

A systematic review of the concept of self-regulation in infants between 0 and 36 months in Latin America

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Abstract

This paper aims to identify how cognitive and emotional self-regulation processes in infants from 0 to 36 months are conceptually and operationally defined within the Latin American academic context. This goal is considered relevant since 1) there still needs to be an academic discussion on self-regulation's conceptual and operational definitions; 2) It is important to characterize the location of researchers working with Latin American samples to explore whether they use theoretical models and designs adapted to the particularities of the region or from other social and cultural contexts; 3) It is important to discuss whether particularities in the definition of the concept related to the region's social and cultural diversity justify a differentiated perspective or approach regarding the self-regulatory construct. With this proposal, a systematic review based on the PRISMA methodology was implemented. The search for articles focused on publications on self-regulatory development from 2000 to date in the databases and search engines Scielo, Redalyc, PubMed, and Ebsco. Twenty-two papers that met the selection criteria were selected. The main findings were the compatibility of the sample with some observed trends, on the one hand, the underrepresentation of the Latin American population in high-impact publications on the subject, even though from 2010 to date, there is evidence of growth in publications on SR in the analyzed sample. On the other hand, the sample also allows us to infer a disparate representation of the countries of Latin America and the Caribbean in the existing publications since only eight countries in the region have at least one publication with the first author from the country. Of those eight, two concentrate almost 60% of the first authors in the publications. Regarding the empirical studies, more than 60% of the samples belong to only two of the eight represented countries. Finally, concerning the adaptation to the cultural context of the research, we found that a small number addresses this variable in a specific and significant way. However, even in these

cases, the approach is carried out based on models and hypotheses that are limited when it comes to understanding the Latin American region's cultural, socioeconomic, and demographic diversity.

Keywords: cognitive and emotional regulation, policy, intervention, culture, 1000 days.

1. Introduction

This paper aims to identify how cognitive and emotional self-regulation (SR) processes in infants from 0 to 36 months are conceptually and operationally defined within the Latin American academic context. Posner and Rothbart (2000; 2007) proposed the comprehensive study of SR at the beginning of the millennium as the main objective to advance the understanding of development and psychopathology. Since that proposal, researchers from various disciplinary fields have made great efforts towards this goal, which has been condensed into a considerable body of publications that continues to grow.

However, the growth of publications and interest in the concept does not necessarily include underrepresented regions or populations. Arnett (2008) argued that the psychology production of high impact marginalizes 95% of the world's population, a notion supported by a recent review conducted by Thalmayer and collaborators (2021), which reported a marginalization of 89% of the population. Additionally, evidence indicates a tendency to generalize psychological principles primarily based on studies conducted within the United States population, with more recent expansion to other English-speaking countries (Arnett, 2008; Henrich et al., 2010; Thalmayer et al., 2021). This general situation in psychology is also observed in the specific field of developmental sciences where, according to Nielsen et al. (2017), study participants involved in research studies published within respected developmental science journals from 2006 to 2010 exhibited a considerable bias. The data indicated that more than 90% of the participants hailed from Western backgrounds, while a mere 6.7% represented regions such as Asia, Africa, South/Central America, and Israel/the Middle East. A recent, although more limited, study (Moriguchi, 2021) maintains that although the bias has been attenuated, it is still significant: most participants (83.33%) were still from Western backgrounds.

These trends have notable implications for Latin America, which is significantly underrepresented in high-impact academic journals, resulting in a limited understanding of the region's contributions to psychology and developmental sciences, the characteristics and variations in the psychology of its inhabitants, and the methods and conclusions it offers.

Consequently, a substantial portion of the world population, the Latin Americans, remains outside of the body of knowledge and the findings published daily in specialized journals worldwide, rendering them an unknown population, or even worse, incorporated into conclusions and features that have not been studied or are underrepresented in samples from these regions.

This study seeks to explore and partially remedy this gap, conducting a systematic review of publications on self-regulatory development from 2000 to date in Latin America, addressing the age group from 0 to 36 months. This goal is considered relevant since: 1) there still needs to be an academic discussion on self-regulation's conceptual and operational definitions; 2) It is important to characterize the location of researchers working with Latin American samples to explore whether they use theoretical models and designs adapted to the particularities of the region or from other social and cultural contexts (Alves et al., 2022; Segretin & Lipina, 2022; Lipina, 2021); 3) It is important to discuss whether particularities in the definition of the concept related to the region's social and cultural diversity justify a differentiated perspective or approach regarding the self-regulatory construct (Lipina & Segretin, 2022). The age cut from 0 to 36 months is based on regional policies and multilateral technical advice that, despite contrasting evidence, define the first three years of life as a single critical period that determines SR skills throughout the life cycle (Lipina, 2021).

SR has been considered an important aspect of behavioral adaptation to the demands of social and physical environments using different emotional skills, the capacity to delay gratification and adhere to social norms, goal-directed cognitive control, linguistic and mathematical reasoning, alongside other skills that seem relevant for academic performance and optimization in multiple areas across cultures (Eisenberg & Sulik, 2012; Lerner, 2018). In infancy and early childhood, children progressively acquire SR capacities and strategies necessary to cope with various developmental challenges, thus gaining autonomy and control and establishing distinct identities from their caregivers (Calkins & Fox, 2002; Posner & Rothbart, 2007).

Current research paradigms in developmental science have been significantly influenced by philosophical debates on the concept of agency and systems theory and by technical breakthroughs in neurobiology (Lerner, 2018). Identifying mechanisms implicated in neural plasticity, stress physiology, and the development of attentional networks has stimulated support for integrating cognitive and temperamental psychobiological models (Rueda et al., 2005; Williams et al., 2008). Although viewpoints on temperament and personality often highlight the relative rank-order stability of self-regulatory traits over time and across contexts, cognitive frameworks commonly emphasize that SR entails adaptive processes and that executive function can be influenced by contextual factors (Bornstein et al., 2015). However, more debate is needed on how to define and measure SR to reach a consensus.

There are also questions about the ecological validity of standard tasks to measure SR in a laboratory context. In particular, standard SR tasks do not significantly assess the construct in populations that differ markedly from that on which the tasks were developed. In short, the cross-cultural validity of the construct. The classic view, as argued by Doebel and Müller (2023), is that standard tasks reach a universal feature of human cognition (a core set of “neurocognitive skills”) that can, in principle, be measured across cultures if researchers approach translating the tasks carefully and conservatively (e.g., Dutra et al., 2022; Obradović et al., 2019; Zelazo & Carlson, 2023). On the other hand, Gaskins and Alcalá (2023) propose that standard tasks are much more culturally embedded than is commonly recognized and that usual recommendations for adapting tasks, insofar as they do not tap what counts as SR from the perspective of the target population, risk measuring it in ways that result in children performing poorly and contribute to deficit models of their performance.

Although only some of the issues raised will be addressed in this work, they will be considered a theoretical framework of the investigation to identify how the construct is defined in Latin America for children from 0 to 36 months. Special emphasis will be placed on the conceptual definition of SR, the operational definition, the type of study, the country of origin

of the authors of the papers, and the reference to the adequacy of the research to the specific cultural context of Latin America.

1.2. Objectives

This review aimed to delve into contemporary developmental research in Latin America to identify how studies referred to regional samples conceptualize and operationalize cognitive and emotional self-regulation processes in infants from 0 to 36 months. To do so in a comprehensive and replicable manner, review articles, perspectives, and empirical studies were considered. We seek to answer the following questions:

1. How do studies with samples from Latin America conceptualize and operationalize cognitive and emotional self-regulation processes in infants from 0 to 36 months?
2. Do operational definitions consider different levels of organization (i.e., physiological, behavioral, contextual)?
3. Which designs and analysis types are employed?
4. Are the theoretical models and designs used in studies with Latin American samples adapted to the region's particularities?
5. Are there particularities in the definition of the self-regulation concept related to the region's social and cultural diversity that justify a differentiated perspective or approach regarding the self-regulatory construct?

The potential benefits of meeting these objectives include: a) Identify how work is being done on the self-regulation process in the selected Latin American population, b) Identify possible gaps or misconceptions regarding the use and operationalization of the concept in the target population, c) contribute to the use and application of the construct that is increasingly appropriate to the cultural context of application. All of this could contribute to the design of future research or even future interventions or development policies for the target population of this study.

2. Methods

2.1 Study design

The search for articles focuses on studies embracing SR development from 2000 to 2023. This choice is based on the significant increase in the volume of psychology and developmental cognitive neuroscience publications over the past twenty years, connected to advancements in techniques and methodologies within both fields and new theoretical viewpoints aimed at comprehensively studying cognition and emotion. Search parameters were set considering keywords related to SR processes. The selection criteria (inclusion/exclusion) were adjusted to the proposed objectives: studies with Latin American samples from 0 to 36 months. Review papers, perspectives, and empirical studies published in Spanish, Portuguese, and English were included.

The present review was designed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009; Shamseer et al., 2015). In order to guarantee publicity, transparency, and replicability, the systematic review, methods, and search materials were registered on the Open Science Framework (OSF) platform.¹

2.2. Search strategy, data sources, and extraction

The search strategy was based on advanced search engines, search parameters, and keywords: Self-regulation, child development, and infant development. The selected search terms were those we considered most appropriate to the review's objective; broad concepts were chosen that allowed us to cover a large sample, which would then have to be carefully screened. Although various terms are associated with SR (i.e., executive functions, temperament, reactivity), the lack of recursivity between the different theoretical frameworks from which these terms come is an obstacle to identifying relevant literature. Considering that the search was carried out in three different languages, the keywords were appropriately

¹ https://osf.io/pfdm2/?view_only=c4ab6bf4adf048ad9f1d0329d909f440

translated and adapted to the resources of each search engine (e.g., filters and boolean operators).

The following databases were consulted searching for articles published in journals from the humanities, education, health, and social sciences: Education full text; Psychology and Behavioral Collection; PubMed; Scielo and Redalyc, using the following search interfaces: EBSCO, PubMed, Scielo, and Google Scholar.

The choice of the databases and interfaces was based on the following criteria. Firstly, PubMed is one of the most recognized databases globally in health studies that include infant development, where this search was framed. For its part, EBSCO provides globally recognized databases in education and psychology that complement PubMed, which is more focused on the health area. Regarding Scielo and Redalyc, they are databases specialized in publications from the Latin American and Caribbean context, with which we intend to cover journals that may not be indexed in non-specialized databases in the region.

The search strategy for each interface and database is outlined below according to the resources of each one:

1) EBSCO (Education full text+Psychology and Behavioral Science Collection): "Self-regulation" AND ("child development" OR "infant development" OR "toddler development").
Filters: published between the year 2000-2023.

2) PubMed: "Self-regulation" AND "development". (Filters: published between 2000-2023/ age: Newborn: birth-1 month, Infant: birth-23 months, Infant: 1-23 months, Preschool Child: 2-5 years/ language English, Spanish, Portuguese).

3) Scielo: "Self-regulation" AND ("child development" OR "infant development"); "Autorregulación" AND "desarrollo infantil"; "Auto-regulação" AND "desenvolvimento infantil" (Filters: published between the year 2000-2023).

4) Redalyc (through indexing in Google scholar): "Self-regulation" AND ("child development" OR "infant development"); "Autorregulación" AND "desarrollo infantil"; "Auto-regulação" AND "desenvolvimento infantil" (Filters: published between the year 2000-2023).

The first search round was based on the design and the specified search terms. This search provided a dataset with the information of all included publications (Title, authors, year, abstract, keywords, Journal, and DOI, among others). Duplicate rows were deleted, and missing information was added using the “tidyverse” and “rcrossref” packages in R (R version 4.3.1, 2023-06-16). Then, through a case-by-case analysis, a data set adjusted to the target age and region was consolidated by a human person. The data of interest were extracted from the consolidated database, and the information extracted from each article that met the criteria to be selected for the review was recorded and organized in CSV files that allow manipulation with specific software and access by a human person. The variables included were: 1) Year of publication, 2) Sample’s country, 3) First author’s location, 4) Age of the sample, 5) Type of sample, 6) Type of work (e.g., empirical, review, meta-analysis), 7) Type of design (synchronous/longitudinal, exploratory, experimental, quasi-experimental), 8) Type of analysis (e.g., regression, mediation), 9) Analysis level (contextual, behavioral, neural, physiological), 10) Conceptual definition of self-regulation, 11) Operational definition of self-regulation, and 12) Presence of references to the cultural context of the study.

2.3. *Data analysis*

We implemented the subsequent mixed-method procedures: 1) frequency analysis of previously listed variables; 2) qualitative analysis of semantic categories used in the conceptualization of SR in accordance with Grounded Theory guidelines (Justicia & Padilla, 2011; Strauss & Corbin, 1998), whose typical process consists of (a) data storing and organization using a manageable digital file (i.e., hermeneutic unit); (b) segmenting text fragments in which conceptual definitions or explanations of SR were provided; (c) coding information; (d) establishing relations between assigned labels; and (e) creating graphical models to depict terms that exhibited stronger associations with conceptual definitions of SR. Both quantitative and qualitative analyses were carried out with the previously mentioned version of R and Rstudio.

Once the information was organized, constant comparisons were used to formulate conceptual categories based on the empirical evidence. Using the open coding process, also

known as microanalysis (Strauss & Corbin, 1998), different codes were chosen to represent relevant conceptual features and theoretical frames generally found in SR research, guided for the author's understanding of the different lines of research that permeate the field (Vohs & Baumeister, 2016). Subsequently, these codes were employed to label all definitions in the sample, thus identifying which theoretical characteristics had the greatest influence on them.

The same methodological strategy was used for the other conceptual variables analyzed if they exist in the text (i.e., not all articles operationally define SR, and only some reference the cultural context). Specifically, the operational definition was extracted from the methodological sections, considering how it is implemented. Questions about whether the authors of the study location match the sample's region were answered based on the author's country of affiliation. Furthermore, the question about whether or not there are adaptations of the methods to the cultural context of the region was answered by observing if there were explicit mentions of them in the article and observing quotes and referenced methodological sources.

3. Results

3.1. Study selection and characteristics

The search was carried out in July 2023 and, based on the selected parameters, allowed the initial identification of 1678 articles that were screened based on the following exclusion criteria: 1) Duplicates. 2) Those outside the age range (0-36 months). 3) Those that do not refer to Latin American samples. 4) Those including the term SR but do not define it or address it operationally in the article. 5) Those referring SR related to food or feeding behavior.

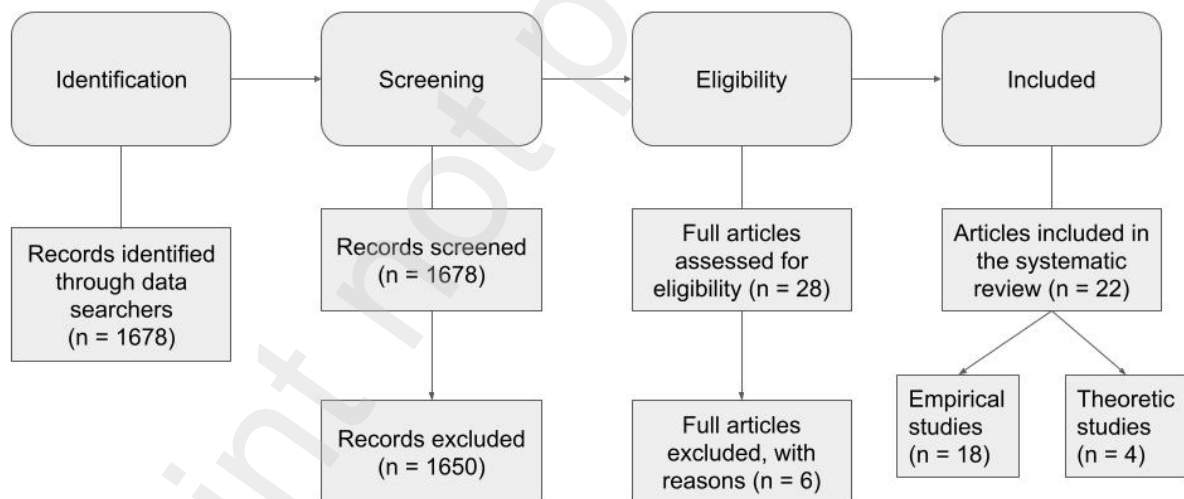
Of all 1678 articles, only 181 met all inclusion requirements except for criterion (3). That is, of 181 articles on SR within the age range of 0 to 36 months, only 22 referenced the Latin American population. Of these 22, 14 came from databases oriented to Latin America and the Caribbean (Redalyc and Scielo). Let us only consider the Ebsco and Pubmed data (bases not specialized in the Latin American region). Of 158 in age and subject range, only 8

(5.06%) have samples from Latin American countries. If we exclude those who do cross-cultural studies, only five exclusively address the Latin American population (3.16%). These data are compatible with the assertion that the region is underrepresented in high-impact academic journals on psychology and, in this case, developmental psychology (Moriguchi, 2021).

The final sample comprised 22 articles that met all the inclusion criteria; of this total, 18 are empirical studies, three are theoretical perspectives, and the last one remaining is a systematic review. Figure 1 illustrates these findings by depicting the information flow across the various phases implemented in this review in accordance with the PRISMA guidelines (Moher et al., 2009).

Figure 1

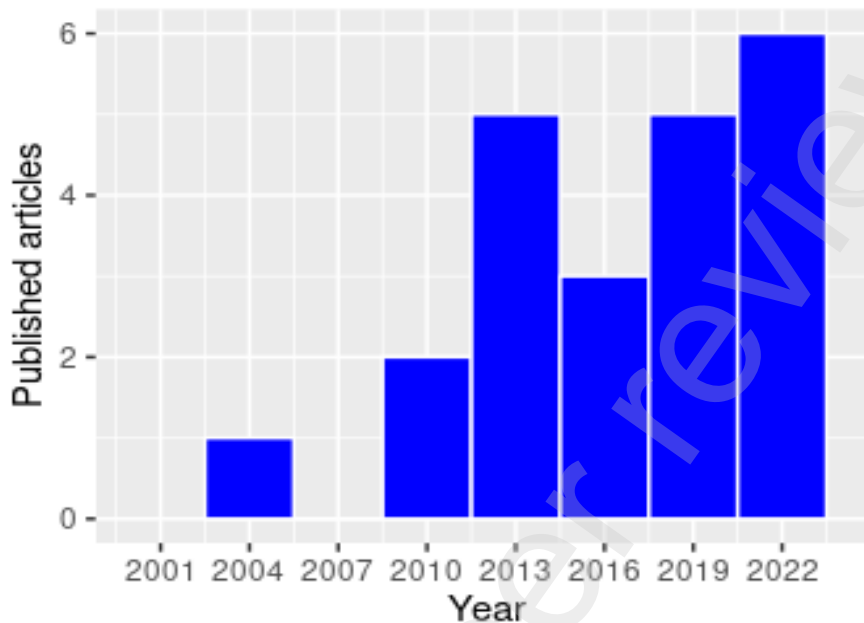
Flow diagram of the studies retrieved for the review.



When considering the statement that SR is currently an expanding area of study (Nachón et al., 2017), this review finds that the trend is confirmed for the selected sample since the production of articles on the topic and in the target population shows a significant increase from 2010 to date (Figure 2).

Figure 2

Number of articles published in the analyzed databases



When we analyze the authors, we find that most of the first authors are Latin American (Figure 3.). In the empirical articles, except for cross-cultural ones, the first author's nationality and the sample's country of origin coincide. In the case of cross-cultural studies, 2 out of four (50%) have Latin American first authors (Chile), and the remaining two are non-Latin American (USA and Germany).

Regarding the populations studied in the empirical articles, we find samples from seven Latin American countries and one from the Caribbean. Eight articles address samples from Chile, of which three belong to cross-cultural studies. Brazil follows with six studies that address its population with a single cross-cultural study. There are two articles with samples from Colombia, one from the Argentine population and one from the Granada population. In addition, the populations of Mexico, Costa Rica, and El Salvador are present in articles that do cross-cultural studies (Figure 4). There are four cross-cultural studies (22.2%), of which three address samples from more than one Latin American country.

Figure 3

First author's Country

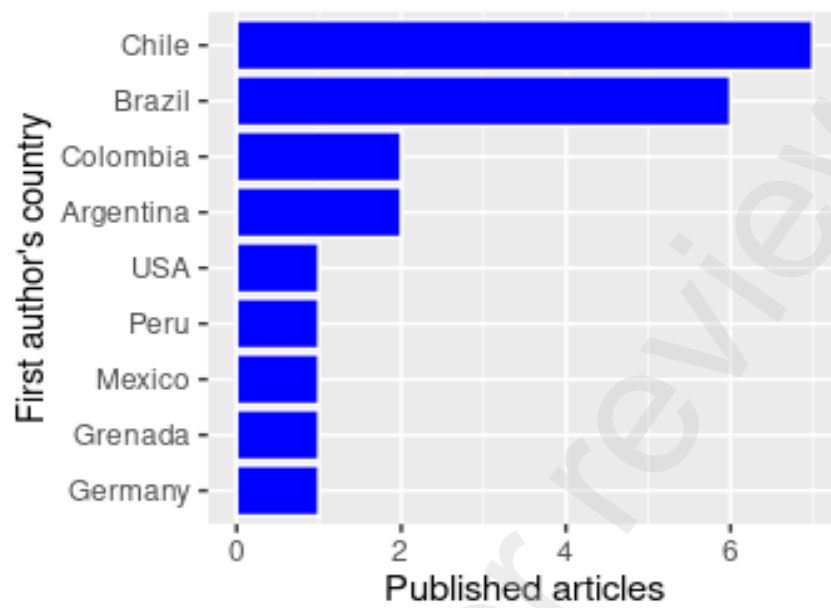
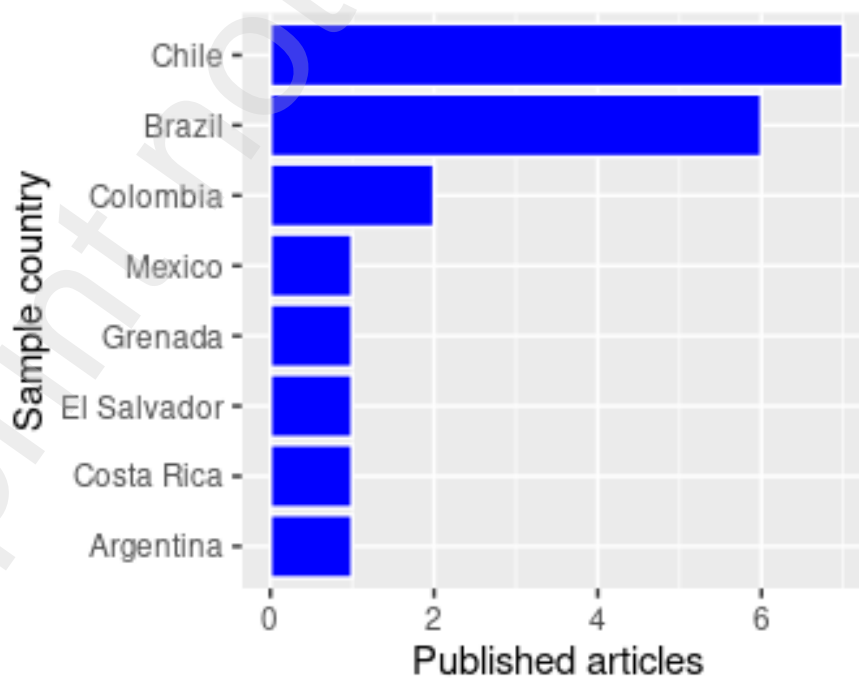


Figure 4

Samples by country



3.2. Conceptual definitions of self-regulation in the Latin American academic context

From the qualitative analysis of the semantic categories used in the conceptualization of SR following the guidelines of the Grounded Theory and especially from the method of constant comparisons, four categories or types of definitions were identified in the reviewed articles. It should be noted that SR definitions in most reviewed studies take up theories and authors who are not Latin American. When the articles cite Latin American authors, those are also enrolled in mainstream approaches on SR, not in particular ones from the region. This situation is expected as the construct originated and became relevant within the US's developmental psychology and cognitive neuroscience framework. We will see in the following sections that cross-cultural studies in this sample make considerable efforts to adapt the construct to the region's cultural particularities in implementing and measuring it. However, at least in the studies reviewed, this is not reflected in the conceptual definitions.

Based on the theoretical framework of developmental psychology and cognitive neuroscience, we identified different sets of definitions for SR: (1) those related to the construct of executive functions (EF); (2) definitions related to temperament, particularly effortful control (EC) and reactivity; and (3) definitions including the previous two sets together. Furthermore, we identified another group of definitions linked to medical sciences, especially those related to preterm newborns, which conceptualize SR as a phenomenon related to psychological homeostasis. Finally, a fourth group of articles does not provide an explicit conceptual definition or define it imprecisely, leaving the reader with the task of interpreting its meaning based on the context.

1. Executive functions: The first group of definitions puts EF as the core of SR. The construct of EF is described as a set of skills involved in the regulation of thoughts, emotions, and behaviors (Diamond, 2013). It has gained increasing prominence in the last two decades, partially due to its association with important outcome measures, such as early school success (Blair & Dennis, 2010; Morrison et al., 2010) and social success with peers. Miyake and Friedman (2012) focused on three fundamental cool EF components primarily associated with top-down regulation: working memory, response inhibition, and shifting. On the other hand,

EF models that have integrated hot EF processes, like the Iterative Reprocessing (IR) theory (Zelazo & Cummings, 2007), underscore the significance of bottom-up regulation. The IR theory accentuates the central role of reflective thought in EF and also incorporates the concept of iterative reprocessing, where lower-level representations are transformed into more abstract representations. While there is no complete consensus, this skill set encompasses compliance, the ability to delay actions, and the modulation of emotions in response to contextual demands. Three definitions of this type were identified in the revised articles, two explicitly defining SR as the ability required to modulate goal-oriented behaviors and emotions, respond to requests, comply with social norms, and adapt to contexts; and the third one, including references to authors who adhere to this paradigm.

2. Temperament: According to Bailey and Jones (2019), temperament alludes to biologically-based individual variances in emotional, motor, and attentional reactivity, as well as the corresponding regulatory mechanisms that moderate this reactivity (Rothbart, 2007). In this concept, SR is understood as part of temperament, and effortful control (EC) is the central construct that measures the ability to self-regulate. In other words, EC represents the regulatory aspect of temperament, while extraversion and negative affectivity represent the reactive dimensions. A significant distinction from the EF tradition, which partially overlaps with the EC construct, is that the temperamental conception pays special attention to emotional regulation (hot skills) rather than specifically cognitive regulation skills, such as those necessary for problem-solving (cool skills). Another interesting feature of this approach is that research on this construct tends to focus on early childhood (from birth to 3 years of age), thereby providing insights into the development of regulated behavior before the emergence of EF (around 3 to 4 years of age). Indeed, several conceptual definitions found in the present review belong to this group, comprising six articles. They were identified as including some of the central concepts proposed within this approach: temperament, effort control, reactivity, or ability or willingness to calm or settle down.

3. Integration model of SR: Relatively recent research integrating EF and EC has highlighted regulation-related skills as central mechanisms of human development (e.g., Blair

2002). The conceptions indicated above overlap in some aspects. The first emphasizes the ability to train and acquire self-regulatory skills, especially EF, and the second understands these skills as based on a certain biological component fundamental for emotional regulation that presents individual variations. However, the convergent perspective does not see these options as exclusive but, on the contrary, as complementary. Studies based on the temperament tradition study the emergence of self-regulatory skills at younger ages before the skills and elements related to EF emerge. In this perspective, the constructs of EC and EF refer to at least partially overlapping abilities, so the two conceptions can be synthesized into a new conception that integrates constructs from both traditions. The integrated model suggests that it propels the field forward by enabling (1) the creation of SR interventions that are more precisely targeted at developmental needs and stages, (2) enhance the level of adaptability or environmental reinforcements for SR, (3) address SR research, teaching, and learning in a unified manner across cognitive, social, and emotional domains, leading to significant progress in both the scientific understanding and practical application of SR (Bayles & Jones, 2019). In the sample studied in the review, this integrated perspective was identified in six articles.

4. Homeostasis: Another approach in the definition of SR is associated with medical sciences, with the phenomenon of physiological homeostasis being relevant. Two articles in the sample of the present review were identified within this group. Both articles studied samples of preterm newborns and evaluated their status, including their capacity for SR, based on the synactive development model (Als, 1989). This paradigm provides a SR evaluation model developed for preterm newborns, which is based on the observation of autonomic stability, smooth respiration, stable color, stable viscera, smooth and well-modulated posture, and well-regulated tone, among other variables.

Finally, a relevant number of the reviewed articles do not define SR explicitly or offer wander conceptualizations with insufficient clarity or tautological statements; the readers are often left to make their inferences or compelled to derive the significance of the notion based on the context in that used. This finding is not accidental and has been reported previously

(Barkley, 2001). Five articles with these characteristics were grouped in the "5. Other" category.

3.3. Operational definitions of SR in the Latin American academic context

Regarding operational definitions, the first issue to point out is that only 12 articles have an operational definition of SR, that is, a method to evaluate SR in a given sample. The most used method to measure SR is the Caregiver Questionnaire Report; these articles propose a conceptual definition in the tradition of temperament or the integrated paradigm. Secondly, it is the Observation of the Dyad, implemented in three studies. Two of them included the observation of activities proposed by the researchers and defined SR in the EF tradition (activities are related to this construct), and the third one observed natural settings. In addition, two articles used a Development Scales to measure SR (one of them is a standardized scale) and were included in the to the "Other" conceptual category group since they do not provide a definition of SR. Finally, an article within the "Homeostasis" definition group, combined caregiver reports and observations of different variables in preterm newborns.

From both the conceptual and operational definitions, the importance given in the reviewed articles to parents and caregivers in the process of acquiring self-regulatory skills at an early age can be inferred.

It should be noted that the instruments with which the SR construct is operationalized are those used by the mainstream approaches. Even in those articles that aim to make cross-cultural comparisons, there is no specific operational adaptation to the Latin American context. The latters have theoretical frameworks and measurement instruments that seek to be sensitive to the cultural context since they assume this affects self-regulatory trajectories. However, these studies have samples from different regions, so they are not specific to the Latin American region; they seek to be sensitive to the effects of the cultural context, whatever it may be (Latin American, African, American or European).

3.4. Types of design, approach, and levels of analysis

The majority of the articles found (18) were empirical, 13 of synchronous design, and five of longitudinal design. Additionally, four theoretical articles were found, three perspectives and one review. Regarding the analysis levels, most articles carry out a behavioral and contextual analysis of the SR construct, with six also carrying out analysis at a cultural-contextual level. Only one was found that added the physiological level to the behavioral level of the construct. Finally, two articles remain, one with exclusively behavioral analysis and the other exclusively contextual.

Regarding the sample type, the majority is a population without preexisting conditions. There are two cases of preterm newborns, four focused on the low SES population and one on infants who attended childcare centers.

Finally, regarding the research approach, we found various types of analysis, the majority being descriptive and correlational (see Table 1).

Table 1*Type of study, design, samples, and analysis*

First autor	Type of definition ¹	Type of Study	Design	Infant age	Type of Sample	Research approaches ²	Levels of analysis ³
Farkas, C., 2017	3	Empirical	Synchronous	10-15m	No pre-existen conditions	Descriptive and correlational	Behavioral and contextual
Keller, H., 2004	1	Empirical	Longitudinal	3-20m	No pre-existen conditions	Descriptive and correlational	Behavioral, contextual and contextual-cultural
Seidl-De-Moura, M.L. 2012	1	Empirical	Synchronous	17-22m	No pre-existen conditions	Descriptive and correlational	Behavioral, contextual and contextual-cultural
Léniz Maturana, L., 2022	2	Empirical	Synchronous	10-24m	Adolescent mothers with low SES	Descriptive, correlational and explanatory	Behavioral and contextual
Mata, C., 2023	3	Empirical	Synchronous	12-47m	No pre-existen conditions	Descriptive and correlational	Behavioral, contextual and contextual-cultural

Farkas, C., 2016	2	Empirical	Synchronous	10-15m	Infant who attended childcare centers	Descriptive and correlational	Behavioral, contextual and contextual-cultural
Ferreira, A.M., 2010	4	Empirical	Longitudinal	31-39 weeks	Preterm newborn	Descriptive and correlational	Physiological and Behavioral
Desmarais, E., 2021	3	Empirical	Synchronous	15-41m	No pre-existen conditions	Descriptive and correlational	Behavioral, contextual and contextual-cultural
Aldrete Cortez, V., 2014	3	Theoretical review	-	-	-	-	-
Riccioppo, M., 2018	4	Empirical	Synchronous	< 3m	Preterm newborn	Quantitative (exploratory and descriptive) and qualitative	Behavioral and contextual
Maurette, M., 2020	2	Empirical	Synchronous	6m	No pre-existen conditions	Descriptive and correlational	Behavioral and contextual
Londoño Mora, E., 2012	2	Theoretical perspective	-	-	-	-	-

Blanco, O.A., 2019	1	Empirical	Synchronous	7-12m	Low SES	Quantitative (exploratory, descriptive and correlational) and qualitative	Behavioral and contextual
Zanetta, A.M., 2017	2	Empirical	Synchronous	27-33m	No pre-existen conditions	Descriptive and correlational	Behavioral and contextual
Gonçalves, L.M., 2021	5	Empirical	Synchronous	12m	Preterm baby	Qualitative	Behavioral and contextual
Caycho Rodríguez, T., 2014	5	Theoretical perspective	-	-	-	-	-
Bastías, C.P., 2021	5	Empirical	Synchronous	0-36m	No pre-existen conditions	Qualitative	Behavioral
Izidoro, I.R., 2020	3	Empirical	Longitudinal	9 and 12m	No pre-existen conditions	Descriptive and correlational	Behavioral and contextual

Moreno, M., 2016	3	Empirical	Synchronous	0-36m	No pre-existen conditions	Quantitative (descriptive) and qualitative	Contextual
Mendes, D.M., 2009	2	Theoretical perspective	-	-	-	-	-
Waechter, R., 2022	5	Empirical	Longitudinal	0-24m	Middle to low SES country	Descriptive, correlational, and explanatory	Behavioral and contextual and contextual-cultural
Sánchez, H., 2013	5	Empirical	Longitudinal	0-12m	Low SES	Quantitative (descriptive and correlational) and qualitative	Behavioral and contextual

Note. 1. Classification of the SR conceptual definition in five groups: (1)= Executive functions; (2)= Temperament; (3)= Integration model of SR; (4)= Homeostasis; and (5)= Other.

2. Research approach and scope in agreement with the classification proposed by Hernandez-Sampieri and colleagues (2014). Qualitative and quantitative approaches. For quantitative research, approaches include: exploratory, descriptive, correlational, or explanatory.

3. Levels of organization analyzed in the study: Behavioral (performance, reports of behaviors, or observations), Contextual (parental, teacher or other significant adults' characteristics or perceptions; dyadic interactions; homes, schools or health care institutions contexts), Contextual-cultural (diverse regions, countries and/or demographic areas).

Preprint not peer reviewed

3.5. *References to cultural context*

Regarding the relationship between cultural context and SR, ten articles include references to the cultural context. Specifically, four articles make cross-cultural comparisons, aim to measure the influence of cultures on SR in different countries, and have specific references and hypotheses about the influence of the cultural particularities of the Latin American region. Of the remaining six, one also has specific references and hypotheses about the influence of the cultural particularities of the region, and there is also a cross-cultural approach but within the same country since it postulates upbringing style differences between regions' samples of the same country (Brazil). The other five generally reference the influence of culture on upbringing and SR but are not specific to the Latin American context, nor do they have specific hypotheses about how the cultural context influences SR. Finally, we found 12 articles that do not reference the cultural context.

It should be noted that articles referring to the influence of the cultural context considered parenting styles as a core mechanism regarding the influence of culture on the development processes of SR at early ages. There seems to be a consensus at this point. What appears less clear in the reviewed articles is how culture influences parenting styles. We quote below two hypotheses that we find most interesting.

One proposes that the component model of parenting (Keller, 2002; Keller, Lohaus, et al., 2004) is the one that best captures the influence of culture (sociocultural orientations on socialization goals, parental beliefs, and parenting practices) in parenting style. This model comprises five independent parenting systems: primary care, body contact, body stimulation, object stimulation, and the face-to-face system. These parenting systems would allow the differentiation of two parenting styles: the proximal and the distal parenting style (Keller, 2003; Keller, Lohaus, et al., 2004), extremes between which different parenting styles would vary in different cultural contexts

Another hypothesis proposes the cultural dimensions developed by Hofstede (1991) to address cross-cultural differences. One of the dimensions that, according to the authors, seems to be the most relevant is power distance, where the US culture obtains a lower score,

and the Latin American and South American cultures obtain a higher score on this dimension (Hofstede et al., 1991). Power distance refers to how a culture addresses status differences and social hierarchies. Individuals from low power distance cultures (such as the US) tend to value equal power distribution, symmetric relationships, horizontal interactions, and equitable rewards and costs based on individual achievements. Individuals from high power-distancing cultures (such as those in South America) tend to accept unequal power distributions, asymmetrical relationships, vertical interactions, and rewards and sanctions based on rank, role, status, age, and even gender rather than individual performance. In South American culture, children – who inherently have less power than adults – can be expected, according to this study, to restrain their expression of negative affect and comply with adult's requests and social norms.

As is evident, the hypotheses and models for approaching the same problems are different, there does not seem to be a consensus on them, and they are based on assumptions that can be questioned from different perspectives.

4. Discussion

4.1. Summary of main findings

The results of the semantic analysis through the method of constant comparisons of the conceptual definitions found in the reviewed texts allowed us to find four types of definitions according to the construct or set of constructs with which SR is defined. The first type of conceptual definition identified is the one that uses EF as the main construct to define the self-regulatory skills of the population studied. Secondly, a type of definitions that use the temperament construct, especially reactivity, and EC as a temperament regulation mechanism, were identified as the main construct to define SR. A third type is the integrated model between the traditions of EF and temperament, which sees some overlap between the constructs of EF and EC and uses concepts from both sides in the definition of SR. Finally, a fourth definition was found linked to medical sciences that understand SR as a phenomenon

linked to physiological homeostasis and appears especially in articles referring to preterm newborns.

It should be noted that the definitions with temperament as a central construct and the integrated model are the majority in the sample of articles analyzed, reaching six articles each. These data make sense if we analyze the age range of the population to which the articles refer: infants between 0 and 36 months. According to Bayles & Jones (2019), the tradition that defines SR as part of temperament tends to focus on early childhood (from birth to 3 years of age), thereby providing insights into the development of regulated behavior before the emergence of EF (around 3 to 4 years of age). On the other hand, several authors (Garon et al., 2008) understand that although EF emerges early, before the age of three, it is true that EF manifests more clearly from the age of 3 or 4, especially the cognitive skills related to solving problems. Therefore, it is also expected that a significant number of studies propose an integrated conception of SR, as it allows the study of skills related to emotional control and temperament at an early age, along with the gradual emergence of typically related skills with EF.

Another element that emerges from the analysis is that the articles of the majority categories used when operationally defining SR in the Caregiver Questionnaire Report method. Conversely, those in the first category that use the Observation of the Dyad method based on activities proposed by the researchers are linked to the EF construct (e.g., compliance to requests or compliance to prohibition). Of the two articles that use the definition related to physiological homeostasis, there is one of a theoretical nature that does not give an operational definition and the other uses the combination of caregiver reports and observation of different variables in preterm newborns, including some at a physiological level.

Finally, regarding conceptual definitions, there is a significant group of five articles (22.7%) that do not propose a clear definition of SR, leaving it to readers to make their inferences or be compelled to derive the significance of the notion based on the context in that used, confirming a trend already reported in the area (Barkley, 2001; Nachón et al., 2017).

About the first authors of the articles, we found that the majority come from Latin American or Caribbean countries, with the exception of two cross-cultural studies. In empirical articles, the country of the sample coincides with the country of belonging of the first author (except in cross-cultural articles). Regarding the samples included in the reviewed articles, we found that they come from seven Latin American countries and one from the Caribbean. Taking apart cross-cultural studies in which more than one country is represented, the number of articles that address the population of one country exclusively is reduced to four from Latin American and one from the Caribbean. These numbers allow us to infer that the region is not only underrepresented as a whole in publications in the field, but that, also, the population of many countries in the Latin American region do not appear in the samples or are underrepresented in them. That is to say, there is a disparity within the region itself.

It is notable that the country with the largest number of first authors and most samples addressed is Chile, although it is not one of the largest countries or with the largest population. This number may be explained because the country has consistently applied public policies for fifteen years, with an investment in the area of childhood development that is around 6% of GDP (UNICEF, 2022; UNESCO, 2021) frequently supported by multilateral development organizations (e.g., Chile Crece contigo²) in early childhood policies, which reasonably stimulates and provides resources for research in the area. Brazil appears in second place, with six articles with first authors and six samples, respectively, an expected situation given the size of the country, its population, and its scientific system. Colombia follows them with two first authors and two samples, Argentina with two first authors and a sample (one of the articles is theoretical), Mexico with a first author (theoretical paper) and a sample of the country, Grenada with a first author and a sample and finally Costa Rica and El Salvador with a sample each. These dates confirm the previous statement and show that an effort must be made so that the different countries and regions of Latin America have adequate representation in scientific production on the topic of this systematic review.

² <https://www.crececontigo.gob.cl>

Regarding the type of study, we found four theoretical articles, three perspectives, and one review, 18 empirical articles, the majority (13) of synchronous design and only five of longitudinal design, with relatively small samples. Therefore, it is also necessary to emphasize longitudinal studies with large samples that homogeneously represent all countries and populations in the region.

The issue that remains to be addressed is whether the cultural context or the cultural particularities of the Latin American region influence how SR is conceptually defined or operationalized. This question is answered based on analyzing the references to the cultural context in the reviewed articles. We observed that 12 of the 22 papers addressed do not refer to the cultural context or adaptation to the context, which allows us to infer that in most of the articles, the cultural particularities of the Latin American region are not considered significant variables. Of the remaining, five make a general reference to the fact that the cultural context influences the processes of acquiring self-regulatory skills but without specific definitions of what they refer to with cultural context, or clear hypotheses about how this influence operates. Finally, five articles refer to the cultural context with specific references and hypotheses on how the cultural context influences the development trajectories of SR, four carry out cross-cultural studies and a fifth makes comparisons between the different regions of the same country (Brazil) assuming that there are relevant cultural differences between them. The five latter are the ones that provide the most relevant insights on the topic addressed.

First of all, it is important to highlight that it can be inferred from the conceptual definitions in the papers reviewed, from the operational ones (Caregiver Questionnaire Report, Observation of the Dyad), or even from the theoretical frameworks that there is a broad consensus on the importance of parents or caregivers for the development of self-regulatory skills. Related to this consensus, the five articles that specifically address the influence of culture on the development of SR postulate that occurs from the parenting style of parents or caregivers. In short, the cultural context is thought to influence child development principally by determining or modulating the parenting styles of parents and caregivers. In this idea, there is also consensus among the papers mentioned above. What needs to be clarified is how

culture affects or determines different parenting styles. In the group of the papers above, there is no consensus on this, but rather general or diffuse ideas or hypotheses.

Some of these works make general statements about Latin American culture, such as that the power distance between infants and adults, between children and caregivers, is significantly greater than in other cultures, such as that of the US, or that in Latin America and the Caribbean region licks, slaps, and beatings are part of the cultural and religious landscape. These general statements ignore the enormous diversity and cultural, demographic, and social complexity of Latin America and the Caribbean, comprised of more than 30 countries, where hundreds of languages are spoken if we include the Native Americans (Alves et al., 2021). In our region, urban populations with a Western standard of living, middle-income populations, large socioeconomic sectors below the poverty line, and rural (although incipiently urbanized) indigenous-peasant populations coexist. Diversity is not only between countries but within the countries themselves, as one of the papers studied points out when trying to identify different parenting styles within Brazil itself and its different geographical, cultural, and socio-demographic regions (Alves et al., 2021).

From these data, we can conclude that a significant portion of studies do not take the cultural context, especially the cultural particularities of Latin American and Caribbean societies, as a relevant variable in the study of SR, or do so in a general and not very specific way. However, there is a set of works that emphasize this variable, considering it significant because they assume that the cultural context influences the trajectory of the acquisition of self-regulatory skills. These studies are mainly cross-cultural and identify the variation in parenting style in different cultures as the main mechanism of influence. What seems to be missing in these articles is a model that explains how culture influences or determines different parenting styles, which in turn influences or determines the self-regulatory trajectories of infants. This model would have the capacity or flexibility to assume the enormous cultural, demographic, and socioeconomic diversity of regions such as Latin America, both between countries and within the Latin American states themselves. The construction of this model is a pending task.

4.2. Limitations

It is possible that the consulted databases did not index all the existing articles on the development of SR in infants from 0 to 36 months in Latin America. In this case, relevant studies that could modify the results of our analysis would be omitted. So, the findings drawn from this review should be considered in the context of our specific sample. Additionally, the limited or simplified use of specific terms in our search approach can be seen as another limitation, as there are significantly more articles related to concepts like executive functions, temperament, and personality (all interconnected in the theory of SR) than those explicitly chosen to carry out the searches.

Another limitation is that despite compliance with PRISMA criteria and the sole consideration of peer-reviewed journals to ensure a certain level of methodological rigor, the authors cannot fully control publication bias and, therefore, cannot guarantee complete access to data in the scope of this review.

5. Conclusions

As a conclusion of this systematic review, we can summarize its main findings. First, the compatibility of the sample with some observed trends: the underrepresentation of the Latin American population in high-impact publications on the subject, even though from 2010 to date, there is evidence of growth in publications on SR in the analyzed sample, which confirms another trend in the area (Nachón et al., 2017).

Second, the sample also allows us to infer a disparate representation of Latin American and Caribbean countries in the existing publications since two of them concentrate almost 60% of the first authors in the publications and more than 60% of the samples in the cases of empirical articles. Here, we find another gap that must be addressed and, if possible, solved in future research. Finally, concerning the adaptation to the cultural context of the research, we found that a smaller but significant number addresses this variable in a specific and significant way. However, even in these cases, the approach is carried out based on models

and hypotheses that are limited when it comes to understanding the Latin American region's cultural, socioeconomic, and demographic diversity. Therefore, future research needs to work on more sophisticated models and hypotheses that allow us to address and understand this complexity and its effects on the self-regulatory trajectories of infants.

Author Contribution Statements

Author, author, author, author, author, and author were involved in the study design. Author collected data with the assistance of author. Data analysis was performed by author with the assistance of author, author, author, author, author, and author. Writing was performed by author with the assistance of author, author, author, author, author, and author.

Conflict of Interest Statement

The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used ChatGPT 3.5 in order to improve readability and language. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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