the surveillance, prevention, and intervention of obesity and metabolic syndrome.”

Items to be addressed in regards to MetS include:

1. **Dietary patterns**
   - Teach the benefits of following a food guide such as the FGP. If the Pyramid is used, consumes will be able to classify foods and mixed dishes correctly and recognize appropriate portion sizes.
   - **NOTE:** a lack of cooking experience and time constraints are likely to have an effect on students’ intake

**Concerns**

- College food services have introduced a “food court” concept, which offers students a chance to choose meals from a number of fast-food-style establishments
- To promote healthy eating in the campus environment, college health services should collaborate with the food services department to ensure that quick and healthy meals and snacks are readily available and easily identifiable
2. Physical activity (PA)

- Numerous studies have shown anywhere from 20% to 68% of college students do not meet minimum PA recommendations.

**What can we do?**

“Without leadership from an administrative perspective, attempts to combat sedentary lifestyles will not be effective. Therefore, the American College Health Association (ACHA) and the National Association of Sport and Physical Education in Higher Education (NASPEHE), as well as the National Institute of Health (NIH), need to collaborate to establish detailed strategic plans to successfully improve students’ PA behaviors.”
Future Research

Why intervene at the collegiate level?

“Colleges and universities can be an ideal setting for interventions because college students are still forming lifestyle patterns. For many, this developmental period may be the last opportunity for cost-effective health education and prevention interventions.”

Considerations

✓ Colleges can implement both professional and peer-led programs that combine outreach, education, and referral services, and offer required courses that provide experiential education in PA and nutrition

✓ Health promotion efforts should be targeted toward first-year college students because many are away from home for the first time
Thank you

Any Questions?
References


