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Body height of migrants reflects their state of social integration

Christiane Scheffler[1] • Michael Hermanussen[2]

University of Potsdam, IBB, Human Biology, 14469 Potsdam, Germany
Aschauhof, 24340 Eckernförde – Altenhof, Germany

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Correspondence to:

Christiane Scheffler
email: christiane.scheffler@uni-potsdam.de

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Abstract

Background Transmitting and receiving status information, including aspects of self-perception, emotions, and anticipated social position, belongs to the essential characteristics of social networks. This also applies to migrants who often differ from their hosts, not only in behaviour and culture, but also in physical appearance. As we consider body height as a signal of social status, we adapt the transmitter-receiver model to emphasize the impact of social signalling for the regulation of height in migrants.

Sample and Methods Existing data of height and social context of migrants of different origin to new societies.

Results Body height of migrants not only differs from that of their host communities, but also from that of their communities of origin. Turkish and Vietnamese migrants in Germany are taller than the counterparts in the country of origin and adjust in body height to their hosts during adolescence according to their sense of belonging to the new community. For Turkish migrants the effect is smaller in the Netherlands. On the other hand, children of former Dutch colonials in Indonesia were even taller than their relatives in the Netherlands.

Conclusion Body height is a social signal associated with the perception of social belonging and position. Height of migrants reflects their current state of integration within the new community. The differences in the height of Turkish migrants in the Netherlands and in Germany appear to reflect the current differences in the national integration policies.

Take-home message for students Migrant adolescents adjust in body height to the height of their host community. The transmitter-receiver model appears appropriate for describing the effects of emotional acceptance and the state of social integration within the new community on the growth of migrants.

Introduction

Since prehistory, migration is a part of history of humankind. Migration is a normal pattern of life (Castles 2010). Push-Pull factors (Ravenstein 1885; Hagood and Ducoff 1946) like economic, political, cultural, and environmental forces, but also climate change (Milán-García et al. 2021) and the risk of conflict (Burrows and Kinney 2016) prompt people to leave their original social network and escape poverty, fear, ecological disasters, and unemployment. Migrants enter a new social network where they hope to find safety, opportunity, stability, and freedom.

Migrants may arrive alone, in groups or as families (Gratton et al. 2007) and have to be open for the new situation. Mostly, they need to adapt within their new social network, but also to acculturate and identify with their new home country (Waldinger 2008). Yet, migrants often maintain cross-border links to their origin communities (Mouw et al. 2014).

At arrival, migrants tend to be marginalised resp. excluded. Depending on the interplay between the culture of origin and the new culture with new social networks migrants often create parallel social networks outside the networks of their hosts. In other cases migrant networks can be integrated as a part of the new social network (van Berkel et al. 2002), but complete inclusion is unlikely at least in the first migrant generation (Fig. 5a).

Migrants often differ from their hosts, not only in behaviour and culture, but also in physical appearance. People who migrate from economically less privileged into wealthier countries tend to be shorter than their hosts. But already the first generation of children usually adapts in body height to the height of their new host peer groups during the process of assimilation. This is common knowledge and has first been published almost a century ago. The first generation of Japanese migrants in the US at the beginning of the 20th century was taller than their relatives in Japan (Spier and Stern 1929).

Conventional wisdom still attempts to explain the adjustment in height of migrants by their adaptation in eating habits, housing, sanitation and health conditions, and a cursory glance at the current literature seems to confirm this preconception.

But an increasing number of observations in stunted populations meanwhile questions a relevant association between being shorter than global references and undernutrition (Scheffler et al. 2019; Scheffler and Hermanussen 2022; Goudet et al. 2019; Griffen 2016; Kristjansson et al. 2015; Uauy et al. 2011; Roberts and Stein 2017; Mumm and Scheffler 2019; Joe et al. 2019). This was shown in countries of the Global South, and also in well-developed populations (Pospisil et al. 2017). The seemingly obvious association between nutrition and body height is deceptive. This becomes even more evident when considering historic data that deal with a different type of migration: growth of the elites.

European children of the colonial masters who were raised under the difficult health and climatic conditions of tropical countries grew significantly taller not only than their colonized subjects. Very convincing data have been published by Haas in 1931. Dutch children raised in Indonesia were even taller than their contemporary Dutch cousins raised in Amsterdam and still taller than European Dutch boys raised 25 years later after the Second World War (Fig. 1). These data strongly suggest that nutrition is not the major regulator of human growth. A closer look at the growth patterns of migrant children reveals a much more nuanced pattern that includes the social situation.

Thus, we will focus not so much on the usual physical explanations for the growth regulation of migrant children and ado-

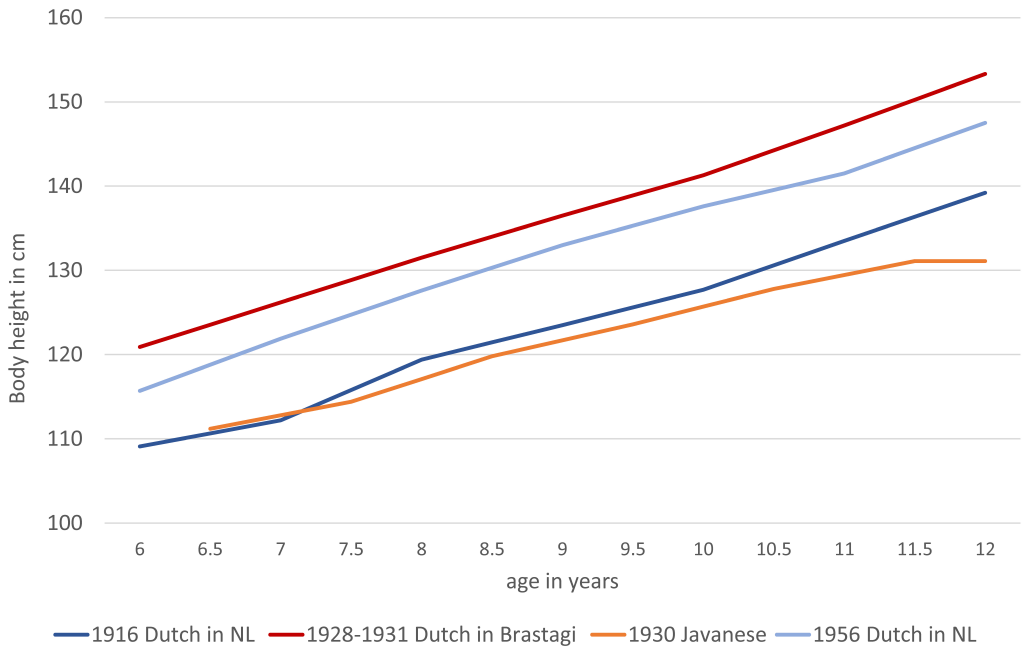


Figure 1 Body height of 6- to 12-year-old Dutch boys in the Netherlands in 1916 and in 1956, of Dutch boys/sons of colonists of Java and the Javanese boys around 1930 (Haas 1931; Wieringen 1972).

lescents, but on the social aspects of geographic relocation: We will focus on the perception of the personal position that has been attained within the new social network, and its potential impact on growth.

Children who enjoy or even, only expect improvements of their economic and social conditions grow better than children under stationary living conditions. This is particularly true for children who left their country of origin.

Several studies underscore the influence of the personal perception of being part or not being part of a particular community, on growth. Body size influences the perception of the social status and in turn, perceived social status influences growth (Aßmann and Hermanussen 2013; Bogin 2021; Hermanussen et al. 2022; Hermanussen et al. 2025). These studies suggest an interaction between the individual perception of the anticipated social and economic status, and height. The influence appears to be greater than the influence of the mere physical conditions including overall health and nutrition, on height.

Within their respective social groups, people perceive their environment, their cultural surrounding, and this perception reflects and interacts with the degree of well-being, the perception of health and disease, and the response to disease (Lebowitz 1975). The social milieu exerts complex, though often indirect influences on individual behaviour. Adolescents are particularly vulnerable to these influences because of the still incomplete maturation of the neural system (Lamblin et al. 2017). Adolescence is the biological age, where individuals may be self-sufficient in physical terms but socially and emotionally highly dependent on peers (Bogin et al. 2018) and start

to strongly anticipate their future social role. The pivotal role of social, economic, and political factors (SEPE) (Bogin 2021) and their emotional perception on the regulation of body height (Hermanussen et al. 2022; Scheffler and Hermanussen 2025) has recently been stressed.

Participants of social networks exchange information. Transmitting and receiving status information belongs to the essential characteristics of these networks. In order to better understand this interaction we adapt the transmitter-receiver model initially developed in the 1940s by Claude Shannon (Shannon 1948) for technical purposes and further specified by Erving Goffman (Goffman 1971) to describe human communication. We consider this approach appropriate to also describe the process of migrant integration into the community of their hosts, and to explain the adaptation of body height during this process.

Let us consider the host as the initial transmitter of various signals that are received by the migrant when entering the new community. The migrant decodes these signals and transmits an individual response according to his perception. This response is in turn perceived by the host (Fig. 2).

Initial signals from members of the host community (transmitters) simply coding: "Hey, you are new in our community", may be perceived as a signal of hospitality: "Yes, I am welcome", and may in turn trigger the desire to integrate and become similar (Fig. 3a). On the other hand, when the same signal is differently decoded and perceived as rejection, feelings of discomfort are triggered ("Yes, but I do not feel well") and sensations of failure are transmitted to the host ("I want to be like you, but I failed") (Fig. 3b).

In the first case, the migrant is happy, successfully transmits feelings of happiness to the host and in turn, receives the confirmation of acceptance: "You are welcome". Now, he feels accepted as a new member of the community and can start to assimilate ("I am like you"). In the second case, the migrant is unhappy and transmits feelings of failure that result in rejection ("You will not be part of us") that is perceived as "I am not a member of the community". The migrant will not integrate and not assimilate.

Sending and decoding signals depend on cultural experiences. Behaviour, language, and physical signs among which bodily appearance plays a major role (Hermanussen and Scheffler 2016), shape the process of signalling and decoding within social networks.

We hypothesize that body height of migrants reflects the self-perception of their future role and their anticipated social position within the new social network of their hosts. We will test the hypothesis in different migrant populations.

Sample and Method

We reused data of body height of Turkish and Moroccan migrants in the Netherlands (Dijkshoorn et al. 2011), Turkish migrants in the Netherlands and Germany (Baran et al. 2024), male Turkish migrants (Özer and Scheffler 2018),Turkish migrant adolescents (Fritsch and Scheffler 2025) and Vietnamese migrants in Germany (Scheffler et al. 2021). All data of body height were collected in different context (Tab. 1). Two studies (Özer and Scheffler 2018; Scheffler et al. 2021) were conducted to analyse SEPE-factors on the regulation of body height. Relevant information was collected with specific questionnaires about e.g., education, peer-groups in childhood and adolescence, nutritional behave, sense of belonging to host and origin culture. Detailed information about data collection, statistical analysis, and limitations is given in the original publications.

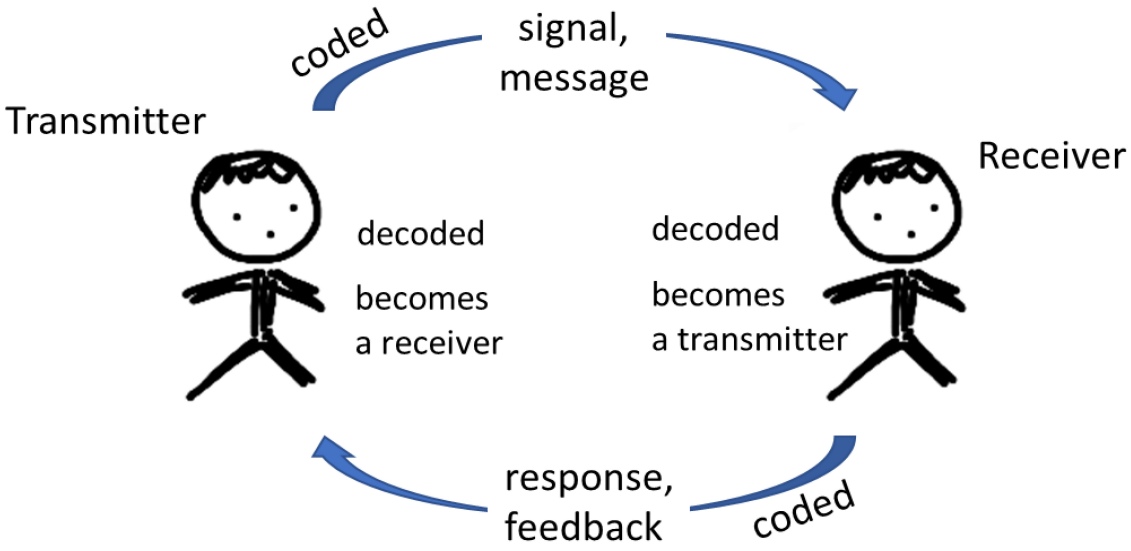


Figure 2 Transmitter-receiver model adapted to general human communication.

The statistics in the original papers were performed using the programming language "R" in RStudio (R-Studio Team 2024; Groth 2024; Groth 2025).

Results

In the Netherlands, Moroccan and Turkish migrants are substantially shorter than their Dutch hosts and were even shorter (Dijkshoorn et al. 2011) than the respective populations in their home countries (NCD Risk Factor Collaboration 2016) (Fig. 4).

A study of young adults of Turkish origin in Germany focused on the social and cultural background with particular emphasis on the personal perception of social integration within their German communities. Body height is associated with the social and cultural background. Young male German Turkish adults (180.05cm, SD=5.57cm) were generally taller than Turkish males living in Türkiye (173.75cm, SD=7.58cm, p=0.002). Those who felt best integrated showed the greatest growth advantage. In contrast, those with a greater sense of still belonging to the Turkish culture were shorter (β=-2.0562, p=0.0224). Friendship too, was an important regulator of growth: The taller a male migrant's best friend, the taller is his own height (β=3.8924, p=0.0063) (Özer and Scheffler 2018).

Similar data were obtained in Vietnamese migrants living in Germany. They also showed a strong secular trend. Males were 7.5cm taller than their fathers, and females were 3.8cm taller than their mothers (Scheffler et al. 2021). In this group, height of the best friend was associated with individual height. Adult height was linked to height of the fathers, but not to height of the mothers. When the young people were retrospectively asked at age of 13 years about their desired adult body height, they answered that they desired a height that almost identically coincided with the German references for young adult men and women.

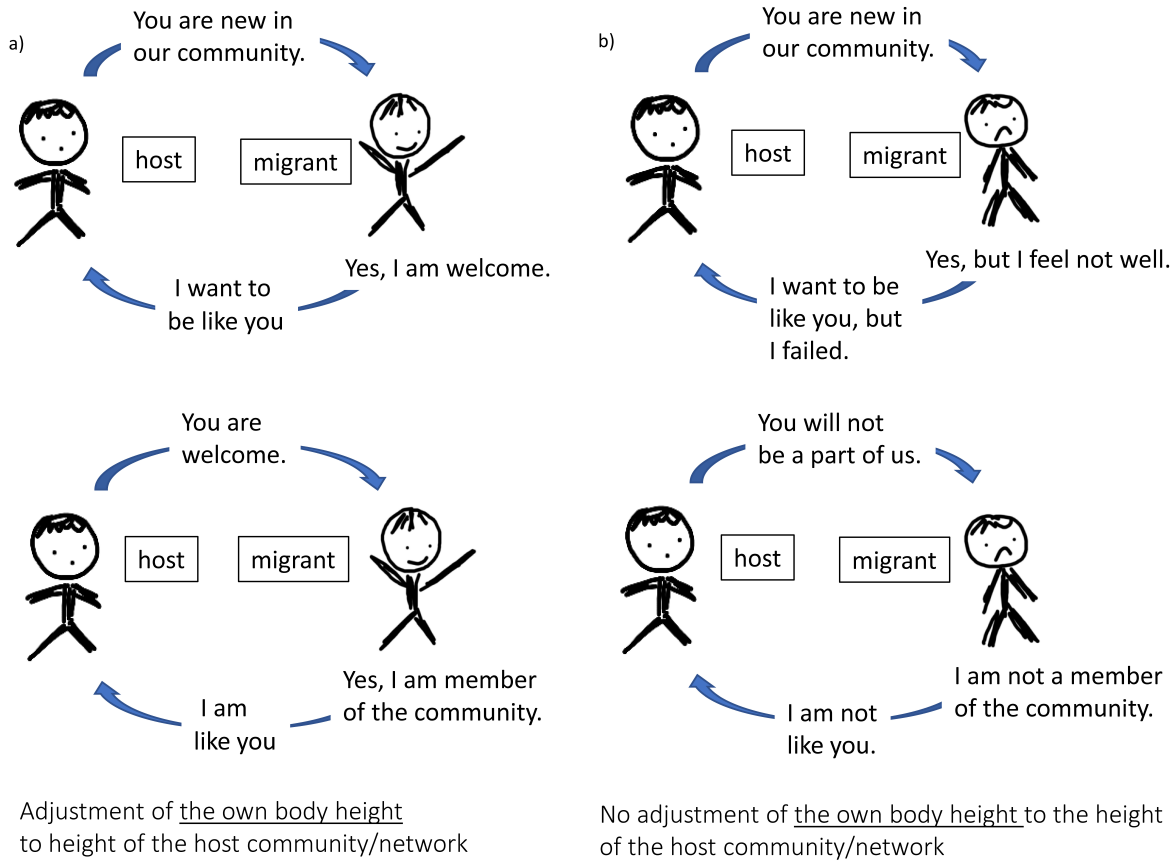


Figure 3 Transmitter-receiver model adapted to the interaction between migrants and members of the host community. (a) migrants perceive they are welcome as a part of the host community, (b) migrants perceive they will not be a part of the host community.

Also children and adolescents of the second generation whose parents or grandparents had migrated from Türkiye to Germany revealed age dependent effects on body height: 3–10 year old children of the first and second generation were still shorter (males: hSDSfirst gen=-0.19 resp., hSDSsecond gen=-0.29; females: hSDSfirst gen=-0.4 resp., hSDSsecond gen=-0.2) than their German counterparts, whereas second generation children at an age of 11–17 years, particularly the boys, tended to catch up and fully adapt in height to their German peers (males hSDSsecond gen=0.12, females hSDSsecond gen=-0.03) (Fritsch and Scheffler 2025). In this study the standard-deviation score of body height (hSDS=(individual value-mean value of reference)/SD of reference) referred to the age-specific complete data set is used to make height values comparable independent of age and sex.

A recent study in 30–40-year-old Turkish migrants found no significant height differences in men and women living in Türkiye and Turkish migrants living in Germany. This is different in the Netherlands. Turkish men living there were shorter than men living in Türkiye. Also, Turkish women living in the Netherlands, were around 2cm shorter than Turkish women living in Türkiye. Turkish women living in Germany are taller. They surpass Turkish women in the Netherlands by about 4cm (Baran et al. 2024) (Tab. 2).

Discussion

Growth and final body height of migrant children and adolescents do not follow a

uniform pattern. Even though migrants physically participate in their new host communities and share the same climatic environment, enjoy similar or the same educational opportunities, are usually integrated in the general health care system, and often consume similar food, their growth patterns can differ considerably. Some migrant groups grow substantially better than their cousins who remained in their countries of origin, others grow substantially worse.

In contrast to the plethora of publications that deal with physical explanations for the substantial variety in the growth patterns of migrant children, we focus on the social aspects and on the perception of the individual regarding his/her personal position within their newly established social networks, and its impact on growth. Migrants

Table 1 Sample-sizes, age, and study context of original data (Dijkshoorn et al. 2011; Özer and Scheffler 2018; Scheffler et al. 2021; Fritsch and Scheffler 2025; Baran et al. 2024) used for this review study.

country	year	study group	Sample				study context	methods collecting
			male	age	female	age		data-body height
NL1	2004	Dutch	183	47.3 (12.3)	258	48.2 (13.0)	invitation for	self- reported
		Turkish m.	197	48.3 (12.6)	217	43.0 (13.0)	medical	
		Moroccan m.	184	51.4 (12.6)	160	43.5 (13.9)	examination	
G2	2018	Turkish m.	39	24.8 (2.9)	45	24.6 (3.2)	study specific	self-reported*
G3	2020	Vietnamese m.	30	26.4 (5.48)	54	26.2 (4.61)	study specific	self-reported
G4	2003-06	Germans	2.813	3-10	2.783	3-10	Germany-wide	
			2.422	11-17	2.320	11-17	survey	measured
		Turkish m.	199	3-10	170	3-10	from RKI	
			137	11-17	102	11-17		
G5,NL,T	2023	Germans	20	40.1 (13.68)	45	41.7 (11.83)	study specific	measured
		Dutch	53	43.2 (15.03)	72	48.9 (12.12)		
		Turkish m.	73	42.3 (14.6)	117	43.3 (12.46)		
		Turks in Türkiye	120	33.4 (12.68)	158	35.7 (11.59)		

Notes:NL=the Netherlands, G=Germany; T= Türkiye, m=migrants, *self-reported, but corrected of overestimation, ** Kiggs study from Robert-Koch-Institute

Tabelle 2 Body height differences of 30–40 year old Turkish males and females living in Türkiye (T), and as migrants in Germany (G) and the Netherlands (NL) (Baran et al. 2024).

	Türkiye	Germany	The Netherlands	*p*-value		
				T-G	T-NL	G-NL
male	175.2 (7.22)	173.5 (7.38)	173.1 (7.08)	0.329	0.077	0.801
female	160.6 (6.4)	162.6 (6.49)	158.1 (6.89)	0.137	0.008**	0.002**

Note: ** significance level <0.01, body height in cm

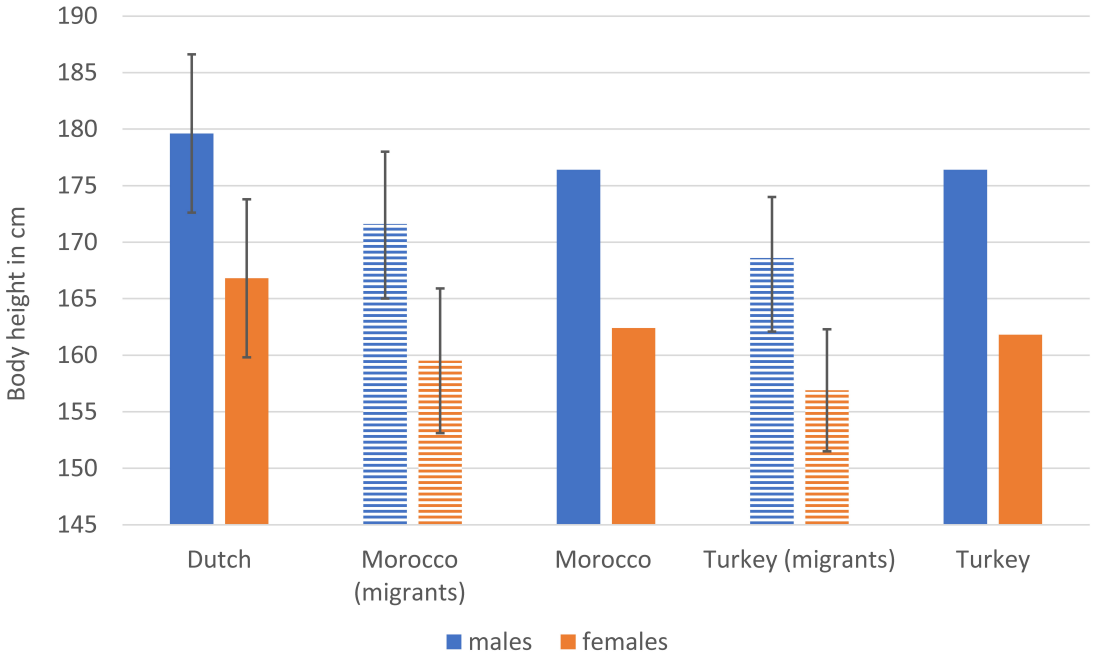


Figure 4 Body height (mean and SD) of Dutch males and females, of migrants from Morocco and Türkiye in the Netherlands (Dijkshoorn et al. 2011) and the respective populations in their home countries (NCD Risk Factor Collaboration 2016).

may not only be welcomed or rejected by their host population; they may also differ in their personal perception of social signals sent out by their new hosts. Perception depends on the cultural background which in return may lead to misunderstandings on either side.

European countries differ greatly in their attitude towards migrants. We take the Netherlands and Germany as two practical examples of different welcoming practices. Both countries are wealthy and host relatively large Turkish communities.

In the Netherlands multicultural policies were long prevalent (Ersanilli and Koopmans 2009). They allowed for strong ethnic retention of the home culture, and facilitate the formation of separate ethnic communities beside the host community (Fig. 5a). The dropout rates from school among second-generation Turkish children was much higher than in Germany. The high risk of being relegated to the lower social class (Crul and Schneider 2009) was clearly perceived by the young people. Though generally class and sex-based educational inequality has decreased over time in the Netherlands, ethnic educational inequality is still very evident, and does not necessarily reflect a disadvantaged socio-economic background (Tolsma et al. 2007).

Germany has struggled for years with its role as an immigrant country and in contrast to the Netherlands, has favoured strong efforts towards integrating its migrants (Eckardt 2007). Migrants are pushed towards adapting the culture of the host community. In consequence, migrants acculturate with their new community, even though they still maintain substantial cultural traditions and cross-border links to their communities of origin (Waldinger 2008; Mouw et al. 2014). It appears that current German policies rather try to disrupt these bonds and to subvert attempts of migrants to compensate for their comparatively disadvantaged social status by revitalizing ethnic cultural habits or homeland-oriented identifications (Diehl and Schnell 2006).

Identification usually leads to assimilation (Manning and Roy 2010; Hansen and Olsen 2023). Migrants who feel integrated and perceive themselves as a part of the social network of their new communities, adjust and fine-regulate height according to their newly attained social position (Fritsch and Scheffler 2025) (Fig. 5). This was obvious also in the case of Vietnamese migrants in Germany (Scheffler et al. 2021).

Migrants who do not feel integrated within their host community may either remain in height at the level of their geographic origin, or adjust according to their self-proclaimed social positions as exemplified by Moroccan and Turkish migrants in the Netherlands (Dijkshoorn et al. 2011). These groups segregate from their hosts and practice multiculturalism. The same was observed in male Turkish migrants in Germany who grow poorly and stay short when their sense of belonging to the Turkish culture persists (Özer and Scheffler 2018).

The endorsement of a climate of multiculturalism among segregated groups within the majority of the population is often associated with lower self-esteem among immigrant adolescents (Baumert et al. 2024). The apparent differences in public policies between Germany and the Netherlands, and thus, the differences in the self-perception of the degree of integration within their host communities, seems to provide a suggestive explanation for the substantial differences in body height between Turkish groups in Germany and in the Netherlands. We consider these differences as natural responses to the discrepant perception of being welcomed or rejected according to the transmitter-receiver model (Fig. 2), with markedly better height adaption of Turkish migrants living in Germany compared to the poorly adapted migrants living in the Netherlands (Fig. 5).

This view is strongly supported by several contrasting examples of overgrowth in children and adolescents from well-defined dominant social strata of class-based societies. E.g., the children of the Dutch colonists who grew up in the Dutch East Indies and represented the well separated dominant social strata in these regions, were much taller than their European relatives who stayed in the Netherlands (Fig 1). Analogue observations though not among migrant children but within a hierarchically organized feudal system, were reported from German boarding school children from different social strata. They lived at the Karlsschule near Stuttgart under the same nutritional, healthcare, and sanitary conditions in 1769 (Komlos 1996), but differed considerably in body height according to social status.

The examples could support our hypotheses, that height of migrants reflects self-proclaimed social positions within the social network of hosts and highlight the influence of personal perception of the social and emotional environment on body height and body composition (Scheffler and Hermanussen 2025; Özer et al. 2026). Differences in the political climate, different welcome culture on the host side, and different perception of being welcomed or rejected on the migrant side could be reflected in the growth of their children. Stimulation or lack of stimulation goes well together with observations on competitive growth and strategic growth adjustments which has repeatedly been studied in social vertebrate species (Buston and Clutton-Brock 2022). Social growth regulations appear to be ubiquitous phenomena and also apply to human subjects (Hermanussen et al. 2022).

The transmitter-receiver model emphasizes the impact of signal transduction within social groups on the regulation of body height. Perceiving signals of welcome or rejection, merging these signals with the self-perception of social status and translating perceived status into physical growth

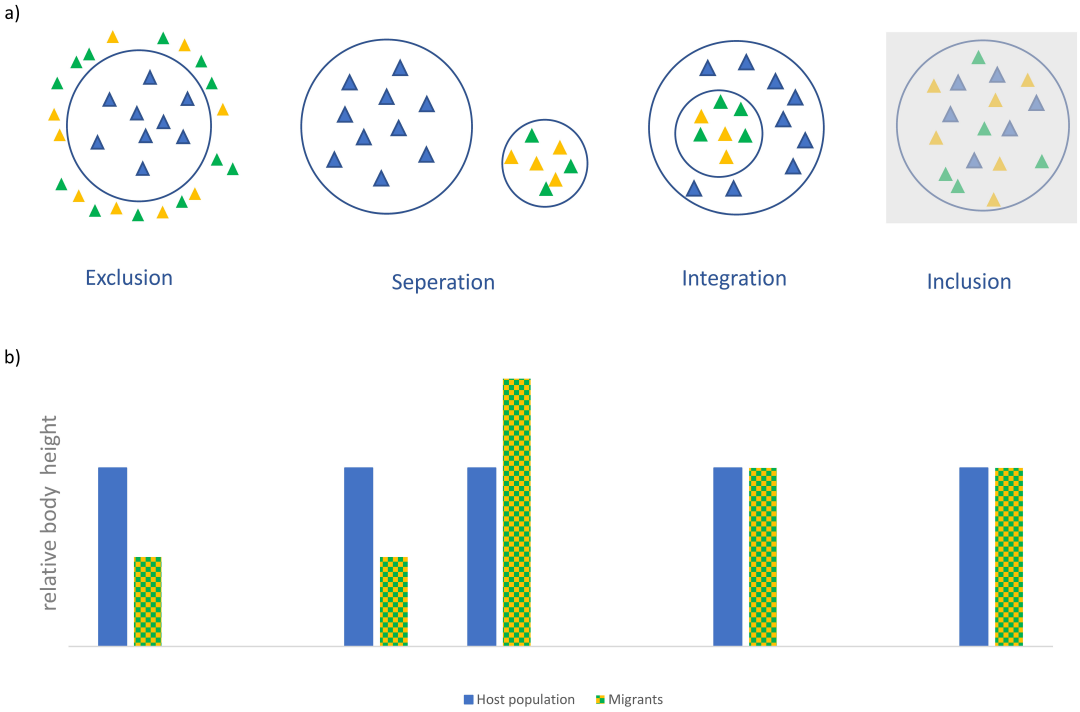


Figure 5 a) Different stages of gathering of migrants (green, yellow) and hosts (blue) – initial exclusion, followed by either separation or integration, or at best, by inclusion which however, is usually not achieved in the first generation of migrants (grey) (after (van Berkel et al. 2002)); b) Theoretical differences in height of migrants (green, yellow) and hosts (blue) based on the theory of community effect on height (Aßmann and Hermanussen 2013).

which in turn transmits respondent signals of who-is-who in the mixed groups of hosts and migrants, reveals a novel aspect within the spectrum of growth regulatory mechanisms. This aspect combines essentials of the Social Identity Theory (Tajfel and Turner 1986), of group identification and identity signalling, in-group favouritism and out-group derogation, and shaping shared common goals and social norms, with metabolism, growth and final height. Within this interaction, body height is regarded as an essential social signal (Hermanussen and Scheffler 2016). Those who feel similar are also similar in height (community effect on height) (Aßmann and Hermanussen 2013; Hermanussen and Scheffler 2019; Hermanussen et al. 2019; Hermanussen et al. 2025).

Children and adolescents within the same social community relate height to each other. Children and above all adolescents who move from one community to another community tend to adapt in height to the new community. Migration itself does not appear to affect height as exemplified by internal migration: E.g., the children of the internal Polish migrants after World War II who were forced to move from the Eastern to the Western part of Poland (Rösler et al. 2023) did not change in height.

The SEPE concept of growth regulation (Bogin 2021) considers emotions associated with an individual's perception of social belonging and position within a social community to be important determinants of the regulation of growth. The current understanding of this regulation considers the neuroendocrine pathways of the hypothalamic-pituitary axis as the key interface between the social "outside" and the metabolic "inside", with body height serving as the central signal that mediates this regulation with profound social and political consequences (Scheffler and

Hermanussen 2025; Hermanussen and Scheffler 2026).

Limitations

As we used published data and data collections that were not explicitly conducted to test our theoretical model, selection or interpretation biases may be possible.

Conclusion

Body height is a social signal associated with the perception of social belonging and position. Height of migrants reflects their current state of integration within the new community. The differences in the height of Turkish migrants in the Netherlands and in Germany appear to reflect the current differences in the national integration policies.

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Use of Artificial Intelligence

The authors used DeepL for language and grammar checking.

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