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Appearance Investment, Quality of Life, and Metabolic Control Among Women with Type 1 Diabetes

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Abstract
Background Concomitants of Type 1 diabetes management include weight gain and dietary restraint. Body image concerns, particularly among women, are therefore common.
Purpose The study evaluated associations between the appearance investment component of body image, age, quality of life and self-reported metabolic control were examined, along with the practice of insulin restriction as a weight control strategy.
Method A questionnaire comprising demographic and diabetes-related information, the Appearance Schemas Inventory, and Diabetes Quality of Life Brief Clinical Inventory was completed by Australian women diagnosed with type 1 diabetes (N=177).
Results Self-evaluative salience was higher among younger participants, those with a lower quality of life, and those with better metabolic control of their diabetes, with the relationships between metabolic control and all of age, quality of life, and self-evaluative salience noted to be non-linear. Among participants who reported restricting insulin for weight control, self-evaluative salience was particularly relevant. Motivational salience was not related to other study variables.
Conclusion Clinically, the provision of information regarding appearance changes that might arise in order to mitigate later body image difficulties is a potentially beneficial adjunct to standard diabetes management protocols that may lead to more successful disease adjustment.

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Keywords Type 1 diabetes · Appearance investment · Quality of life · Metabolic control · Insulin restriction

Introduction

Type 1 diabetes is a lifelong disease causing major health, social, and economic burdens for individuals with the condition, their families, and the community. The disease usually arises in childhood although it can occur at any age [1]. Onset is thought to be via an interaction of genetic predisposition and environmental triggers resulting in autoimmune destruction of the insulin-producing islet beta cells of the pancreas [2]. As these cells are destroyed, a deficiency of the hormone insulin develops. Insulin is essential for dietary carbohydrate utilization and fat metabolism [3]. Currently, there is no cure. Rather, the goal is to optimize metabolic control by maintaining blood glucose levels as near to normal as practicable [4]. In order to achieve this, individuals monitor their condition on a daily basis using finger-prick blood tests to provide feedback on the need to inject synthetic insulin. To measure longer-term control, laboratory blood tests are used to assess glycated hemoglobin (% HbA1c) which quantifies the average blood glucose level across the past 3 months. HbA1c can be indicative of recurrent episodes of both hyperglycemia (high blood sugar) and hypoglycemia (low blood sugar), respectively. That is, both high and low HbA1c levels may indicate poor control and pose a serious health risk [5].

Notably, negative body image is a key issue for women with type 1 diabetes, with its relationship to elevated HbA1c levels clearly established [6, 7]. However, a clearer understanding of the complexity of body image, particularly in chronic disease populations, requires its recognition as a multidimensional construct [8]. For example, the individual experience of body image has been described as comprising an

evaluative component (satisfaction or dissatisfaction related to magnitude of discrepancy from self-ideal) and an appearance investment component (the importance or cognitive-behavioral salience attached by the individual to perceptions of appearance) [9]. Appearance investment is further divided into self-evaluative salience, reflecting how much individuals define themselves by the importance of appearance to sense of self and self-worth, and motivational salience which is the extent to which individuals attend to their appearance by engaging in appearance-management behaviors such as grooming, focus on clothing, and weight management [10].

In comparison to the evaluative component of body image, appearance investment has been considered little in relation to people with diabetes. One exception is a study of a range of diet-related chronic health conditions (which included 20 type 1 diabetics of unspecified gender) in which cases and controls were found not to differ in either self-evaluative salience or motivational salience [11]. Importantly, there are specific image-linked experiences associated with the disease and its management that are particularly salient for women and may influence this relationship. These include weight gain resulting from the need for exogenous insulin and the continual need for dietary restraint which may involve ignoring internal cues of hunger and satiety to achieve metabolic control [12–14].

Therefore, studying appearance investment among women with type 1 diabetes serves to expand the understanding of the attitudinal, behavioral, and emotional elements of body image that may relate to adjustment for this group. This in turn may have practical implications for clinicians working with those affected as they may be able to more precisely identify and target barriers. With this in mind, the primary aim of the current investigation was to assess relationships between adjustment to diabetes (operationalized in terms of quality of life and metabolic control) and appearance investment among women. It was hypothesized that higher quality of life and better metabolic control would be associated with lower appearance investment concerns.

As noted above, both low and high HbA1c levels can indicate poor control and may therefore be associated with negative outcomes. A corollary is that metabolic control may perhaps be best characterized as a non-linear rather than linear variable. Such an association has been advocated based on biological plausibility [15], with the likely pattern an inverted U-curve. On this basis, it was therefore hypothesized that the relationship between HbA1c and quality of life would be non-linear, with both low and high HbA1c levels associated with lower levels of quality of life. Further, given the potential importance of metabolic control as a non-linear construct, ad hoc testing of other key study variables (i.e., age, disease duration, appearance investment) was also undertaken to determine the extent of this pattern.

An additional concern among type 1 diabetics, also related to body image, is the practice of insulin restriction, as it provides a unique strategy with which to control weight [12]. Considered a form of disordered eating, it involves deliberately not taking, or taking less of, a recommended insulin dose [16, 17]. A lack of insulin impairs cellular glucose uptake resulting in hyperglycemia and rapid loss of calories as glucose is excreted in urine, ultimately leading to weight loss [18]. The reported prevalence of insulin restriction for weight control is from 13 to 39 %, with its use most common among women aged between 15 and 30 years [17, 19, 20].

Insulin restriction for weight control has been found to be significantly associated with poorer metabolic control [21], higher complication rates, poorer well-being [22], and, most alarmingly, premature death [21]. Notwithstanding these potential consequences, the ease and secrecy associated with insulin restriction may present as an attractive option for women with diabetes whose body image is challenged [23]. Therefore, the final aim of the current study was to further consider the associations introduced above by examining the relevance of insulin restriction to study variables. It was hypothesized that insulin restriction, particularly for weight control, would be associated with lower quality of life, poorer metabolic control, and higher levels of appearance investment concern.

Methods

Participants and Procedure

A convenience sample targeting women with a mean age of 36 years and a diagnosis of type 1 diabetes of at least 6 months standing, with sufficient command of receptive and expressive English to allow completion of a self-report questionnaire, was recruited for the study. Age and disease duration for the final sample (N=177) are further summarized in Table 1. The exclusion of men was based on the observation that a gender difference exists for both diabetes-related quality of life and metabolic control [24]. Women with type 1 diabetes record lower quality of life and have poorer metabolic control than men.

Participation was sought in two main ways. First, a link to the questionnaire was available online for members of key Australian diabetes support groups (e.g., Diabetes Australia). Second, the lead author attended local (Adelaide, Australia) diabetes education seminars. In both cases, brief details concerning the aims of the study (lifestyle issues associated with diabetes and its management) were provided prior to access to the questionnaire. The online version was submitted anonymously and the hard copy version was returned in a reply paid envelope at participants' convenience. The study was approved by the authors' institutional ethics committee.

Table 1 Summary statistics and correlations for key study variables

	Valid *N*	Range	Mean (SD)	1	2	3	4	5
1. Age (years)	176	18–68	36.32 (11.33)					
2. Disease duration (years)	176	1–48	18.39 (11.15)	.38***				
3. Self-evaluative salience	175	1.42–5.00	3.11 (0.72)	−.35***	−.12			
4. Motivational salience	177	1.75–4.88	3.45 (0.70)	.05	−.10	.40***		
5. Diabetes quality of life	174	26–72	51.36 (8.93)	.25***	.09	−.40***	−.13	
6. Self-reported HbA1c	169	4.5–14.7	7.84 (1.63)	−.15*	−.05	.28***	−.02	−.30***

* $p \leq .05$; *** $p \leq .001$

Measures

A questionnaire was compiled specifically for the study. It contained demographic and diabetes-related information and the following validated scales.

Body Image The revised 20-item Appearance Schemas Inventory assesses thoughts about the significance of physical appearance [9] in two domains. Self-evaluative salience (12 items) assesses the extent to which individuals define self-worth by their physical appearance. Motivational salience (8 items) assesses actual engagement in appearance-management behaviors. Respondents indicate the extent to which they agree with a series of statements such as "When I see good looking people, I wonder about how my own looks measure up" (self-evaluative salience) and "I try to be as physically attractive as I can be" (motivational salience) using a 5-point scale ("strongly disagree" to "strongly agree"). In each case, responses are summed and divided by the number of items to produce scores ranging from 1 to 5. Individuals with higher scores are more schematic toward appearance (i.e., have greater self-evaluative salience or motivational salience, respectively). Reliability and validity data for this instrument are well documented [8]. Internal reliabilities (α) for the current sample were 0.87 (self-evaluative salience) and 0.84 (motivational salience).

Adjustment to Diabetes Two indices were used. First, the 15-item Diabetes Quality of Life Brief Clinical Inventory is a reliable and valid measure of perceptions of how diabetes impacts on day-to-day functioning [25]. Participants respond using 5-point scales to items that address their satisfaction ("very dissatisfied" to "very satisfied"; e.g., "How satisfied are you with your current diabetes treatment?") or seek the frequency with which they feel or act with respect to their diabetes ("all the time" to "never"; e.g., "How often do you find that you eat something you shouldn't rather than tell someone that you have diabetes?"). Items are summed (range 15–75), with higher scores indicating a better quality of life. Internal reliability for the current sample was 0.82.

Second, participants self-reported their most recent metabolic control (HbA1c) reading which was analyzed in two ways. As well as being treated as a continuous variable, categories of "low" (<6.5 %), "ideal" (6.5–7.0 %), "somewhat high" (7.1–8.0 %), and "very high" (>8.0 %) were created by the authors using locally accepted clinical classifications of HbA1c [5] and represent a practical interpretation of the control achieved by participants [26], with both low and very high readings indicating the need for proactive management.

Demographic and Other Diabetes-Related Information Chronological age and age at diagnosis were used to determine disease duration. Participants were asked whether they had ever engaged in insulin restriction and the purpose of this practice ("no," "yes—not for weight control," "yes—for weight control").

Results

Summary statistics and correlations among study variables are shown in Table 1. The first hypotheses to be tested were that quality of life and metabolic control would be associated with appearance investment concerns. In accord with these hypotheses, self-evaluative salience was inversely related to quality of life and positively associated with metabolic control. That is, self-evaluative salience was of more concern among participants with a lower quality of life and those with higher self-reported HbA1c readings. However, while motivational salience shared a significant negative correlation with quality of life, implying that higher motivational salience scores were associated with lower quality of life, it was not related to HbA1c. Other relationships of note were a negative association between self-evaluative salience and age, an increase in quality of life and lower HbA1c readings with age, and higher HbA1c readings with lower quality of life.

Associations involving metabolic control were further analyzed via a series of one-way ANOVA using the categories of low, ideal, somewhat high, and very high. The goal was to test the hypothesis that HbA1c should be considered a non-linear

variable. That is, both low and high HbA1c levels may be indicative of lower quality of life (and potentially also better reflect associations with other key variables). Table 2 displays the results. For all the variables, the test for linear trend is displayed (F_{linear}) and, in those cases for which a significant deviation from linear was also indicated, the quadratic term is shown ($F_{quadratic}$). For age, self-evaluative salience, and diabetes quality of life, the quadratic term was significant with the deviation from linear attributable to participants with a low HbA1c reading. Figure 1 presents these data graphically. Table 2 also includes measures of effect size (η^2) for these results, demonstrating the associations fell between small (.01) and medium (.06) [27]. Notably, the effect for quality of life was the largest.

The final hypotheses to be tested were that the practice of insulin restriction would be associated with lower quality of life, poorer metabolic control, and higher levels of appearance investment concern. Participants were classified as "no insulin restriction," "restriction not for weight control," or "restriction for weight control." Again, one-way ANOVAs were conducted. However, as no a priori reason existed to examine linearity for these analyses, only group differences were sought (F_{group}, Table 3). Significant effects were followed by post hoc tests using Tukey's LSD procedure. A significant effect for self-evaluative salience was obtained (effect size>medium; see Table 3), with post hoc tests suggesting that self-evaluative salience was significantly more relevant for both insulin restriction groups compared to those who had never restricted insulin. A significant effect also held for quality of life (effect size>medium), with all pairs of participant groups significantly different from each other. Quality of life was highest for those who had never restricted their insulin dose and lowest for those who had restricted insulin for weight control. Finally, a significant, albeit relatively small, effect (effect size small to medium) was evident for self-reported HbA1c. Those who had restricted insulin for weight control had higher HbA1c scores than those who had never restricted insulin.

Discussion

Type 1 diabetes is a common chronic disease that exacts a substantial personal and societal health burden. Appropriate management to avoid serious long-term consequences requires active engagement by patients in a regimen that is potentially more difficult if treatment is perceived as exacerbating body image concerns.

The core interest of the current study was the potential implication of appearance investment in diabetes adjustment, defined by quality of life and self-reported metabolic control (HbA1c). Perceptions of body image have been shown to significantly affect disease-related quality of life and health outcomes in a variety of chronic disease contexts [28–30] and are a key issue for women with type 1 diabetes [6, 7]. Weight gain resulting from the need for exogenous insulin, the continual need for dietary restraint, and the frequent need to ignore internal cues of hunger and satiety to achieve metabolic control are particularly salient [12–14]. Yet to our knowledge, this is the first study to evaluate the appearance investment component of body image (self-evaluative salience and motivational salience) in this population. Understanding the multidimensional nature of the body image construct as it relates to women with type 1 diabetes may advance knowledge regarding those elements of body image that are particularly relevant to adjustment.

Overall, self-evaluative salience was shown to be associated with more dysfunctional adjustment to type 1 diabetes, whereas motivational salience bore little relationship to disease management or quality of life. The principal findings were that higher levels of self-evaluative salience were evident among younger type 1 diabetics, those with a lower quality of life, and those with higher self-reported HbA1c readings. The implication is that the extent to which women with type 1 diabetes define or measure themselves by the importance of appearance to their sense of self-worth relates negatively to disease control and life satisfaction, particularly for younger individuals. Motivational salience was less important, being

Table 2 Evaluation of relationships between study variables and the classification of metabolic control using one-way ANOVA with planned contrasts

	Metabolic control (self-reported HbA1c)				F_{linear}	$F_{quadratic}$	η^2
	Low (n=24) Mean (SD)	Ideal (n=31) Mean (SD)	Somewhat high (n=62) Mean (SD)	Very high (n=52) Mean (SD)			
Age	33.83 (8.76)	40.52 (12.00)	37.87 (11.89)	33.76 (10.93)	0.11	7.45**	.043
Disease duration	16.63 (13.33)	18.00 (9.56)	19.89 (12.01)	17.86 (9.79)	0.42	–	
Self-evaluative salience	2.95 (0.66)	2.97 (0.74)	2.99 (0.67)	3.40 (0.69)	6.80**	4.37*	.025
Motivational salience	3.53 (0.54)	3.36 (0.72)	3.39 (0.73)	3.52 (0.70)	0.01	–	
Quality of life	53.00 (8.13)	54.17 (8.07)	53.44 (8.15)	46.59 (8.65)	9.64**	10.77***	.058

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

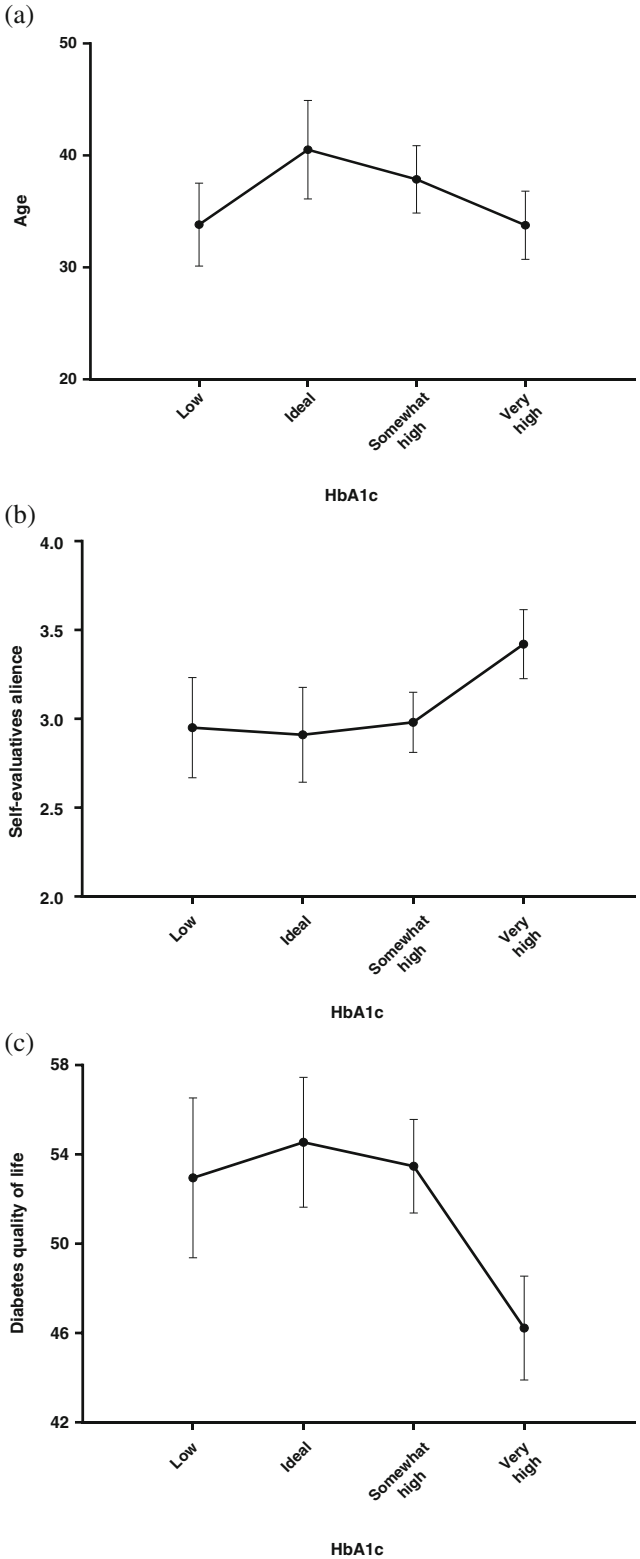

Fig. 1 Graphical representation of the non-linear associations between HbA1c and **a** age, **b** self-evaluative salience, and **c** diabetes-related quality of life, respectively. Means and standard deviations are shown

only weakly associated with lower quality of life. This suggests that the effort invested in maintaining or improving appearance, such as through specific attendance to grooming or exercise, was not a key concomitant of negative health outcomes for this sample.

This distinction between self-evaluative salience and motivational salience may be dependent upon the specifics of the sample in question. Generally, motivational salience has been reported to be neither consistently adaptive nor maladaptive [8, 31, 32]. For example, among brides-to-be, higher motivational salience was significantly associated with potentially harmful appearance-related behaviors such as tanning bed use and invasive cosmetic procedures [33]. Conversely, in healthy participants exposed to the "thin media," only high self-evaluative salience groups were found to have higher body image dissatisfaction and attach higher importance to current/ideal body image discrepancy after viewing "thin" images [31]. Data regarding the connection between fear of negative evaluation by others and dietary restraint in a non-illness population has found that both self-evaluative salience and motivational salience mediate this link [34]. Yet in studies of other disease samples (e.g., breast cancer), motivational salience has been observed to be a protective factor [35]. A key difference between diabetes and breast cancer is that only the former is directly associated with diet. Further, if motivational salience is argued to represent an attempt at control over the appearance changes characteristic of a disease and its management, again these two diseases differ markedly. Breast cancer patients have specific, effective, well-recognized behaviors that can be undertaken to modify appearance (e.g., wigs for chemotherapy-related alopecia and breast prostheses post-mastectomy), whereas in type 1 diabetes, the lack of clear image-modulating strategies could result in feelings of futility for individuals with high motivational salience. There are no obvious strategies available beyond insulin non-compliance which both the current data and past studies have demonstrated to be contraindicated, both medically and psychologically [12, 16, 18].

The potential use of insulin restriction as a weight control strategy cannot be overstated and warrants a more focused examination in relation to appearance investment. Although its reported use in the current sample (21 %) is in accord with other published data of between 13 and 39 % [17, 19, 20], the ability to explore this issue in detail with the available data was limited. Issues such as timing (i.e., age), frequency, and intensity could usefully be explored in future studies of appearance investment with similar samples. As is common in studies of disease processes, both objective measures of insulin restriction rather than self-report and the ability to monitor behaviors longitudinally would be beneficial. However, such enquiries are encouraged as the current data suggest self-evaluative salience is more relevant to participants who reported restricting insulin to achieve weight control. Further, those who reported insulin restriction had poorer metabolic control and also a lower quality of life. While the associated effect

Table 3 Evaluation of relationships between study variables and the restriction of insulin using one-way ANOVA with post hoc tests for group differences

	No restriction (n=49) Mean (SD)	Restriction not for weight control (n=91) Mean (SD)	Restriction for weight control (n=37) Mean (SD)	F_{group}	η^2
Age	38.98 (13.97)	36.16 (10.48)	33.19 (8.54)	2.83	.032
Disease duration	19.00 (12.75)	19.01 (11.50)	16.08 (7.33)	1.01	.012
Self-evaluative salience	2.87 (0.63)	3.09 (0.68)	3.47 (0.80)	7.86***	.084
Motivational salience	3.48 (0.64)	3.35 (0.75)	3.64 (0.59)	2.27	.025
Quality of life	54.60 (8.97)	51.22 (8.12)	47.49 (9.39)	7.13***	.077
Self-reported HbA1c	7.51 (1.52)	7.79 (1.53)	8.37 (1.89)	2.97*	.035

* $p \leq .05$; *** $p \leq .001$

sizes were of relatively modest size (.035–.084), it would appear that despite attempts to address body image concerns using this potentially harmful strategy, such actions did not benefit adjustment.

As noted above, Quick and colleagues [11] have previously compared appearance investment between a small subsample of individuals with type 1 diabetes and control participants, finding that neither self-evaluative salience nor motivational salience differed. However, the current study is quite different, as our sample was larger and expressly of diabetes participants, with a focus on the association between appearance investment and adjustment. Conversely, we did not assess disturbed eating behaviors and related psychographic characteristics. However, the value of a comparison group should not be discounted. Without, for example a non-diabetes control group, any assertion that the associations highlighted are unique to women with diabetes is inappropriate. Future research may usefully combine elements of these two studies to further reveal characteristics that may impede or enhance adjustment.

Finally, study hypotheses also focused on the potential value in analyzing metabolic control as a non-linear variable. Self-reported HbA1c shared a non-linear association not only with quality of life but also with age and self-evaluative salience. Again, the effect sizes associated with these results were not large, yet such observations are in accord with biological theory [15]. Despite this, non-linear associations are rarely considered by social and psychological theorists or clinicians engaged in diabetes research. As such, it remains an untapped area of enquiry that may serve to further explain diabetes self-management behavior and outcomes. To summarize, the current data suggest that both ends of the metabolic control spectrum need to be recognized as potentially detrimental to patient well-being. Further, the precise pattern of results, with hyperglycemia (high HbA1c levels) being more problematic than hypoglycemia, confirms previous speculation with respect to quality of life [15]. The additional contribution of the current study had been the identification of this pattern also for self-evaluative salience.

In summary, findings demonstrated that perceptions of body image, specifically self-evaluative salience, relate to the degree of successful diabetes adjustment. At the clinical level, the implication is that understanding patients' body image as a multidimensional construct, including the perception and importance attached to it, could be a beneficial adjunct to achieve improvement in blood sugar control and a better quality of life. Appropriately assessing patients' body image problems as they result from the real or perceived effect of diabetes management with insulin, providing accurate education and prospectively informing women of the appearance changes that might arise from management, and, in turn, developing individually tailored healthy behavioral strategies in order to mitigate body image difficulties are potentially beneficial adjuncts in successful disease adjustment.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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