

Gender differences in disordered eating behaviours and body dissatisfaction among adolescents with type 1 diabetes: Results from the Diabetes MILES Youth - Australia

Emanuala Araia¹, Christel Hendrieckx^{1,2}, Timothy Skinner³, Frans Pouwer⁴, Jane Speight^{1,2,5} & Ross King¹

1. School of Psychology, Deakin University, Geelong, Australia;
2. The Australian Centre for Behavioural Research in Diabetes, Diabetes Victoria, Melbourne, Australia;
3. School of Psychology and Clinical Sciences, Charles Darwin University, Casuarina, Northern Territory, Australia;
4. Department of Psychology, South Danish University, Odense, Denmark;
5. AHP Research, Hornchurch, United Kingdom



The Australian Centre
for Behavioural Research
in Diabetes

Partners for better health



Diabetes
MILES Youth
Study



**I declare I have no
conflicts of interest**



Gender differences in disordered eating behaviors and body dissatisfaction among adolescents with type 1 diabetes: Results from diabetes MILES youth—Australia

Emanuala Araia, Doctor of Psychology (Health) Candidate¹  |

Christel Hendrieckx, PhD^{1,2} | Timothy Skinner, PhD³ | Frans Pouwer, PhD⁴ |

Jane Speight, PhD^{1,2,5} | Ross M. King, PhD¹ 

¹School of Psychology, Deakin University, Geelong, Australia

²The Australian Centre for Behavioural Research in Diabetes, Melbourne, Diabetes Victoria, Australia

³School of Psychology and Clinical Sciences, Charles Darwin University, Casuarina, Northern Territory, Australia

⁴Department of Psychology, South Danish University, Odense, Denmark

⁵AHP Research, Hornchurch, United Kingdom

Correspondence

Ross King, School of Psychology, Deakin University, Geelong, Australia.
Email: ross.king@deakin.edu.au

Funding information

The Diabetes MILES Youth—Australia 2014 Survey was funded by the National Diabetes Services Scheme (NDSS) Young People with Diabetes National Development Programme. The NDSS is an initiative of the Australia Government administered with assistance from Diabetes Australia. CH and JS are supported by core

Abstract

Objective: To examine gender differences in disordered eating behaviors (DEB) and body dissatisfaction in adolescents with type 1 diabetes. While evidence shows that female youth with type 1 diabetes are more prone to DEB compared to their peers without diabetes, little is known about male adolescents.

Method: In a national online survey, adolescents (13–19 years) with type 1 diabetes for ≥ 1 year completed the Diabetes Eating Problem Survey-Revised (DEPS-R), and the Body Mass Index Silhouette Matching Test (BMI-SMT) and items on binge eating and insulin omission.

Results: About 477 adolescents (mean age 16 years; 62% females) completed the DEPS-R and 431 the BMI-SMT. The DEPS-R total score was higher for females than males, with scores for females increasing with age. BMI, HbA_{1c}, insulin omission, and binge eating frequency were associated moderately with DEPS-R for both genders. On the BMI-SMT, 88% of females wanted to be thinner. Of the males, 76% reported body dissatisfaction; however, only 43% expressed a desire for thinness with the remainder desiring a larger body size. DEPS-R was positively associated with the discrepancy between perceived actual and ideal body size for both genders.

Discussion: A large proportion of adolescents with type 1 diabetes, particularly females reported engaging in DEB. Similarly, high rates of body dissatisfaction were reported, though ideal body shape preferences differed by gender. Given the high levels of self-reported DEB and gender-based patterns of body dissatisfaction, future research needs to examine the effectiveness of routine screening of DEB and consider implementation of stepped care approaches.

Today's presentation is based on the following previously published research:

Araia, E., Hendrieckx, C., Skinner, T., Pouwer, F., Speight, J., & King, R. M. (2017). Gender differences in disordered eating behaviors and body dissatisfaction among adolescents with type 1 diabetes: Results from diabetes MILES youth—Australia. *International Journal of Eating Disorders*, 50(10), 1183-1193.



DISORDERED EATING BEHAVIOURS (DEB) IN T1D

- DEB are more prevalent T1D compared to the general population (Colton et al., 2004; Neumark-Sztainer et al., 2002; Nielsen, 2002; Young et al., 2013).
- A meta-analysis of 664 adolescents with T1D and almost 1900 peers without T1D across five studies revealed;
 - DEB (39% vs 33%) and eating disorders (ED) (7% vs 3%) was greater in adolescents with T1D (Young et al., 2013).

DISORDERED EATING BEHAVIOURS IN T1D

- However, some studies have found no significant differences in prevalence rates between individuals with/without type 1 diabetes and DEB/ED (e.g., Meltzer et al., 2001; Peveler, Fairburn, Boller, & Dunger, 1992; Striegel-Moore, Nicholson, & Tamborlane, 1992; Svensson, Engstrom, & Aman, 2003).
- ... likely due to methodological limitations, including small sample sizes, and **the measure(s) used to assess DEB/ED** and the lack of suitability for use with individuals with diabetes.



ASSESSING DEB WITHIN T1D

- Many studies typically use measures developed and standardized for the general population (Young-Hyman & Davis, 2010).
- ... which fail to capture DEB unique to type 1 diabetes, such as insulin restriction/omission for weight loss (d'Emden et al., 2012; Markowitz et al., 2010).
- and tend to overestimate DEB in people with T1D when recommended diabetes management practices (e.g., restricting certain food groups, portion control) are misconstrued as DEB (Hanlan et al., 2013; Markowitz et al., 2010; Young-Hyman & Davis, 2010).



ASSESSING DEB WITHIN T1D

- A panel review of the EDE-Q revealed 50% of the items could be influenced by having type 1 diabetes (Powers et al., 2013).
- Problematic items on the EDE-Q related to setting limits around foods and calorie counting which may represent diabetes treatment regimen rather than the presence of eating-related psychopathology (Powers et al., 2013).



ASSESSING DEB WITHIN T1D

- In Young et al.'s (2013) systematic review and meta-analysis prevalence of DEB differed depending on the use of generic measures (24%), diabetes-adapted measures (52%) or both (39%).
- However, when utilising diabetes-adapted measures for eating disorders prevalence rates were lower compared to general measures (6% vs 10%) and were still lower in studies that utilised a combination of both measures (7%).
- Recent recommendations suggest screening tools for DEB should include measures that consider the impacts of diabetes management including specific eating problems solely attributable to diabetes (Young-Hyman et al., 2016).



DIABETES-SPECIFIC SCREENING TOOLS

- More recently, diabetes- specific screening measure have been developed and revised that assess the presence of DEB, such as the Diabetes Eating Problem Survey- Revised (DEPS-R) (Markowitz et al., 2010).
- The scale has since been refined for use in younger individuals with T1D and is now a brief 16-item questionnaire (DEPS-R).
- The DEPS-R has been translated and used in several countries including Norway, Italy and Germany (Cherubini et al., 2018; Saßmann et al., 2015; Wisting et al., 2013), demonstrating very good reliability and validity.

BODY DISSATISFACTION

- Limited research of BD in diabetes.
- Recent meta-analysis comparing the body image of children and adolescents with a chronic illness to their healthy peers found that of the 330 studies (of which 8% focused on type 1 diabetes), individuals with T1D reported higher levels of BD (Pinquart, 2013).
- Negative body image has been found to be associated with DEB in female adolescents with type 1 diabetes (Grylli et al., 2010).

BODY DISSATISFACTION

- BD and engaging in peer comparisons with others have been identified as important factors in the subsequent development of their ED in young females with T1D (Powers et al 2016).
- Adolescents with T1D are also more likely to restrict their insulin if they reported BD (Ackard et al., 2008).
- Currently there is limited understanding regarding the prevalence and implications of BD in T1D.

OBJECTIVES – DIABETES MILES YOUTH STUDY

- To assess prevalence of self-reported DEB including eating binges in Australian adolescents (aged 13-19) with T1D ≥ 1 year, using a diabetes-specific screening tool (DEPS-R).
- To explore BD using gender-specific silhouettes (BMI-SMT).
- To examine potential gender and age differences in both DEB and BD.
- Additional objectives included identifying predictors of DEB which is beyond the scope of today's presentation. ***

DIABETES MILES-AUSTRALIA STUDY

- The Diabetes MILES (Management and Impact for Long-term Empowerment and Success) study - international collaborative between Australia and The Netherlands.
- To date, largest Australian survey conducted with adults (aged 18-70) with diabetes ($N = 3,338$) examining the psychosocial and behavioural aspects of living with diabetes (Speight et al., 2012).
 - 54% female; 59% with Type 2 Diabetes (T2D); mean age 52 years old.
 - Participants reported significantly lower subjective well-being compared to the Australian population (Holmes-Truscott et al., 2016).
- Diabetes MILES-2 recently completed to extend understanding by following up on past participants and the recruitment of new ones.



The Australian Centre
for Behavioural Research
in Diabetes



Partners for better health



Diabetes
MILES Youth
Study



DIABETES MILES YOUTH STUDY

- Significant gap remained regarding the issues faced by adolescents with diabetes.
- Adolescent survey needed to capture the experiences of youth with diabetes.
- The Diabetes MILES Youth Study was the first large-scale Australian study to assess the psychosocial impacts of living with T1D in youth and their parents in order to identify unmet needs, explore current supports, diabetes care and overall emotional well-being.
- *Study initially intended to include individuals with T2D, however due to low response rates ($N = 11$), analyses were limited to individuals with T1D.

DIABETES MILES YOUTH STUDY

- Survey was developed in consultation with expert reference groups including Australian and International clinicians and researchers.
- Three different versions of the survey was created:
 - Youth aged 10-12 years with T1D* (only contained subset of measures)
 - Youth aged 13-19 years with T1D
 - Parents of youth aged 10-19 with T1D
- Cognitive debrief interviews conducted in youth with T1D *prior* to survey dissemination.



The Australian Centre
for Behavioural Research
in Diabetes



Partners for better health



Diabetes
MILES Youth
Study



DIABETES MILES YOUTH STUDY

- Previously consenting registrants listed on the National Diabetes Service Scheme (NDSS) were invited ($N = 5,928$) to participate.
- Additional recruitment was through social media, flyers, diabetes clinics and paediatric centres.
- Survey was made available online for 8 weeks (Aug – Oct, 2014).
- Ethics approval was received from Deakin University (EC2014-260).

DIABETES MILES YOUTH STUDY

- 934 young people completed the survey;
 - 153 excluded due to not specifying age and/or type of diabetes
- In total, 781 youth aged 10-19 with T1D completed the survey;
 - 551 completed the 13-19 version of the survey containing all key survey measures
- Further 74 excluded for multiple reasons:
 - drop-out pre-survey completion (36); intentionally skipping questions (2); diabetes duration <1yr (36); and extreme HbA1c scores (2).
- Final sample = 477 adolescents (Response Rate: 93%) fulfilled the inclusion criteria and completed the measures of DEB.



MILES Youth Survey Measures

Version No.	Participant group	Number of items	
Version 1	Type 1 ; aged 13-19 years	169	
Version 2	Type 1 ; aged 10-12 years	69	
Section	Items / scale	No. of items	Version
About you	Demographics, family composition, occupation	12	All
	Diabetes type, treatment, duration, family history	4	All
My Mood	General QoL	1	All
	WHO-5 Wellbeing Scale	5	All
	Depression - PHQ-8	8	V1
	Anxiety - GAD-7	7	V1
My Feelings About Diabetes	PAID-Teen	26	V1
	Family conflict	2	V1
	Responsibility for diabetes management	2	V1
	Open questions: Parental support	2	V1
My Health & Health Checks	Perceived health, health conditions, HbA1c, SMBG frequency, weight, height	7	V1
	DKA frequency	1	V1
	Insulin dosing, SMBG, Insulin omission	7	V1

MILES Youth Survey Measures

Section	Items / scale	No. of items	Version
Hypos	Hypo frequency & symptoms	6	V1
	Hypo awareness	2	V1
	Fear of hypoglycaemia – behaviour scale	11	V1
	Fear of hypoglycaemia – worry scale	15	V1
My Eating Habits	Diabetes Eating Problem Survey-Revised	16	V1
	Frequency of binge eating	1	V1
	Body image silhouettes (male/female)	3	V1
My Health Care Team	Patient-centred communication	5	V1
	Treatment satisfaction	3	V1
	Open question – Health professional support	1	V1
Support to manage my diabetes	Resilience scale	12	V1
	Open questions – Social support (friends, teachers)	3	All
	NDSS support		
Technology	Use of diabetes ‘apps’	5	All
Final comments	Open question – Anything else?	1	All
Unique ID	NDSS number	1	All

MILES Youth Survey Measures

- DEB = Diabetes Eating Problem Survey-Revised (DEPS-R; Markowitz et al., 2010);
 - 16-items
 - Diabetes-specific screening tool of disordered eating
 - Total score range: 0 to 80 with scores ≥ 20 indicative of increased risk of DEB.
- BD = Body Mass Index-Silhouette Matching Test (BMI-SMT; Peterson et al., 2003);
 - 27-point scale with each point = 1 BMI unit
 - 4 BMI-level matched gender-specific silhouettes.
 - Respondents select along the continuum the size they are now (actual) and the size they would like to be (ideal).
 - Level of BD calculated by subtracting perceived current size from ideal body size.
 - Additional item added asking participants to mark the size they would be without diabetes (actual without diabetes).



MILES Youth Survey Measures

- Eating Binges = Adapted from the MIND Youth Questionnaire (MY-Q; De Wit et al., 2012);
 - Single item
 - *“Excluding when you are having a hypo, on how many of the past **14 DAYS** have you had eating binges? (Feeling you cannot stop eating, and/or eating more than other people your age in a similar situation).”*
 - Responses recoded into *0 days, 1-3 days, ≥4 days.*
- Intentional Insulin Omission = Adapted from the MY-Q (De Wit et al., 2012);
 - Single item
 - Participants were asked to indicate, over the past 14-day period, how often they had **not** taken their insulin on **purpose**.
- BMI was calculated using age and sex-specific growth charts (Kuczmarski et al., 2002) for females and males.

RESULTS

Participants:

- mean age 16 ± 2 years
- 62% females
- 85% living with two parents either biological/adoptive or one being a step-parent
- diabetes duration 7 ± 4 years
- self-reported HbA1c 66 ± 17 mmol/mol ($8 \pm 2\%$) [recommended target < 58 mmol/mol; 7.5% (Craig et al., 2011)]
- 53% using an insulin pump
- 32% of females and 25% of males had a higher BMI (slightly higher than the Australian average for children and adolescents; Australian Bureau of Statistics, 2013)

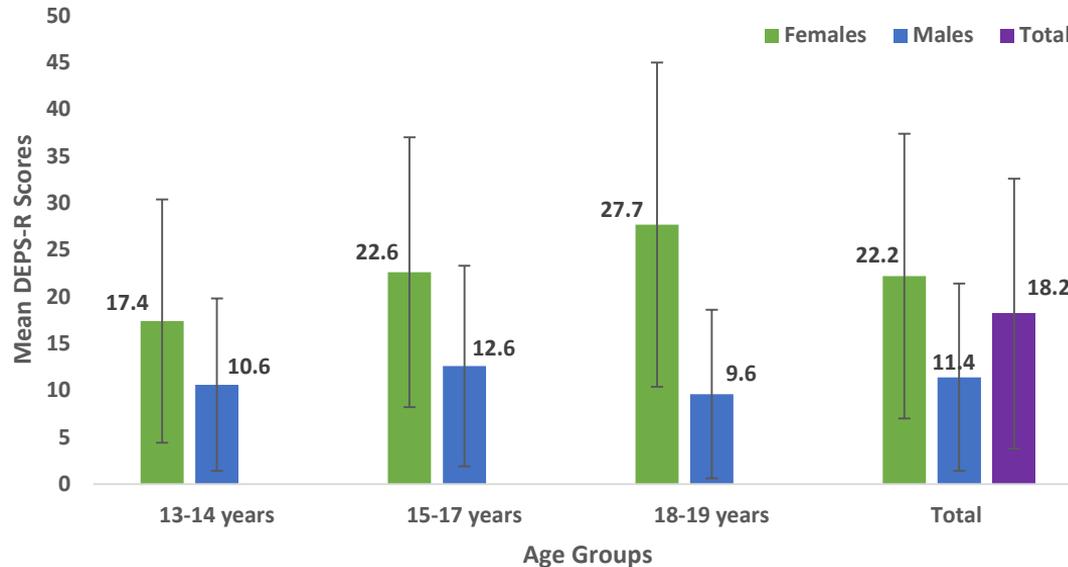


DATA ANALYSIS

- Correlational (Pearson/Spearman) analyses to assess relationships between clinical, demographic and diabetes-specific variables.
- T-tests and chi-squares to examine gender differences.
- ANOVA's to examine the association between
 - (1) insulin omission and DEB, and
 - (2) BD differences and DEB in males
- Post hoc comparisons conducted using the Bonferroni test.

DISORDERED EATING BEHAVIOURS

Figure 1. Mean DEPS-R scores overall and according to age and gender



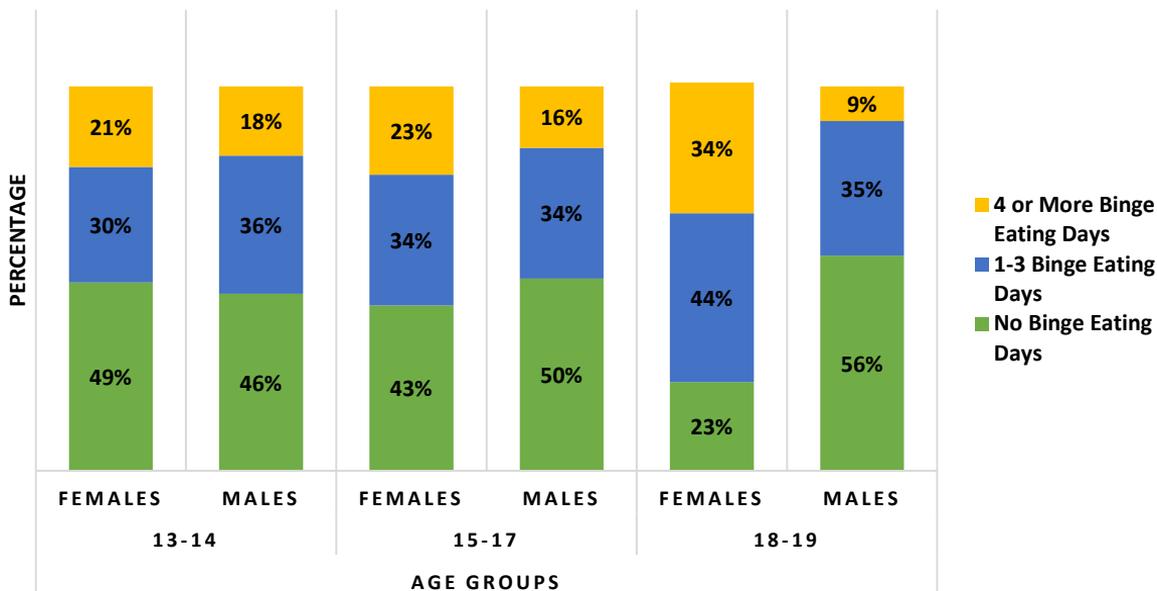
38% of the total sample ($n = 181$); specifically 50% of females and 18% of males scored above the cut-off both ≥ 20 , indicative of DEB.

Note. Mean Scores reported, error bars represent SD

Araia, E., Hendrieckx, C., Skinner, T., Pouwer, F., Speight, J., & King, R. M. (2017). Gender differences in disordered eating behaviors and body dissatisfaction among adolescents with type 1 diabetes: Results from diabetes MILES youth—Australia. *International Journal of Eating Disorders*, 50(10), 1183-1193.

EATING BINGES

Figure 2. *Percentage of eating binges by age and gender*



High percentage of both female (60%) and male (51%) adolescents reported an eating binge at least once in the past two weeks.

INTENTIONAL INSULIN OMISSION

- No significant differences across gender related to intentional insulin omission.

Intentional insulin omission	Total	Female	Male	ns
0 days	386 (81%)	239 (81%)	147 (82%)	
1-3 days	65 (14%)	39 (13%)	26 (14%)	
4+ days	24 (5%)	17 (6%)	7 (4%)	

DEB AND INTENTIONAL INSULIN OMISSION

- Significant association between DEB (DEPS-R scores) and intentional insulin omission ($F(2, 472) = 55.2, p < 0.001$), with a large effect size ($d = 0.97$).
- Mean DEPS-R score based on no. of days insulin intentionally withheld:
 - “no days”, $M = 15.6, SD = 11.8$;
 - “1-3 days”, $M = 23.7, SD = 16.8$; and
 - “4 or more days”, $M = 42.5, SD = 19.0$
- All groups statistically significantly different from each other ($p < 0.05$).



DEB AND CLINICAL VARIABLES

Positively Correlated with DEPS-R Scores (all, $p < 0.001$)	Negatively Correlated DEPS-R Scores (all, $p < 0.001$)
<ul style="list-style-type: none">• Eating binges (females: $r_s = 0.64$, males: $r_s = 0.55$);• Current body size (females: $r = 0.47$, males: $r = 0.39$);• HbA1c (females: $r = 0.37$, males: $r = 0.43$);• BMI (females: $r = 0.21$, males*: $r = 0.19$, $p < .05^*$).• Age* ($r = 0.25$), significant for females only	<ul style="list-style-type: none">• Ideal body size ($r = -0.32$), significant for females only <div data-bbox="1128 530 1750 845" style="border: 1px solid black; padding: 10px; text-align: center;"><p>Diabetes duration and type of diabetes management (insulin pump versus multiple daily injections) was not associated with DEB.</p></div>

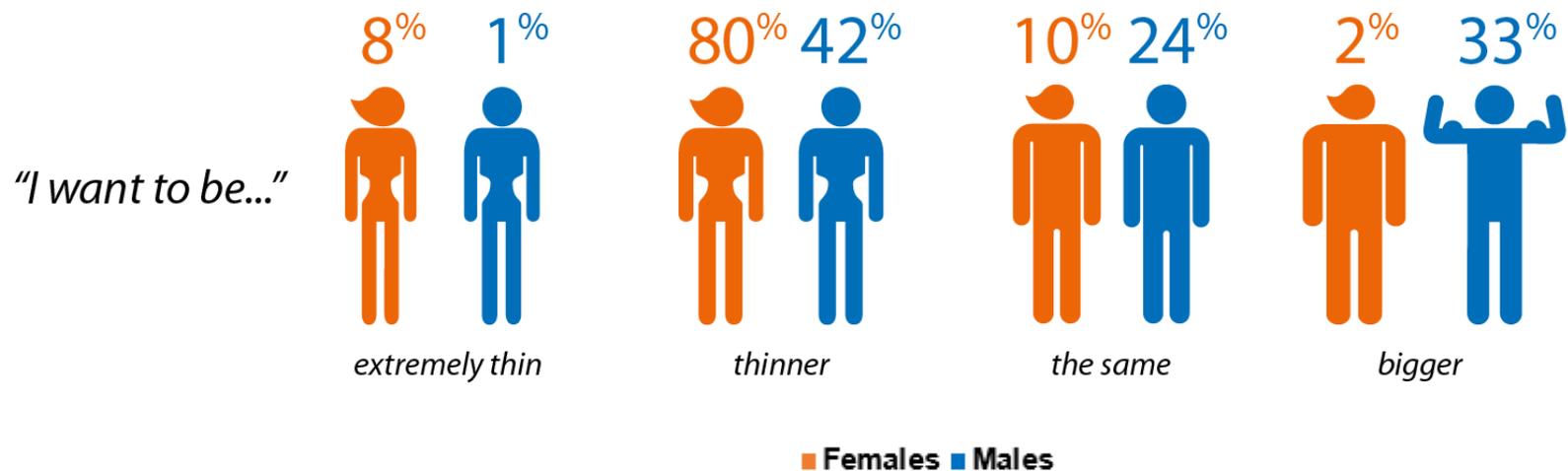
BD AND CLINICAL VARIABLES

- BD for both sexes ($p < 0.001$) correlated with:
 - eating binges (females: $r_s = 0.45$; males: $r_s = 0.26$)
 - and BMI (females: $r = 0.39$, males: $r = 0.42$)
- BD for females also correlated with age ($r = 0.20$, $p < 0.01$) and insulin omission ($r_s = 0.23$, $p < 0.001$).
- BD was not associated with type 1 diabetes duration or differ by mode of management (insulin injections versus pumps).



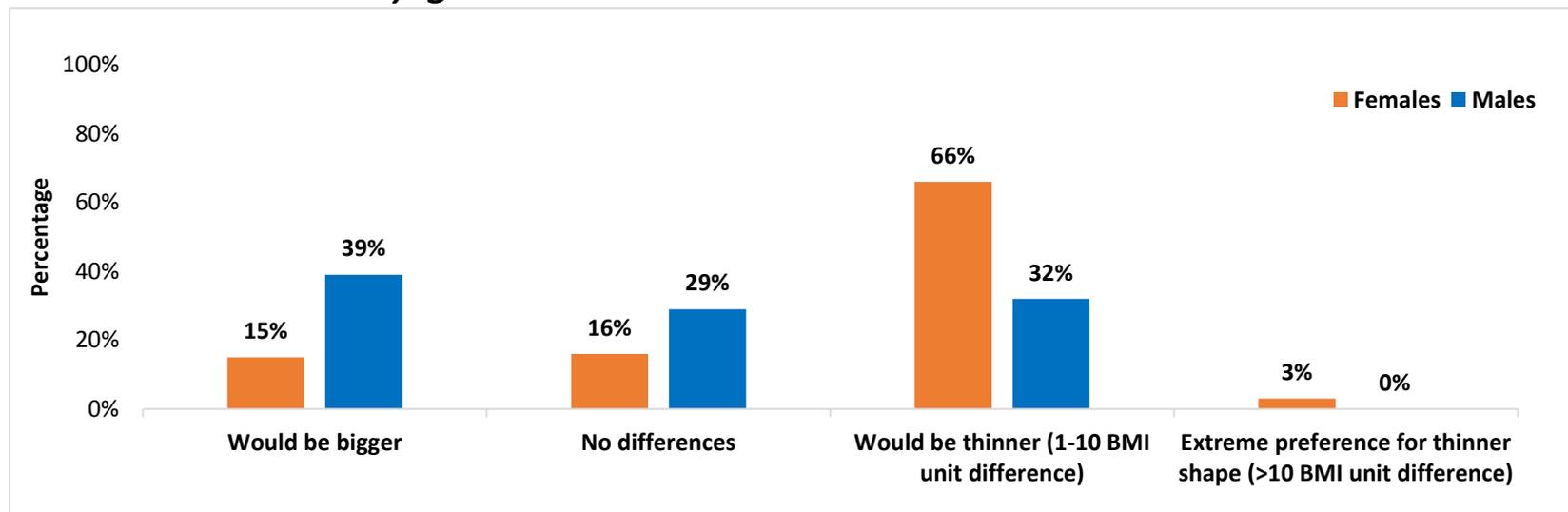
BODY DISSATISFACTION AND GENDER

Figure 3. Differences between perceived actual and ideal body image scores on the BMI-SMT by gender



BODY DISSATISFACTION AND GENDER

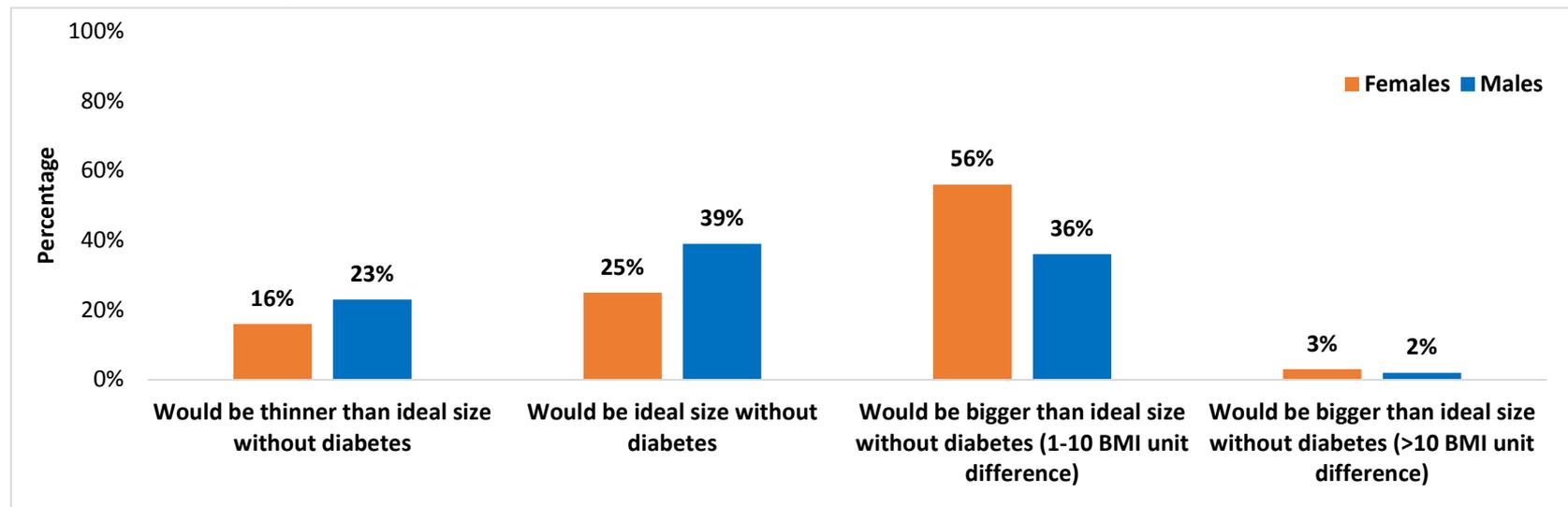
Figure 4. *Body shape differences between perceived actual size and perceived size without T1D by gender*



Araia, E., Hendrieckx, C., Skinner, T., Pouwer, F., Speight, J., & King, R. M. (2017). Gender differences in disordered eating behaviors and body dissatisfaction among adolescents with type 1 diabetes: Results from diabetes MILES youth—Australia. *International Journal of Eating Disorders*, 50(10), 1183-1193.

BODY DISSATISFACTION AND GENDER

Figure 5. *Body shape differences between perceived size without T1D and ideal size by gender*



Araia, E., Hendrieckx, C., Skinner, T., Pouwer, F., Speight, J., & King, R. M. (2017). Gender differences in disordered eating behaviors and body dissatisfaction among adolescents with type 1 diabetes: Results from diabetes MILES youth—Australia. *International Journal of Eating Disorders*, 50(10), 1183-1193.

BODY DISSATISFACTION, DEB AND CLINICAL VARIABLES

- Strong correlations were observed between BD and DEPS-R scores (females: $r = 0.67$, $p < 0.001$; males: $r = 0.42$, $p < 0.001$).
- Difference between perceived size without diabetes and ideal size was also associated with (all $p < 0.01$);
 - DEPS-R scores (females: $r = 0.28$, males: $r = 0.31$)
 - Eating binges (females: $r_s = 0.26$; males: $r_s = 0.23$)
 - insulin omission for females ($r_s = 0.15$) and
 - BMI for males ($r = 0.29$).
- For females, DEPS-R scores were also associated with the *discrepancy* between perceived actual size and perceived size without diabetes ($r = 0.40$, $p < 0.001$), however this was not found in males.



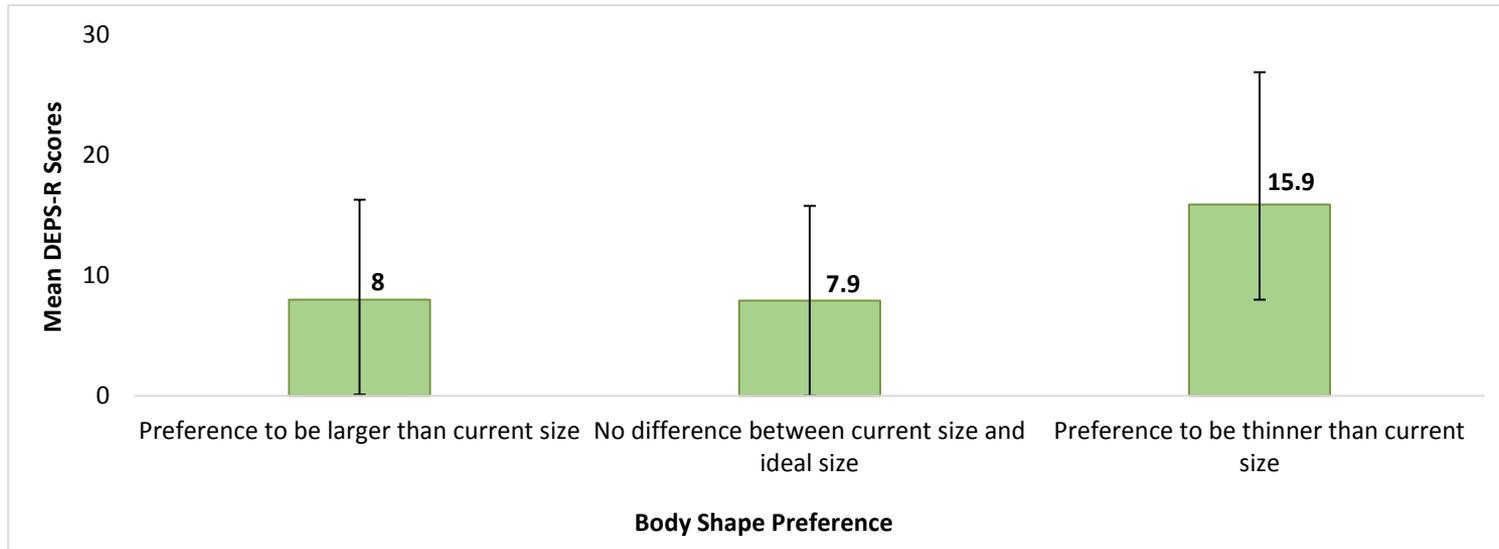
DEB AND BODY DISSATISFACTION IN MALES

- In male adolescents, significant differences were found across varying levels of body dissatisfaction and DEPS-R scores, despite the split in body shape preferences (thinner versus larger).
- Males who indicated a desire to be **thinner** had **higher** DEPS-R scores and were statistically significantly different from those who wanted to be larger or those who were satisfied with their body, $F(2, 156) = 13.7, p < 0.001$.



DEB AND BODY DISSATISFACTION IN MALES

Figure 6. *Body dissatisfaction differences for mean DEPS-R scores in males*



Note. Mean Scores reported, error bars represent SD

Araia, E., Hendrieckx, C., Skinner, T., Pouwer, F., Speight, J., & King, R. M. (2017). Gender differences in disordered eating behaviors and body dissatisfaction among adolescents with type 1 diabetes: Results from diabetes MILES youth—Australia. *International Journal of Eating Disorders*, 50(10), 1183-1193.

CONCLUSIONS

- DEB including eating binges is highly prevalent in youth with T1D, even when using diabetes-specific tools for DEB;
 - 38% of the total sample scored above the DEPS-R risk cutoff
 - 35% reported at least one eating binge and 21% on at least four days in a 2 week period
- Male adolescents with T1D are also impacted by DEB.
- Clear gender differences apparent in prevalence of DEB.
- ↑ age = ↑ DEB for females; 18-19 year olds, highest risk.

CONCLUSIONS

- BD almost universally experienced;
 - 88% females dissatisfied with a preference for thinness
 - 76% males dissatisfied split between wanting to be thinner/larger.
- Differences in BD between sexes highlights the need for gender-specific screening tools and tailored support.



CONCLUSIONS

- For the majority of male adolescents, specific items within the DEPS-R may not be applicable.
 - E.g. items relating to weight loss and feeling ‘fat’ were only endorsed by a small percentage of adolescent males
- Males may be more likely to engage in different DEB, such as excessive exercise, which was the most commonly reported form of DEB endorsed by adolescent males with type 1 diabetes in a previous study (d’Emden et al., 2013).
- DEPS-R may require modification or additional items to better capture these behaviours and reflect the spectrum of DEB within males.



CONCLUSIONS

- In addition to DEB, DEPS-R also taps into the difficulties associated with managing diabetes.
- High DEPS-R scores warrant attention;
 - may indicate the need for additional support with diabetes management and/or
 - likely increased risk of developing an eating disorder if left untreated.

STRENGTHS

- Large Australian sample of adolescents with T1D (including 38% of males).
- Use and/or adaption of tools which consider the diabetes context.
- Examination of potential changes in perceptions about body shape with and without diabetes.
- Positive qualitative feedback received by youth who completed the MILES Youth survey with topics relevant for their experience of living with diabetes (Hagger et al., 2016).



LIMITATIONS

- Self-reported data
- Low response rate (13%)
- Self-selection of participants
- Single items to assess eating binges and insulin omission



FUTURE RESEARCH

- More research into males and the development of screening tools that consider the full spectrum of DEB.
- Greater understanding is required into the impact of BD, particularly if perceived as being due to having diabetes.
- Research to assess the effectiveness of routine screening of DEB in youth with T1D.



ACKNOWLEDGEMENTS

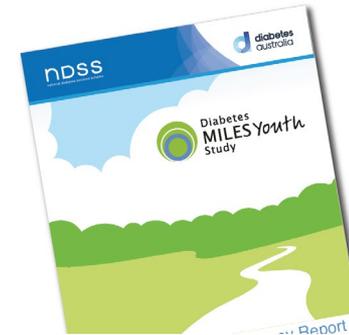
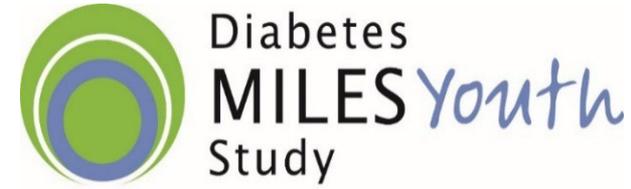
We thank all the young people with diabetes who participated in the study.

The Diabetes MILES Youth Study 2014 is an activity of the NDSS Young People with Diabetes National Development Program. The NDSS is an initiative of the Australian Government administered by Diabetes Australia.

QUESTIONS?

Emanuala Araia

email: earaia@deakin.edu.au



Download the report: www.ndss.com.au/young-people-with-diabetes



The Australian Centre
for Behavioural Research
in Diabetes

Partners for better health



Diabetes
MILES Youth
Study



THANK-YOU

REFERENCES

- Ackard, D. M., Vik, N., Neumark-Sztainer, D., Schmitz, K. H., Hannan, P., & Jacobs, D. R. (2008). Disordered eating and body dissatisfaction in adolescents with type 1 diabetes and a population-based comparison sample: comparative prevalence and clinical implications. *Pediatric Diabetes*, 9(4pt1), 312–319.
- Araia, E., Hendrieckx, C., Skinner, T., Pouwer, F., Speight, J., & King, R. M. (2017). Gender differences in disordered eating behaviors and body dissatisfaction among adolescents with type 1 diabetes: Results from diabetes MILES youth—Australia. *International Journal of Eating Disorders*, 50(10), 1183–1193.
- Australian Bureau of Statistics (ABS) (2013). *Australian Health Survey: Updated results, 2011–2012 (Cat. no. 4364.0.55.003)*. Canberra: ABS. Retrieved from <http://www.aihw.gov.au/who-is-overweight/#children>
- Cherubini, V., Skrami, E., Iannilli, A., Cesaretti, A., Paparusso, A. M., Alessandrelli, M. C., ... & Gesuita, R. (2018). Disordered eating behaviors in adolescents with type 1 diabetes: A cross-sectional population-based study in Italy. *International Journal of Eating Disorders*, 1-9.
- Colton, P. A., Olmsted, M. P., Daneman, D., Rydall, A., & Rodin, G. M. (2004). Disturbed eating behavior and eating disorders in preteen and early teenage girls with type 1 diabetes: A case-controlled study. *Diabetes Care*, 27, 1654–1659.
- Craig, M. E., Twigg, S. M., Donaghue, K. C., Cheung, N., Cameron, F., Conn, J., ... & Silink, M. (2011). *National evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults*. Canberra: Australian Government Department of Health and Ageing, 346
- d’Emden, H., Holden, L., McDermott, B., Harris, M., Gibbons, K., Gledhill, A., & Cotterill, A. (2013). Disturbed eating behaviours and thoughts in Australian adolescents with type 1 diabetes. *Journal of Paediatrics and Child Health*, 49(4), E317-E323. doi: 10.1111/jpc.12014
- d’Emden, H., Holden, L., McDermott, B., Harris, M., Gibbons, K., Gledhill, A., & Cotterill, A. (2012). Concurrent validity of self-report measures of eating disorders in adolescents with type 1 diabetes. *Acta Paediatrica*, 101(9), 973–978.
- De Wit, M., Winterdijk, P., Aanstoot, H. J., Anderson, B., Danne, T., Deeb, L., ... Snoek, F. (2012). Assessing diabetes-related quality of life of youth with type 1 diabetes in routine clinical care: The MIND Youth Questionnaire (MY-Q). *Pediatric Diabetes*, 13(8), 638–646.
- Grylli, V., Wagner, G., Berger, G., Sinnreich, U., Schober, E., & Karwautz, A. (2010). Characteristics of self-regulation in adolescent girls with type 1 diabetes with and without eating disorders: A cross-sectional study. *Psychology and Psychotherapy: Theory, Research and Practice*, 83(3), 289–301.



REFERENCES

- Hagger, V., Trawley, S., Hendrieckx, C., Browne, J. L., Cameron, F., Pouwer, F., . . . Speight, J. (2016). Diabetes MILES Youth—Australia: Methods and sample characteristics of a national survey of the psychological aspects of living with type 1 diabetes in Australian youth and their parents. *BMC Psychology*, 4(1), 42.
- Hanlan, M. E., Griffith, J., Patel, N., & Jaser, S. S. (2013). Eating disorders and disordered eating in type 1 diabetes: Prevalence, screening, and treatment options. *Current Diabetes Reports*, 13(6), 909–916.
- Holmes-Truscott, E., Browne, J. L., Pouwer, F., Speight, J., & Cummins, R. A. (2016). Subjective Wellbeing Among Adults with Diabetes: Results from Diabetes MILES—Australia. *Journal of Happiness Studies*, 17(3), 1205–1217.
- Kuczumarski, R.J., Ogden, C.L., Guo, S.S., et al. (2002). 2000 CDC growth charts for the United States: methods and development. *Vital Health Stat*, 11(246), 1-190.
- Markowitz, J.T., Butler, D.A., Volkening, L.K., Antisdell, J.E., Anderson, B.J., & Laffel, L.M.B. (2010). Brief Screening Tool for Disordered Eating in Diabetes. *Diabetes Care*, 33, 495-500.
- Meltzer, L. J., Johnson, S. B., Prine, J. M., Banks, R. A., Desrosiers, P. M., & Silverstein, J. H. (2001). Disordered eating, body mass, and glyce- mic control in adolescents with type 1 diabetes. *Diabetes Care*, 24(4), 678–682.
- Neumark-Sztainer, D., Patterson, J., Mellin, A., Ackard, D. M., Utter, J., Story, M., & Sockalosky, J. (2002). Weight control practices and dis- ordered eating behaviors among adolescent females and males with type 1 diabetes. *Diabetes Care*, 25(8), 1289–1296.
- Nielsen, S. (2002). Eating disorders in females with type 1 diabetes: An update of a meta-analysis. *European Eating Disorders Review*, 10(4), 241–254.
- Peterson, M., Ellenberg, D., & Crossan, S. (2003). Body-Image Perceptions: Reliability of A BMI-Based Silhouette Matching Test. *American Journal of Health Behaviour*, 27, 4, 355-363.
- Peveler, R. C., Fairburn, C. G., Boller, I., & Dunger, D. (1992). Eating dis- orders in adolescents with IDDM: A controlled study. *Diabetes Care*, 15, 1356–1360.
- Pinquart, M. (2013). Body image of children and adolescents with chronic illness: A meta-analytic comparison with healthy peers. *Body Image*, 10(2), 141–148.



REFERENCES

- Powers, M. A., Richter, S. A., Ackard, D. M., & Cronemeyer, C. (2016). Eating disorders in persons with type 1 diabetes: A focus group investigation of early eating disorder risk. *Journal of Health Psychology, 21*(12), 2966–2976.
- Powers, M. A., Richter, S., Ackard, D., Critchley, S., Meier, M., & Criego, A. (2013). Determining the influence of type 1 diabetes on two common eating disorder questionnaires. *The Diabetes Educator, 39*(3), 387–396.
- Saßmann, H., Albrecht, C., Busse-Widmann, P., Hevelke, L. K., Kranz, J., Markowitz, J. T., ... & Lange, K. (2015). Psychometric properties of the German version of the Diabetes Eating Problem Survey–Revised: Additional benefit of disease-specific screening in adolescents with Type 1 diabetes. *Diabetic Medicine, 32*(12), 1641-1647. doi: 10.1111/dme.12788
- Speight, J., Browne, J. L., Holmes-Truscott, E., Hendrieckx, C., & Pouwer, F. (2012). Diabetes MILES-Australia (Management and Impact for Long-term Empowerment and Success): Methods and sample characteristics of a national survey of the psychological aspects of living with type 1 or type 2 diabetes in Australian adults. *BMC Public Health, 12*(1), 120. doi: 10.1186/1471-2458-12-120
- Striegel-Moore, R. H., Nicholson, C. J., & Tamborlane, W. V. (1992). Prevalence of eating disorder symptoms in preadolescent and adolescent girls with IDDM. *Diabetes Care, 15*, 1361–1368.
- Svensson, M., Engstrom, I., & Aman, J. (2003). Higher drive for thinness in adolescent males with insulin-dependent diabetes mellitus compared with healthy controls. *Acta Paediatrica, 92*, 114–117.
- Wisting, L., Frøisland, D. H., Skrivarhaug, T., Dahl-Jørgensen, K., & Rø, Ø. (2013). Psychometric properties, norms, and factor structure of the Diabetes Eating Problem Survey–Revised in a large sample of children and adolescents with type 1 diabetes. *Diabetes Care, 36*(8), 2198-2202. doi: 10.2337/dc12-2282
- Young-Hyman, D., & Davis, C. (2010). Disordered eating behaviour in individuals with diabetes: Importance of context, evaluation, and classification. *Diabetes Care, 33*, 683–689.
- Young-Hyman, D., De Groot, M., Hill-Briggs, F., Gonzalez, J. S., Hood, K., & Peyrot, M. (2016). Psychosocial care for people with diabetes: A position statement of the American Diabetes Association. *Diabetes Care, 39*(12), 2126-2140. doi: 10.2337/dc16-2053
- Young, V., Eiser, C., Johnson, B., Brierley, S., Epton, T., Elliot, J., & Heller, S. (2013). Eating problems in adolescents with type 1 diabetes: A systematic review with meta-analysis. *Diabetic Medicine, 30*, 189– 198.



DEPS-R ITEMS (Markowitz et al., 2010)

- Losing weight is an important goal to me.
- I skip meals and/or snacks.
- Other people have told me that my eating is out of control.
- When I overeat, I don't take enough insulin to cover the food.
- I eat more when I am alone than when I am with others.
- I feel that it's difficult to lose weight and control my diabetes at the same time.
- I avoid checking my blood glucose when I feel like it is out of range.
- I make myself vomit.



DEPS-R ITEMS (Markowitz et al., 2010)

- I try to keep my blood glucose high so that I will lose weight.
- I try to eat to the point of spilling ketones in my urine.
- I feel fat when I take all of my insulin.
- Other people tell me to take better care of my diabetes.
- After I overeat, I skip my next insulin dose.
- I feel that my eating is out of control.
- I alternate between eating very little and eating huge amounts.
- I would rather be thin than have good control of my diabetes.

