ORIGINAL SCIENTIFIC PAPER

ORIGINAL RESEARCH: CLINICAL

Agreement between parental perception of child weight status and actual weight status is similar across different ethnic groups in New Zealand

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ABSTRACT

INTRODUCTION: Accurate parental perception of their child's weight is poor. Accuracy may be influenced by differences in ethnicity but this is currently unknown.

AIM: To determine whether agreement between parental perception of child weight status and actual child weight status differs according to ethnic group (NZ European, Māori, Pacific, Asian), and to investigate whether it is influenced by various demographic and behavioural factors.

METHODS: A total of 1093 children (4–8 years old) attended a weight screening initiative. Parents completed questionnaires on demographics, beliefs about child weight, parenting style, parental feeding practices and social desirability. Actual measured weight status was compared with parental perception of weight status (underweight, normal weight, overweight).

RESULTS: Agreement about child weight status was apparent in 85% of NZ European, 84% of Māori, 82% of Pacific and 88% of Asian children. However, adjusting for chance led to kappas of 0.34, 0.38, 0.41 and 0.53, respectively, indicating only fair-to-moderate agreement. Overall, agreement between measured body mass index and parental perception was not related to ethnic group, child sex and age, maternal age and education, and household deprivation (k ranged from 0.16 to 0.47). However, agreement about weight status was higher in parents who reported higher levels of restrictive feeding than in parents who reported less restriction ($P < 0.01$) but agreement was only fair.

CONCLUSION: Agreement between parental perception and actual weight status was fair and did not differ between the ethnic groups examined.

KEYWORDS: Ethnicity; parental perception; child; overweight; BMI

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Introduction

In the past 30 years, the prevalence of overweight and obesity has rapidly increased worldwide, with more than 20% of boys and girls now considered to be overweight or obese.[1] Obesity rates are similar in New Zealand, and vary with ethnicity, with overweight and obesity rates as high as 45% and 55% in Māori and Pacific children, respectively.[2]

Despite this widespread phenomenon, there is overwhelming evidence that the majority of parents with overweight children fail to recognise their child as such.[3,4] Several characteristics are thought to influence parental recognition of overweight in their children, including age, sex and weight status of the child,[5–10] as well as weight and educational level of the parents, and family income.[6,7] A limited number of studies

internationally suggest that ethnic differences in parental perception may be apparent because larger body sizes are more tolerated in certain ethnic groups.[11–13] However, although parental underestimation of child weight appears common among all parents, regardless of ethnic group, whether accuracy in perception varies among different ethnic groups in New Zealand is unknown.

Given the lack of comparable research in New Zealand Māori, and the clear disparities in weight status and weight-related comorbidities between ethnic minorities and New Zealand Europeans,[2] the aims of our study were to: (1) determine whether the level of agreement in parental perception of child weight status and children's actual weight status differed according to child ethnic group; and (2) examine other factors that might underlie weight misperception within an ethnically diverse population in New Zealand.

WHAT GAP THIS FILLS

What is already known: Parental perception of overweight in their child is poor and a limited number of studies suggest that ethnic differences in parental perception exist.

What this study adds: Parental perception of their child's weight does not appear to differ across ethnic groups in New Zealand and is not related to behavioural or demographic differences.

Methods

This analysis involved Phase 1 of our Motivational Interviewing and Treatment (MInT) study, which investigated different methods for informing parents that their young child was overweight or obese after a weight screening initiative. Ethical approval was obtained from the Lower South Regional Ethics Committee (LRS/09/09/039) and all parents gave informed consent.

The study has previously been described in detail.[14] In brief, all families with children aged 4–8 years enrolled at nine participating general practices or attending secondary care clinics were invited to participate in a comprehensive health check. Children were excluded if they had severe childhood arthritis, severe asthma, cystic fibrosis, inflammatory bowel disease, congenital or chromosomal abnormalities, severe developmental delay, were on medication that may influence body composition or their families were not planning to remain in the region for the next two years.

At the health check session, duplicate measures of height (Tanita portable stadiometer) and weight (Tanita BC-418) were obtained following standard techniques, and body mass index (BMI) was calculated. BMI z-scores were obtained using USA reference data,[15] and body composition was assessed using bioelectrical impedance (Tanita BC-418). Excess body fat was defined using the age- and sex-specific body fat criteria, described by McCarthy *et al*.[16] While children were being measured, their main caregiver (virtually all mothers) completed a comprehensive online questionnaire assessing demographic characteristics including child ethnic group, maternal education and maternal age. Child ethnicity was categorised as New Zealand European and Others (NZEO), Māori, Pacific or Asian. The 'Other' ethnic group (comprising mainly Middle Eastern, Latin American and African ethnic groups) has been combined with 'European' due to small numbers. An index of socioeconomic status (New Zealand deprivation index, NZDep2006[17]) was obtained from their residential address. Parents were also asked to complete questionnaires on parenting style[18] and feeding practices,[19] as described below. The Comprehensive Feeding Practices questionnaire has 12 subscales including monitoring, environment, use of food as a reward, restriction for weight and restriction for health. Parental perception of their child's weight status was assessed using a five-point Likert scale question (where 1 = underweight; 2 = a little underweight; 3 = about right; 4 = a little overweight; 5 = overweight for levels of perception). Scores of 1 and 2 were combined to describe underweight and scores of 4 and 5 were combined to describe overweight for final analyses. Parent scores were then compared to the child's actual BMI classification where underweight ≤ 3rd centile; normal weight = 3rd–84th centile; overweight and obese ≥ 85th centile. Social desirability was assessed using the 13-item short form of the Marlowe–Crowne Social Desirability scale (MCSDS), where higher scores indicate more generally

socially desirable responses.[20] Maternal BMI was obtained for 97% of mothers (3% missing), with 49% from duplicate measurements in the clinic and 48% from self-reported data. Once the questionnaire had been completed, parents were informed about the weight status of their child.[21]

Statistical analyses

Descriptive statistics were used to summarise the characteristics of the sample. Cross-classification was used to show the correspondence between perceived weight status (the proxy measure) and actual weight status (the gold standard), classified as underweight, normal weight and obese for each ethnic group. As the interpretation of agreement between a proxy measure and a gold standard depends on chance, the kappa statistic is used to assess agreement.[22] As ethnicity was our primary focus, we calculated a weighted kappa for the whole sample and separately for each ethnic group. Because we were also interested in several other variables, we used two comprehensive ordinal logistic regression models, with a cumulative logistic link, to estimate the marginal probabilities of obtaining the three outcomes in the proxy and gold standard measure. These were used to estimate chance agreement, which was then used to adjust agreement to obtain Cohen's kappa. Linear regression was used to obtain estimates of kappa for several variables of interest. The method is described in detail by Lipsitz *et al*.[23] Kappa statistics measure the level of agreement between two measurements beyond what would be expected by chance. Kappa values were interpreted as follows: $k < 0.00$ = poor agreement; k between 0.20 and 0.40 = fair agreement; k between 0.40 and 0.60 = moderate agreement; k between 0.61 and 0.80 = good agreement; and $k \geq 0.80$ = very good agreement.[22]

Results

A total of 1093 children attended the health check session (Table 1). Similar to current New Zealand population data,[24] 15% of children were classified as overweight (BMI $\geq 85^{th} < 95^{th}$), with an additional 10% being classified as obese (BMI $\geq 95^{th}$).

Agreement between the parental perception of weight status and actual weight status was 85% for the whole sample. As the chance agreement was 76%, kappa was 0.35 (95% CI: 0.32, 0.39), showing that agreement was only fair. The percentage agreement and kappa values were 85% and 0.34 (CI: 0.29, 0.38) for NZEO, 84% and 0.38 (CI: 0.28, 0.48) for Māori, 82% and 0.41 (CI: 0.20, 0.62) for Pacific and 88% and 0.53 (CI: 0.35, 0.72) for Asian children.

While differences between ethnic groups in the proportion of parents correctly identifying their child as being overweight were not apparent (Table 2), mean BMI z-scores (data not shown) were significantly higher in Māori and Pacific children ($P < 0.01$) compared to NZ European and Asian children, indicating that Māori and Pacific children may be significantly more overweight before parents accurately identify the problem. Misclassification of weight status using percentage fat cut-offs showed similar results, with more than half of parents of children with body fat percentages above the 85th percentile rating their child as normal weight (Table 3). Percentage agreement and kappa for fat percentage were 67% and 0.35 (CI: 0.30, 0.40) for the whole sample, 67% and 0.34 (CI: 0.28, 0.39) for NZEO, 66% and 0.36 (CI: 0.23, 0.49) for Māori, 78% and 0.56 (CI: 0.31, 0.80) for Pacific and 60% and 0.20 (CI: –0.01, 0.42, $P = 0.04$) for Asian children.

Table 4 reports the level of agreement between parental perception and actual weight status for a variety of demographic and behavioural measures. The kappa values in the first column indicate the level of agreement for each of the variables of interest. Although the agreement between perception and actual weight is higher than that expected by chance, the kappa values of 0.16 to 0.47 indicate poor to fair agreement. After adjusting for sex, ethnic group, household structure, maternal age and BMI, deprivation score, child health, concern about weight and ratings of physical activity, the overall chance agreement increased to 58% and the magnitude kappas estimated from the regression model were similar (Table 4).

Differences in kappa between different categories of a particular variable are shown in the second column. For example, while agreement between perceived and actual weight status was apparent for each individual ethnic group, there were no differences in the level of agreement, above that

Table 1. Characteristics of the study population

Variable	Category	*n* (%)
Age (years)		6.5 (1.4)
Sex	Male	543 (50)
	Female	550 (50)
Ethnic group[A]	NZ European and Others (NZEO)	851 (78)
	Māori	151 (14)
	Pacific	42 (4)
	Asian	47 (4)
Household deprivation[B]	NZ deprivation index low (1–3)	425 (39)
	NZ deprivation index medium (4–7)	412 (38)
	NZ deprivation index high (8–10)	224 (21)
Maternal education[C]	Some secondary	293 (27)
	Completed secondary	73 (7)
	Other tertiary qualification	224 (21)
	University degree	448 (41)
	Other	44 (4)
Household structure[D]	Two adult (including partner)	922 (84)
	One adult	132 (12%)
	Other (including other relative)	38 (4%)
Child weight status	Underweight ($<5^{th}$)	15 (1%)
	Normal weight ($5^{th} \leq$ BMI $< 85^{th}$)	807 (74%)
	Overweight ($85^{th} \leq$ BMI $< 95^{th}$)	166 (15%)
	Obese (BMI $\geq 95^{th}$)	105 (10%)
Maternal weight status[E]	Normal weight ($18.5 \leq$ BMI < 25)	458 (43%)
	Overweight ($25 \leq$ BMI < 30)	319 (29%)
	Obese (BMI ≥ 30)	273 (25%)

Data are presented as *n* (%) except for age, which is mean (s.d.). Data were missing for 1[A], 32[B], 11[C], 1[D] and 43[E] participants.
NZ, New Zealand; BMI, body mass index.

expected by chance, *between* the ethnic groups. Similarly, differences in the other measured behavioural and demographic variables did not influence the level of agreement. The single exception observed was for restrictive feeding practices; the level of agreement was higher for parents in the highest quarter of restrictive feeding, with an increase in kappa of 0.24 compared with the lowest quarter ($P = 0.02$). However, this finding should be interpreted with caution as agreement is poor in both cases and a large number of tests were undertaken.

Discussion

Consistent with international findings, parents of New Zealand children do not recognise excess weight in their overweight child. Importantly, this lack of agreement does not differ by ethnic group, with parents of children from all four groups studied reporting similar low levels of agreement. Level of agreement in parental perception is also not associated with any other demographic variable tested.

Despite similar levels of agreement among parents, the BMI z-scores among Māori and Pacific children were significantly greater compared to their Asian and NZEO counterparts. Qualitative studies have shown that Māori and Pacific families do not believe the bodyweight of their child is an issue until there are signs that it is directly affecting the child concerned, either

Table 2. Misclassification of weight status by ethnic group

	Actual weight status	Perceived weight status			Total
		Underweight	Normal weight	Overweight	
		% within actual weight status category			
NZEO	Underweight	8 (80)	2 (20)	0	10
	Normal weight	128 (20)	510 (79)	12 (2)	650
	Overweight	5 (3)	109 (57)	78 (41)	192
Māori	Underweight	2 (100)	0	0	2
	Normal weight	17 (17)	81 (81)	1 (1)	99
	Overweight	0	30 (60)	20 (40)	50
Pacific	Underweight	0	0	0	0
	Normal weight	5 (23)	17 (77)	0	22
	Overweight	0	10 (50)	10 (50)	20
Asian	Underweight	3 (100)	0	0	3
	Normal weight	6 (17)	28 (80)	1 (1)	35
	Overweight	0	4 (44)	5 (56)	9

Data presented as *n* (% within actual weight status category). NZEO, New Zealand European and Others; Normal weight, body mass index (BMI) <85th centile; overweight, BMI 85th–95th centile; obese, BMI <95th centile.[17]

Table 3. Misclassification of weight status according to % fat cut-offs by ethnic group

	Percentage fat 85th centile cut-off	Perceived weight status			Total
		Underweight	Normal weight	Overweight	
		% within actual weight status category			
NZEO	Below	10 (2)	398 (92)	27 (6)	435
	Above	0	250 (60)	164 (40)	414
Māori	Below	2 (3)	55 (86)	7 (11)	64
	Above	0	44 (51)	43 (49)	87
Pacific	Below	0	15 (88)	2 (12)	17
	Above	0	7 (30)	16 (70)	23
Asian	Below	2 (9)	19 (83)	2 (9)	23
	Above	1 (4)	16 (67)	7 (29)	24

Data presented as *n* (% within actual weight status category). NZEO, New Zealand European and Others; Normal weight, body mass index (BMI) <85th centile; Overweight, BMI 85th–95th centile; Obese, BMI > 95th centile.[17]

physically or mentally.[25] Given the high rates of obesity among Māori and Pacific families, heavier children may be more prevalent, making visual comparison with peers an unreliable indicator of overweight status for parents. Although some international studies have reported that Latino/Hispanic[26] and African-American parents[13] prefer large body types and do not identify their child's excess weight as a problem, recent reviews suggest that parental underestimates of overweight/obese status is a common phenomenon among parents of overweight/obese children, regardless of the child's ethnic group, gender or the parent's age or own weight status.[4,27]

From a clinical perspective, recognition of overweight before the child is above the 95th centile is important.[28] Inaccurate perception of overweight at lower BMI z-scores means that Māori and Pacific parents may not seek treatment for their child until they are considerably more overweight. In turn, this conceivably limits introducing smaller,

Table 4. Strength of agreement and linear regression estimates between perception of child weight status by parent and measured body mass index (BMI) categories based on Cohen's kappa

		Kappa (95% CI)	Difference in kappa (95% CI)
Child age (years)	<5	0.16 (0.01, 0.31)	
	5–7	0.27 (0.16, 0.38)	0.11 (–0.08, 0.29)
	≤10	0.33 (0.22, 0.45)	0.17 (–0.02, 0.35)
Child sex	Male	0.24 (0.15, 0.34)	
	Female	0.30 (0.20, 0.40)	0.06 (–0.08, 0.20)
Child ethnic group	NZ Euros	0.25 (0.17, 0.33)	
	Māori	0.36 (0.18, 0.54)	0.11 (–0.08, 0.31)
	Pacific	0.37 (0.05, 0.68)	0.12 (–0.21, 0.44)
	Asian	0.36 (0.03,0.69)	0.11 (–0.23, 0.45)
Household deprivation	Low	0.31 (0.20, 0.42)	
	Medium	0.28 (0.16, 0.39)	–0.04 (–0.19, 0.12)
	High	0.20 (0.06, 0.34)	–0.11 (–0.29, 0.07)
Household structure	Two parent	0.26 (0.19, 0.34)	
	Single	0.38 (0.20, 0.57)	0.12 (–0.08, 0.32)
Maternal education	Secondary	0.27 (0.16, 0.38)	
	Tertiary	0.27 (0.11, 0.43)	0.00 (–0.19, 0.19)
	University	0.28 (0.17, 0.39)	0.02 (–0.14, 0.17)
Maternal age (years)	<35	0.20 (0.08, 0.33)	
	35–40	0.27 (0.16, 0.39)	0.07 (–0.10, 0.24)
	> 40	0.33 (0.21, 0.45)	0.13 (–0.05, 0.30)
Maternal weight	Normal weight	0.23 (0.12, 0.34)	
	Overweight	0.30 (0.17, 0.42)	0.06 (–0.11, 0.22)
	Obese	0.32 (0.20, 0.44)	0.09 (–0.08, 0.25)
Social desirability[A]	1st quarter	0.22 (0.04, 0.40)	
	2nd quarter	0.22 (0.04, 0.39)	–0.01 (–0.26, 0.24)
	3rd quarter	0.27 (0.08, 0.45)	0.04 (0.22, 0.30)
	4th quarter	0.47 (0.21, 0.73)	0.24 (–0.07, 0.56)
Parenting score	1st quarter	0.26 (0.11, 0.41)	
	2nd quarter	0.21 (0.06, 0.36)	–0.05 (–0.26, 0.16)
	3rd quarter	0.24 (0.10, 0.39)	–0.02 (–0.23, 0.19)
	4th quarter	0.22 (0.06, 0.38)	–0.04 (–0.25, 0.18)
Feeding practices			
Healthy eating	1st quarter	0.29 (0.14, 0.43)	
	2nd quarter	0.14 (–0.01, 0.30)	–0.14 (–0.36, 0.07)
	3rd quarter	0.27 (0.13, 0.40)	–0.02 (–0.22, 0.18)
	4th quarter	0.22 (0.06, 0.39)	–0.06 (–0.28, 0.16)
Monitoring	1st third	0.20 (0.09, 0.31)	
	2nd third	0.30 (0.10, 0.49)	0.09 (–0.13, 0.32)
	3rd third	0.26 (0.14, 0.37)	0.06 (–0.10, 0.22)

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Table 4. (continued)

		Kappa (95% CI)	Difference in kappa (95% CI)
Parent pressure	1st quarter	0.21 (0.06, 0.35)	
	2nd quarter	0.31 (0.18, 0.45)	0.11 (–0.09, 0.31)
	3rd quarter	0.30 (0.16, 0.45)	0.10 (–0.10, 0.30)
	4th quarter	0.06 (–0.13, 0.24)	–0.15 (–0.38, 0.09)
Child control	1st quarter	0.29 (0.15, 0.43)	
	2nd quarter	0.19 (0.06, 0.33)	–0.10 (–0.29, 0.10)
	3rd quarter	0.32 (0.17, 0.46)	–0.03 (–0.17, 0.23)
	4th quarter	0.06 (–0.13, 0.26)	–0.23 (–0.46, 0.01)
Restriction	1st quarter	0.13 (–0.02, 0.28)	
	2nd quarter	0.18 (0.04, 0.32)	0.05 (–0.15, 0.25)
	3rd quarter	0.28 (0.11, 0.44)	0.15 (–0.08, 0.37)
	4th quarter	0.37 (0.22, 0.53)	**0.24 (0.03, 0.46)***

* $P < 0.05$. [A]Data only available for 601 cases. Data analysed using Cohen's kappa and kappa linear regression. CI, confidence interval.

more achievable behavioural changes and means larger changes are required to make a difference to weight; posing a greater challenge. Given the high risk for adult obesity and obesity-related conditions among Māori and Pacific people, and the high rates of overweight in their children,[24] improving accuracy in identification at earlier stages of overweight is warranted.

While several studies have identified that parental perception of their children's weight status is poor, the reasons for this misperception are not clear. Some suggest mothers may put greater emphasis on other factors such as physical activity and social participation,[29] or may be better at identifying excess weight in older rather than younger children.[5] In a large, representative sample of children aged 5–12 and 13–17 years in Ireland, Hudson *et al.*[7] reported that inaccurate perception of overweight was higher in younger children and suggested that lack of awareness may be particularly evident for younger children because the prevailing health message to mothers of young children is to encourage growth and keep pace with centile charts. For comparison, we calculated the kappa coefficient on the whole sample, categorising the groups into normal weight and overweight and obese (2×2 table) from the results reported by Hudson *et al.*[7] Similar to our results, the level of agreement was fair in this sample ($k = 0.30$); therefore, it is feasible that the higher levels of agreement at older ages reported by Hudson *et al.*[7] may have been due to chance. However, given that other studies[6,30] have shown parents are better at correctly identifying overweight in older versus younger children and the relatively restricted age range in our study, further research is required.

Unlike previous studies that have reported associations between parental misclassification and factors such as sex of the child,[31] low maternal education level,[32] lower socioeconomic status[7] and higher maternal BMI,[33] our study found no relationship with these variables. However, none of the previous research has adjusted for chance agreement (such as by using Cohen's kappa), which could lead to inflated estimates and false conclusions. In our study, those who reported the highest level of restrictive feeding practices were significantly more accurate at perceiving overweight in their child. Several recent studies have also demonstrated an association between restrictive feeding and accurate perception of their child's weight.[34–36] Although cross-sectional studies such as ours cannot demonstrate causality, previous studies have also reported that parents use restrictive feeding practices to a greater extent when they are concerned about children's weight.[36] Although earlier work thought that higher maternal restriction increased the risk of

future weight gain[37,38] or eating in the absence of hunger,[38] more recent work has shown that higher degrees of maternal restriction are associated with decreased BMI in longitudinal analyses.[39,40] Given these conflicting data, it is important for health professionals to understand that parents who have high levels of concern for their child's weight may use restrictive feeding practices that could have unintended consequences.[36]

The strengths of our study include the use of Cohen's kappa to control for chance agreement and our recruitment strategy. We also included objective measures of height and weight. Because some debate remains over the comparability of BMI as a measure of body composition in children from different ethnic groups,[41,42] we were also able to show that parental inaccuracy in perception is not because BMI does not distinguish between body composition differences in children from different ethnic groups. This observation supports earlier work from our group, showing that parental perception is poor even when accurate estimates of body composition are obtained by dual-energy x-ray absorptiometry.[3] Our study also has some limitations. Although more than half of mothers' heights and weights were directly measured, 48% were self-report and therefore maternal BMI may have been underestimated. Education levels were high, with 40% of mothers having a university degree, although a wide range of household deprivation was still observed. Our participants were mainly European, with underrepresentation of Pacific Island (8%) and Asian (12%) children.[43] However, our numbers of Māori children reflected national figures (15%) and were higher than is typically observed locally (8%).[43] No formal power analysis was performed for the outcomes of interest. Instead, the statistical power is reflected in the widths of the reported confidence intervals. As the upper limits for the confidence intervals generated around the overall and subgroup kappas only surpassed 0.6 (our criterion for acceptable agreement, indicating 'moderate agreement') in two subgroups (Pacific and Asian, which were also the smallest subgroups), we can be confident in our conclusions that agreement between perceived and actual child weight status in our study was below acceptable levels overall and for all other subgroups (European and Māori). So, for this purpose, the secondary analysis was sufficiently powered, aside from those subgroups (Pacific and Asian). However, the relatively wide confidence intervals for differences in kappa between subgroups did not allow us to rule out potentially interesting differences in agreement between all pairs of subgroups.

In conclusion, despite the lack of evidence that ethnic group plays a role in parental misperceptions, the consequences of such misperception may be greater for Māori and Pacific children. This observation emphasises the importance of clinicians discussing the weight status of Māori and Pacific children with their parents as early as possible. However, given that many of the behavioural and demographic variables were unrelated to accuracy of parental perception of their child's weight status, clinicians should inform all parents, regardless of ethnic group, education or household deprivation, of their child's weight status and provide appropriate information to reduce the risk of their child becoming an overweight adult. Improved understanding of parental perception may improve how the risks of overweight are communicated to all parents and can increase engagement with behavioural interventions.[21] It may be important for clinicians to reframe discussions of weight in terms of concern for future overweight as opposed to identifying current overweight, which may avoid the stigma of parental blame and initiate behaviour change.

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