

# Determinants of the Under-five Child's Physical Well-being in Morocco: The Case of Fertility

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**Abstract:** It is very remarkable that interest in the physical well-being of children and the underlying factors that affect it is growing. Therefore, this paper attempt to shed light on some aspects of children's well-being in Morocco and what influences it. Statistical data collected by the 2011 National Demographic and Health Survey (individual child data) and the 2014 Census (municipal data) are used. Physical well-being includes health status, nutrition, preventative health care, as well as physical activity and safety. However, the choice of the most relevant indicators of child's physical well-being is limited by the availability and the representativeness of data. A principal component analysis (PCA) was applied. It permits us to explore the association between children's well-being and the total fertility rate. Also, it takes into account other socio-economic indicators, all measured at the macro level. In addition, the PCA approach has been applied to a set of child well-being measures and the first factorial axis scores were retained as a composite indicator of the child's well-being. This composite index of the child's physical well-being was used as the dependent variable in a multiple regression analysis. The main conclusions are: 1- The city characteristic of the area of residence improves children's chances of enjoying a certain standard of well-being. 2- Child well-being is adversely correlated with the level of fertility and the rate of illiteracy at the municipal level. 3- The regression model confirmed the links between fertility (measured by both individual and contextual indicators) and child well-being. The regression analysis also highlights the impact of the child's mother's level of education, the child's mother's professional status and the place of residence.

**Keywords:** Well-being, Fertility, Child, Right

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## 1. Introduction

In the recent past, well-being has gained a firm foothold in both academic and policy discourse, as reflected in the rising number of publications, reviews and meetings. It is also becoming a very popular and embedded concept in many fields of social policy, international development and more recently in the field of childhood development [1-4]. Well-being is now being used in the empirical investigation [5]. White et al. [6] has offered a framework for embracing the diversity of concepts of well-being by making a distinction between living a good life (material well-being and standard of living), conducting a good life (values and ideals) and positioning one's life (experience and subjectivity).

The well-being of the child shares common characteristics

with that of the entire population. But it is distinct from it in terms of the particularities of the population under consideration: a population that is growing, vulnerable and lacking in the means to protect itself. The notion of "the child" has considerably evolved over the centuries and through different cultures to ultimately refer to the human being from the moment of birth to the point of adulthood. But the concept of the child was a broad one and the age of majority depended on the culture. For the Romans, the child was defined from the moment of birth until the age of seven. Currently, under the 1989 United Nations Convention on the Rights of the Child (UNCRC), the term "child" refers to "every human being below the age of eighteen years unless under the

applicable legislation, the age of majority is attained earlier"<sup>1</sup>. In the past, infancy was considered a stage of life to be survived and endured without being enjoyed or even adored. The abandonment of children to serve richer households or to be exchanged as hostages or slaves was common practice up to the 16<sup>th</sup> century. Thereafter, the regression of harmful practices towards children was noted, but they continued to work despite their young age. Over time, the situation of the child has improved, particularly with changes in the world from the 17<sup>th</sup> to the 19<sup>th</sup> century. Indeed, as Western Europe and North America moved into the phase of the demographic transition, partly characterised by a decline in fertility, the number of children per woman declined, giving way to a greater interest in each particular child.

The 19<sup>th</sup> century witnessed a shift from the notion of 'protecting the children' to the notion of 'saving the children'. Thus, the focus was first on food security and prevention of physical and sexual exploitation of children. Then other aspects such as education, recreational activities and the fight against mortality and infectious diseases began to be integrated. In addition, the concept of child welfare was also extended to parents. They were supported to care for their children at home instead of placing them in institutions such as orphanages or foster homes.

In the 20<sup>th</sup> century, the Adoption and Safe Families Act (ASFA) was enacted in 1997 in the United States. It was intended to address concerns that many children were remaining in foster care for long periods of time or were being placed in several different homes, which was detrimental to their well-being. To ameliorate this well-being, three goals were set: to improve the economic ability of families to support their children; to provide children with an appropriate education; and to meet the physical and mental health needs of children.

Researchers in the field of child well-being also recognise that this concept is dynamic and covers several domains: namely physical, cognitive, social, emotional and economical [6-9]. This concept, which used to cover dimensions related to the survival and satisfaction of necessities (infant and child mortality control; vaccination against diseases of childhood; malnutrition control; obligatory schooling, etc.), has been expanded to include dimensions of a good quality of life. The latter is perceived as a function of the material and psychosocial environments (perceptions, evaluations and aspirations of people) [10]. The concept of well-being of children has also been extended to take in to account the child's current well-being (immediate Wellbeing) and the development of the child towards adulthood (well-becoming) [6, 9, 11-15]. The concept of child well-being has also moved into approaches which consider both the strengths and positive attitudes as well as the shortcomings and weaknesses of this population category [9, 14-18].

According to Moore [20], the well-being must consider all dimensions of individual functioning. The authors also highlight the correlation and interdependence between these

domains. The latter relates to:

- 1) physical well-being, including health and nutritional status, preventative health care, physical activity and safety;
- 2) psychological well-being, measuring how children perceive themselves and imagine the future;
- 3) social well-being, referring to a child's capacity to develop social networks and includes basic social competencies, time use and the ability to form emotional relationships;
- 4) cognitive or educational well-being, concerning the skills related to a child's age appropriate ability to learn, remember and reason [20].

While conceptualizations of child wellbeing usually include multiple dimensions and complex notions, measurements of child wellbeing often tend to be simpler. This mismatch between concepts and measurements is often rooted in a limitation in the instruments that were originally conceived to assess child well-being [21].

It's now accepted that the psychological development of the children and the environment in which it occurs affect their well-being. The ecological model of human development [22] is a powerful framework for making sense of this influence. As stated by Bronfenbrenner, the development of the child occurs in an inter-actionist socio-ecological space on which his or her quality of growth depends. This interaction of the child with his/her environment is made more challenging as the child's cognitive and physiological structures grow and mature [23]. Bronfenbrenner has adjusted the ideas from the definition of ecology to the study of human socialisation, i.e., by observing how a child or young person gradually becomes a full member of society [24].

As Bronfenbrenner points out, early child development is essentially based on the concrete, sustained and emotional involvement of at least one person. This latter is actively engaged in care and in regular, shared activities with the young child. The family is a child's primary context for socialisation and it contributes to the child's well-being. Cultural patterns, standards and values are communicated by close family relatives (parents, siblings). Also, they are transmitted through friends, schools and other peer groups [20]. The family has a dual function in the life of the child. In addition to its emotional role, it is a source of transmission of the economic heritage. Parents, in particular, have a responsibility to support their children and help them to "become themselves". The best ways are to contribute to their happiness and well-being, to enable them to acquire autonomy and to facilitate their academic and social success. Many researchers consider the family to be the first base for the child's growth and development (primary socialization according to Emile Durkheim). As the child grows, it opens up to other reference models (secondary socialization). Indeed, the child regularly moves from the family to different systems. These last ones contribute in their turn to his development, by a new organization of the activities and the creation of secure bonds of attachment. These links, while

<sup>1</sup> [www.humanium.org/fr/les-droits-de-l-enfant](http://www.humanium.org/fr/les-droits-de-l-enfant)

meeting social and emotional needs, also facilitate learning and later social integration [24, 25].

The key question is whether all the families are in a position to assume their full role in their children's well-being. In other words, which family characteristics or conditions hamper the family's ability to fulfil its responsibilities towards its children?

Family factors that may have an impact on child well-being include: family size and the number of children to be cared for. This later is influenced in turn by fertility levels; the family structure; the socio-economic background of family members; the dwelling conditions, etc.

These questions have been the subject of much debate and several researchers have attempted to answer them. However, this investigation is most often limited to the most developed countries because of the lack of data for this type of study in other countries. Nevertheless, this is not to exclude that some research has looked, at least in part, at the relationship between child well-being and specific socio-demographic characteristics in the developing countries.

In particular, many studies have examined the associations and links between reduced fertility and specific components of children's well-being. These include their chances of survival, health, nutritional status, education, and many other aspects of their subjective well-being.

Firstly, fertility decline reduces the risk of maternal death [26]. These changes in fertility also have a positive impact on women's reproductive health and their nutritional status, which may be depleted by successive childbirths and breastfeeding [27-29]. In turn, gains in maternal survival, health, and nutrition should improve child survival, health, and nutrition [30].

Secondly, as maintained by Lee [7], women who spent 70 percent of their adulthood giving birth and raising young children before the demographic transition (in 1800), are now spending only 14 percent of their adulthood on such activities. In addition, a study conducted between 1994 and 2004 in nineteen countries showed a negative relationship between total fertility rate and human capital expenditure per child (public and private) [7]. Similarly, the risk of infant death is higher when the mother's age exceeds 35 years and childbearing intervals are less than 24 months [31].

In the same way, Giroux [33] and Kravdal [34] have examined the effect of fertility and the number of siblings on childhood stunting in sub-Saharan Africa. Despite finding a strong association at the aggregate level, their estimates of the effect magnitude are quite small at the household level. [33] used household-level data from twenty-three countries and found that an additional sibling increased the risk of stunting by about 2 percent. While Giroux [33] estimated that the risk of stunting in six countries increased by about 1 percent for each additional child, Kravdal [34] found significant effects of birth spacing on stunting risk.

Finally, lower fertility can lead to higher rates of labor force participation, especially for women. Reducing youth dependency ratios can also lead to increased investment in the health and rehabilitation of individual children. This

increases the productivity of children when they enter the labor market. There may also be a positive feedback effect between demographic and economic transitions: lower fertility leads to improvements in health, education, women's labor force participation, and economic growth. These improvements in turn provoke further fertility reductions and additional economic benefits [34]. The idea behind microeconomic approaches, developed by Leibenstein in the 1950s, is to consider that individuals are rational and that their demand for children is determined by a comparison of their costs and benefits [35]. In this respect, the models developed by economists converge in terms of the relationship of fertility to income, but diverge in terms of the mechanisms of action. Thus, the theories of Becker (1960) and Easterlin (1973), as being the most famous in this field, attribute the impact respectively to the "value of time" and to "relative income". Becker's model includes not only the usual income and expenditure variables, but also variables measuring the quality of children and the time and opportunity cost constraints on childbearing. For Becker, the notion of child quality is one of the key factors in the inverse relationship between income and the number of children. This approach has been very controversial. Much of the criticism is that it is too static, in that it does not take into account the evolution of preferences over the life course [36], [39].

In contrast, the model developed earlier by Easterlin (cyclical fertility) incorporates variable preferences. His theory is partly based on the notion of relative income measured by the possibility of gains in the couple's material aspirations. Easterlin then argues that as relative income increases, there is less economic pressure on the couple, and thus they are freer to marry and have children [39].

Morocco has undergone a series of transformations and changes since its independence. But these latest have not been without influence on the demographic revolution. The changes made in the economic and social spheres have indeed been accompanied by a fertility transition. The last-mentioned, despite the fast pace at which it has taken place at the national level, masks regional, provincial and even municipal disparities. The most recent General Census of Population and Housing (RGPH-2014) highlighted that:

- 1) the fertility behavior of Moroccan women is not homogeneous;
- 2) the level of multidimensional poverty, which is considered as the other facet of well-being, also differs among areas. All categories of the population are affected by this poverty. But the most affected are children, who represent a significant share of this population. Indeed, according to data published by the Moroccan High Commission for Planning (HCP) in 2019, the number of children in Morocco is estimated at 11.2 million (49% are girls). In other words, about one-third of Moroccans are under the age of 18. Children under the age of five represent more than 25% of all children. This huge number of children poses a great challenge for the country.

Certainly, Morocco has signed on to several international and regional conventions to improve the rights and well-being<sup>2</sup> of children. It has made enormous progress in this area, particularly in the areas of child survival, development and protection.

However, despite the efforts of Morocco to guarantee the same rights to its children, as stipulated by the UNCRC<sup>3</sup>, which it ratified in 1993, Moroccan children do not enjoy their rights in the same way. Indeed, the living conditions of children and the realization of their rights are linked to the different systems in which these children live and grow up. Many studies conducted in Morocco highlight the situation of Moroccan children [39-41]. However, these interesting studies are purely descriptive and do not capture the association between the well-being of the child and many explicative factors as internationally documented. The objective of this manuscript is to test the relationship of some aspects of children's physical well-being with some explanatory factors related to the family and the municipality. Because of the lack of comparable information on all dimensions of child well-being, this analysis will be limited to the physical well-being of children under five, and more specifically to health status, nutrition and child protection.

## 2. Patterns of Fertility and of Selected Indicators of Child Physical Well-being in Morocco

Until the early 1960s, Moroccan women's fertility was comparable regardless of their place of residence (~7 children per woman). Fifteen years later, rural women maintained their high fertility levels, while urban women had only 4.4 children. The decline only became noticeable in rural areas in the late 1980s (6.7 children per woman according to the 1987 DHS). Thereafter, an increasingly accelerated pace was experienced with a TFR of 2.8 children per rural woman according to the 2018 DHS (0.7 children more than their fellow citizens). Urban women's fertility is

currently approaching that of developed countries and has even crossed the generation replacement threshold within some categories of women, such as women with a secondary education or higher (TFR=1.64 children/woman). This decline is accompanied, at the macro level, by an improvement in the under-five children population survival and health.

In order to monitor trends and changes in fertility status and child well-being, some indicators derived from the population and family health surveys conducted by the Ministry of Health in Morocco during the period 1987-2018 had been selected. This has the benefit of providing comparable information collected using the same methodologies. These indicators are used to highlight aspects of child well-being over the past few decades. They also allow us to examine their trends and possible links with fertility decline (see table 1).

As anticipated, all the indicators outlined in Table 1 are significantly correlated with the total fertility rate ( $p_{\text{value}} < 5$  percent). This indicates that the opportunity for the child to be completely vaccinated; to be attended by a qualified staff during childbirth; to have received a prenatal medical consultation; to be treated by a health professional in case of pneumonia or diarrhea increases with the decline in fertility. On the other hand, the risk of suffering from malnutrition in its various forms is positively correlated with the level of fertility.

**Table 1.** Levels and trends of child well-being indicators related to health and nutrition (%), and of the Total Fertility Rate (child/woman) by area of residence, Morocco 1987-2018.

Indicators	Population and Family Health Surveys					
	1987 <sup>a</sup>	1992 <sup>b</sup>	1997 <sup>c</sup>	2004 <sup>d</sup>	2011 <sup>e</sup>	2018 <sup>f</sup>
<b>Towns</b>						
Total fertility rate	3.2	2.5	2.3	2.1	2.2	2.1
Completely vaccinated	82.8	93.7	94.4	93.5	95.2	Data not available
Supervised child birth	56	63.7	80.7	85.3	92.1	96.6
Qualified prenatal care	49	61	85	85	91.6	95.6
Moderate under weight	6.8	3.3	4.1	6.5	1.7	2
Severe under weight	1.2	0.6	0.5	1.1	0.5	0.7
Moderate growth retardation	17.2	13.1	15	12.9	8.6	10.4
Severe stunted growth	5.3	3.1	10.6	3.8	2.3	3.5
Moderate emaciation	1.9	1.9	2.7	7.6	1.6	2.5
Severe emaciation	0.5	0.4	0.7	1.8	0.7	1
Care to treat diarrhea	Data not available	28.9	41.7	43.3	63.9	48.4
Care to treat suspected pneumonia	23.5	12.5	38	26.9	46.4	40.8
<b>Country side</b>						
Total fertility rate	5.8	5.5	4.1	3	3.2	2.8
Completely vaccinated	57.6	66.7	80.9	84.1	86.5	Data not available
Supervised child birth	11	13.8	27.9	39.5	35	74.2
Qualified prenatal care	13	18	40	48	62.7	79.6
Moderate under weight	14.9	12	9.1	14.1	4.3	3.8
Severe under weight	4.8	2.4	2.6	2.9	1.1	0.6
Moderate growth retardation	29.8	27.7	14	23.6	20.5	20.5
Severe stunted growth	11.4	10.6	8.6	9.2	6.4	5.9
Moderate emaciation	4.7	2.4	3.4	11.1	3	2.7
Severe emaciation	0.8	0.5	0.8	3.2	1.3	1.2

<sup>2</sup> Child well-being and international children's rights law have much in common. Specifically, they both focus on a category of human beings defined by age (children), and both are concerned about 'child flourishing'. Surprisingly perhaps, the word well-being is rarely used in children's rights work, and it is not very prominent in the leading human rights instrument on children's rights, the Convention on the Rights of the Child.

<sup>3</sup> The CRC provides a normative framework for understanding the child well-being. Indeed, its four general principles are entirely consistent with discussions on how to conceptualize child well-being: (i) non-discrimination (Art. 2) emphasizes the need to ensure the well-being of all children, including children with disabilities, children in institutions or refugee children; (ii) the best interests of the child (Art. 3) reinforces the role of the child as a full citizen. Therefore, in data on child well-being, the unit of analysis should be the child; (iii) Article 6 reflects the complexity of children's lives and thus the importance of a holistic view of the child, giving equal weight to his or her civil, political, social, economic and cultural rights, which are interdependent, universal and indivisible. Concepts of child well-being must therefore be multidimensional and ecological; (iv) respect for the views of the child (Art. 12) finally recognizes the right of children to be heard and to have their views taken into account in matters that affect them.

Indicators	Population and Family Health Surveys					
	1987 <sup>a</sup>	1992 <sup>b</sup>	1997 <sup>c</sup>	2004 <sup>d</sup>	2011 <sup>e</sup>	2018 <sup>f</sup>
Care to treat diarrhea	Data not available	13.6	16.7	24.5	54.1	44.4
Care to treat suspected pneumonia	10.5	9.7	24.4	17.5	26.4	35.2
National Total fertility rate	4.8	4	3.1	2.5	2.6	2.4
Completely vaccinated	69.8	75.7	87.1	89.1	90.9	Data not available
Supervised child birth	26	31	48.4	62.6	73.6	86.6
Qualified prenatal care	25	32	58	68	77.1	88.5
Moderate under weight	12.1	9	7.1	10.2	3.1	2.9
Severe under weight	3.6	1.8	1.8	2	0.8	0.7
Moderate growth retardation	25.5	22.6	14.5	18.1	14.9	15.1
Severe stunted growth	9.3	8	9.6	6.5	4.5	4.7
Moderate emaciation	3.7	2.3	3.1	9.3	2.3	2.6
Severe emaciation	0.7	0.4	0.8	2.5	1	1.1
Care to treat diarrhea	Data not available	18.7	28.3	34.5	60.3	47
Care to treat suspected pneumonia	15.1	10.5	28.3	22.1	36.4	39.2

1987<sup>a</sup>: National Population and Health Survey - 1987

1992<sup>b</sup>: Population and Health Panel Survey - 1992

1997<sup>c</sup>: National Survey on Mother and Child Health - 1997

2004<sup>d</sup>: Population and Family Health Survey - 2003-2004

2011<sup>e</sup>: National Population and Family Health Survey - 2011

2018<sup>f</sup>: National Population and Family Health Survey - 2018

Source: Moroccan Ministry of Health<sup>4</sup>

This simultaneous change suggests a relationship between fertility and some aspects of child's physical well-being. So, an in-depth analysis is needed to investigate this link. Hence, both a Principal Component Analysis (PCA) and a Multiple Regression Analysis are used to achieve this goal. Firstly, the PCA is an explorative technique which allows us, in particular, to reduce a large set of individual well-being measures and to produce a composite well-being index. Secondly, this index is treated as the variable to be explicated in a multiple regression model. This analysis helps us to evaluate the impact of certain explicative factors (the independent variables of the model) on the child's physical well-being (the dependent variable). In the following sections, we discussed the data sources, the choice of indicators of child's physical well-being and the statistical method.

### 3. Data and Methods

#### 3.1. Data

This study used data collected by the Moroccan Ministry of Health (ENPSF-2011)<sup>5</sup> and by the High Commission for the Plan (RGPH-2014)<sup>6</sup>. These data sources were merged by us to constitute a unique file containing the information

<sup>4</sup> [https://www.sante.gov.ma/Publications/Etudes\\_enquete/Pages/default.aspx](https://www.sante.gov.ma/Publications/Etudes_enquete/Pages/default.aspx)

<sup>5</sup> This survey carried out by the Department of Health Studies and Information (SEIS) reporting to the Financial Planning and Resources Directorate - Ministry of Health with the technical assistance of PAPFAM of the League of Arab States.

<sup>6</sup> Sixth census carried out in Morocco and whose data made available by the High Commission for the Plan, the Moroccan national institution responsible for statistical production, planning, forecasting, analysis and economic forecasting.

required for our analysis.

ENPSF-2011 is a representative sampling survey conducted by Moroccan's Ministry of Health. Standard validated questionnaires were used. The household questionnaire is about:

- 1) the socio-demographic profile of household members;
- 2) the characteristics of the housing (age; gender; relationship to the head of the household; level of education; marital status; general health; anthropometric measures of children under six years old, etc.);
- 3) and the quality of the environment surrounding it.

The household questionnaire makes it possible, in particular, to identify women of reproductive age eligible for the direct individual interview. So, a specific questionnaire was designed to gather information on the characteristics of the woman and her reproductive life. These characteristics relate to socio-demographics, activities and marriage, reproduction and child survival, maternity care and morbidity, contraceptive use, and unmet need. This individual questionnaire also includes specific modules to collect information about the woman's under-five children especially their health, nutrition, care and protection, etc.

It should be noted that this survey reached a national sample stratified by type of habitat of approximately 16,000 households divided into 640 clusters (including 240 in rural areas) of 25 households each. It targeted women of childbearing age (15-49) and children under five. Response rates were very high (98.5 percent and 95 percent for the household and individual questionnaires respectively).

The household survey covered 75,061 people, 38,410 of whom were women. Of these, 11,697 were eligible for the individual questionnaire addressed to any woman aged between 15 and 49. The survey also covered 8,136 children under the age of five for the anthropometric measures. But the other modules on child health, nutrition and child care were only filled in for the last birth given by the women covered by the individual survey in the last five years prior to the interview, i.e. a total of 5,890 children. The nutritional status of children under five is considered in the literature as an indicator of their well-being. For this reason, the above data were enriched with height-for-age indices measuring chronic malnutrition; weight-for-height as a measure of acute malnutrition and weight-for-age as an indicator of underweight. These indices<sup>7</sup> were converted into Z-scores using the WHO/GRS - 2006 reference standard and merged with the ENPSF-2011 file.

RGPH-2014: the sixth General Population and Housing Census was carried out in Morocco in 2014. This census made available a large body of:

- 1) macro demographic data (total fertility rate; average parity of women 45-49 years; age at first marriage by sex; average household size; etc.);
- 2) economic and social data (unemployment rate by sex;

<sup>7</sup> The anthropometric measurements were generated by anthro2005 software and used the height, age, and sex information of the child under five years of age that was collected during ENPSF2011.

school enrolment rate 7-12 years by sex; illiteracy rate by sex; distance to the asphalt road for rural environment; water, electricity, sanitary equipment for housing; property of housing, etc.).

These data were published by the HCP, in two separate files, in Excel format:

- 1) the first file presents the indicators relating to households;
- 2) the second file looks at the individual characteristics of household members (distribution by age; marital status; age at first marriage; disability rate; fertility; school enrolment rate for children aged 7 to 12; employment status; etc.).

These indicators (average, proportion) are measured at an aggregate level (region; province; municipalities and other administrative subdivisions) and by area of residence (countryside and towns).

The two databases *ENPSF-2011* and *RGPH-2014*, described above, were merged by us to constitute a unique file where the under-five child was the unit of analysis. Our data contains 5,890 children under five. Each unit is described by individual characteristics relating to:

- 1) the child (gender, age, health status, etc.);
- 2) to his/her mother (age; education level, work, parity, etc.);
- 3) to his/her household (size of the household, wealth index, equipments, etc.);
- 4) to his/her municipality (total fertility rate, unemployment rate, illiteracy rate, infrastructure, etc.).

### 3.2. Indicators

In Appendix A, were presented selected indicators related to fertility and physical well-being of children under five. Other contextual indicators are also available in the merged data file described above. these indicators were chosen according to the literature review and to the goals of our research. The child's physical well-being is measured by indicators relating to the child health status, nutrition, preventative health care, and safety. So, the pneumonia care, diarrhoea care and symptom disease severity were used as indicators of child health status. The nutritional status is measured by breastfeeding, vitamin A intake, vitamin D intake, moderate malnutrition and severe malnutrition. With regard to preventative health care, the prenatal care, supervised childbirth and immunization coverage have been selected. The safety is measured by child protection. All these indicators are described in appendix A, which contains also other indicators relating to:

- 1) fertility (total fertility rate, average parity, fertility level, Household size, woman parity, under five children per house);
- 2) socio-demographic characteristic of the women (woman age, woman education, woman work, woman age at first marriage);
- 3) contextual characteristics of the municipality (poorest,

rich, illiteracy rate, unemployment rate, schooling children, W.C, water, electricity);

- 4) moreover, and in order to take into account the disparities according to the sex, age of the child and his place of residence, these indicators were also taken into account (area, child gender, child age).

### 3.3. Methods

The analyses are based on different approaches, which examine the impact of fertility level on the under-five child physical well-being. The authors started with a detailed analysis of all the variables retained for the analysis. This made it possible to verify the integrity of the data and the accuracy of the responses. Then they have moved on to the study of the correlations that could exist between each pairs of variables, both dependent and independent. This descriptive analysis was completed by an exploratory analysis using the principal component analysis. The PCA process is based on the matrix of correlations, and its relevance depends on the level of correlation between initial variables. AKaiser-Meyer-Olkin (KMO) test tending towards one or a p-value of Bartlett's sphericity test tending towards zero means that the PCA is applicable. The factors retained are those whose eigenvalues are greater than one.

Because of the limitations of any one-dimensional analysis of physical well-being, our goal here is to find the best theoretical path to a multidimensional approach to this phenomenon. One of the steps of the PCA proposed here is to construct a composite indicator from a list of primary indicators relating to physical well-being. This construction is therefore based on the inertia approach aimed at defining a composite indicator for each unit of the child population. This is a way of summarizing the various information on children's well-being in a single variable. The objective of the PCA is in fact to identify a reduced-dimensional subspace onto which the Scatter plot of units and/or variables selected will be projected. This method consists of seeking, in the first instance, the first factorial axis on which the Scatter plot is least distorted in projection. This axis, by construction and by definition, captures the largest share of the total inertia (total variability) of the Scatter plot, or the information that the Scatter plot contains. This index deduced from the PCA is therefore a linear combination of the modalities of the basic variables constructed with the least possible arbitrariness.

Furthermore, and given that PCA is not an explanatory method, the authors have also used the multiple regression procedure. they have considered the child score on the first axis deriving from the PCA as the dependent variable in the regression model. This latter makes it possible to explain the dependent variable (physical well being index) by a number of independent variables relating to fertility. It permits also to control for variables which could have an effect as well on child well-being than fertility. The procedure used is the Stepwise method whose principle of inclusion of the

explanatory variables in the model depends on their mathematical contribution to its improvement. SPSS chooses among all these variables, the most correlate with the dependent variable. Next, the software assesses whether the inclusion of other variables in the regression model is significant. Then, it begins by integrating the variable with the highest partial correlation with the dependent variable and so on. Moreover, the software re-evaluates at each step the contribution and significance of other variables in order to eliminate redundant ones.

## 4. Results

### 4.1. Descriptive Analysis

The descriptive analysis of the data allows us to ensure that all the selected indicators for advanced analysis were available for all under-five children. For each quantitative variable, the mean and standard deviation were calculated in addition to the minimum and maximum values. The descriptive analysis results reproduced in appendix B shows a degree of heterogeneity in the population of children under five years of age with regard to all the variables considered in our analysis and which are described above in appendix A. Thus, for example, it can be seen that the parity of the mother of the under-five child (Woman parity) varies between a minimum of one to a maximum of 14 children, with an average of 2.9 and a standard deviation of 1.9. For the same variable, but this time measured at the contextual level (Average parity woman 45-49), the number of children per woman varies between 1.4 and 9.1, with an average of 3.8 and a standard deviation of 1.2.

The description of each of the variables retained for this analysis was completed by the calculation of the correlation. The correlation matrix in Appendix C shows that, with the exception of a few coefficients, all the correlations are statistically significant ( $pvalue < 1\%$ ).

### 4.2. Exploratory Analysis

The PCA seems to be perfectly adapted to our data. In fact, the three criteria required are verified: significant correlation between indicators Kaiser-Meyer-Olkin index exceeds 0.9 and Bartlett's sphericity test is very significant ( $p_{value}$  tends to 0) (see correlation matrix at appendix A). Three eigenvalues are greater than 1 with a total explained variance of 67.5 percent. The first factor plane explains more than 59 percent. The first component alone accounts for about 48 percent while the second explains 11.5 percent (table 2). The first factorial axis is defined positively by the indicators relating to access to child schooling; equipping housing with drinking water, electricity and sanitation; proportion of households belonging to the most rich quintile of well-being; qualified prenatal consultation; supervised childbirth; child social interest. On the other hand, the indicators relating to illiteracy, at current fertility level (Total Fertility Rate) and the frequency of households in the poorest quintile of well-being by municipality seem to contribute negatively to the formation of this first axis.

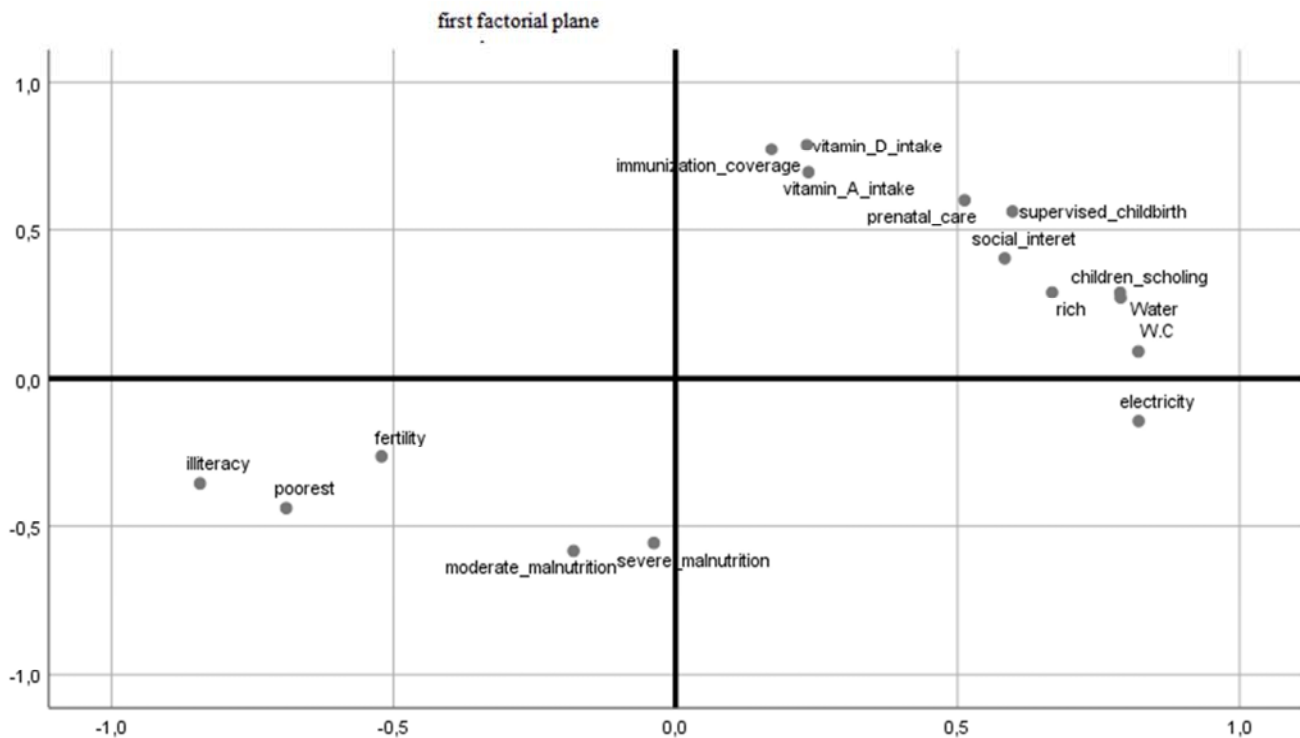
Moreover, the second factorial axis seems to be mainly and positively determinate by the indicators of preventative cares especially the completeness of immunisation and the vitamins A and D intake (figure 1). On the other hand, the third factorial axis distinguished by its strong relationship with the prevalence of both moderate and severe malnutrition in its different forms (Stunting, wasting or underweight).

The projection of the municipalities on the first factorial plane (axis 1 and 2) shows that under-five children living in an urban municipality generally enjoy a higher level of well-being compared to their rural counterparts. Indeed, of the one hundred two urban municipalities covered by the ENPS-2011, only eight municipalities (5 percent) have a negative score on the first factorial axis.

**Table 2.** Contribution of the different indicators for measuring child well-being and from fertility to the formation of factor axes corresponding to eigenvalue ( $\lambda$ ) greater than 1.

Indicators	Component 1 eigenvalue_1 ( $\lambda_1=7,7$ ; explained variance =48,1%)	Component 2 eigenvalue_2 ( $\lambda_2=1,78$ ; explained variance =11,16%)	Component 3 eigenvalue_3 ( $\lambda_3=1,3$ ; explained variance =8,2%)
Electricity	0,8263	-0,1138	0,0438
W.C	0,8237	0,0292	-0,1708
Children schooling	0,7788	0,2915	-0,0845
Water	0,7766	0,3189	-0,0767
The most rich	0,6593	0,2703	-0,1502
Supervised childbirth	0,5818	0,4981	-0,2994
Interest given to the child by parents and other members of the household	0,5638	0,4758	-0,0313
Qualified prenatal consultation	0,4985	0,4941	-0,3725
Vitamin A intake	0,2058	0,7382	-0,1429
Vitamin D intake	0,1961	0,8729	-0,1030
Immunization coverage	0,1347	0,8472	-0,1119
Severe malnutrition	-0,0513	-0,1061	0,8828
Moderate malnutrition	-0,1904	-0,1653	0,8447
Total fertility rate	-0,5107	-0,2817	0,0732
The poorest	-0,6823	-0,3378	0,3192
Illiteracy rate	-0,8321	-0,3421	0,1639

Source: table developed by us on the basis of ENPSF-2011 and RGP-2014 data.



Source: figure developed by us on the basis of ENPSF-2011 and RGPH-2014 data

**Figure 1.** The contribution of various indicators of child well-being to the first factorial plane, Morocco 2014.

The children living in urban municipalities are more likely to be vaccinated; to benefit from follow-up during the prenatal period and to be assisted by qualified personnel at birth. These children are also more likely to live in low fertility households and having a high level of well-being. They also live in housing equipped with water, electricity and sanitation (figure 2a). The projection of municipalities according to factorials axis 1 and 3 seems to reproduce the same scheme as the projection on the first factorial plane (figure 2b). Indeed, except that many urban municipalities on the third factorial axis, defined positively by the indicators of malnutrition, have positive scores indicating a relatively high prevalence of malnutrition among under-five children. Effectively, the correlation between the two factorials axis, even though, it is significant is not strong. Therefore, a satisfactory level of child well-being according to the first factorial axis does not systematically imply a high level of well-being on the third factorial axis (figure 2c).

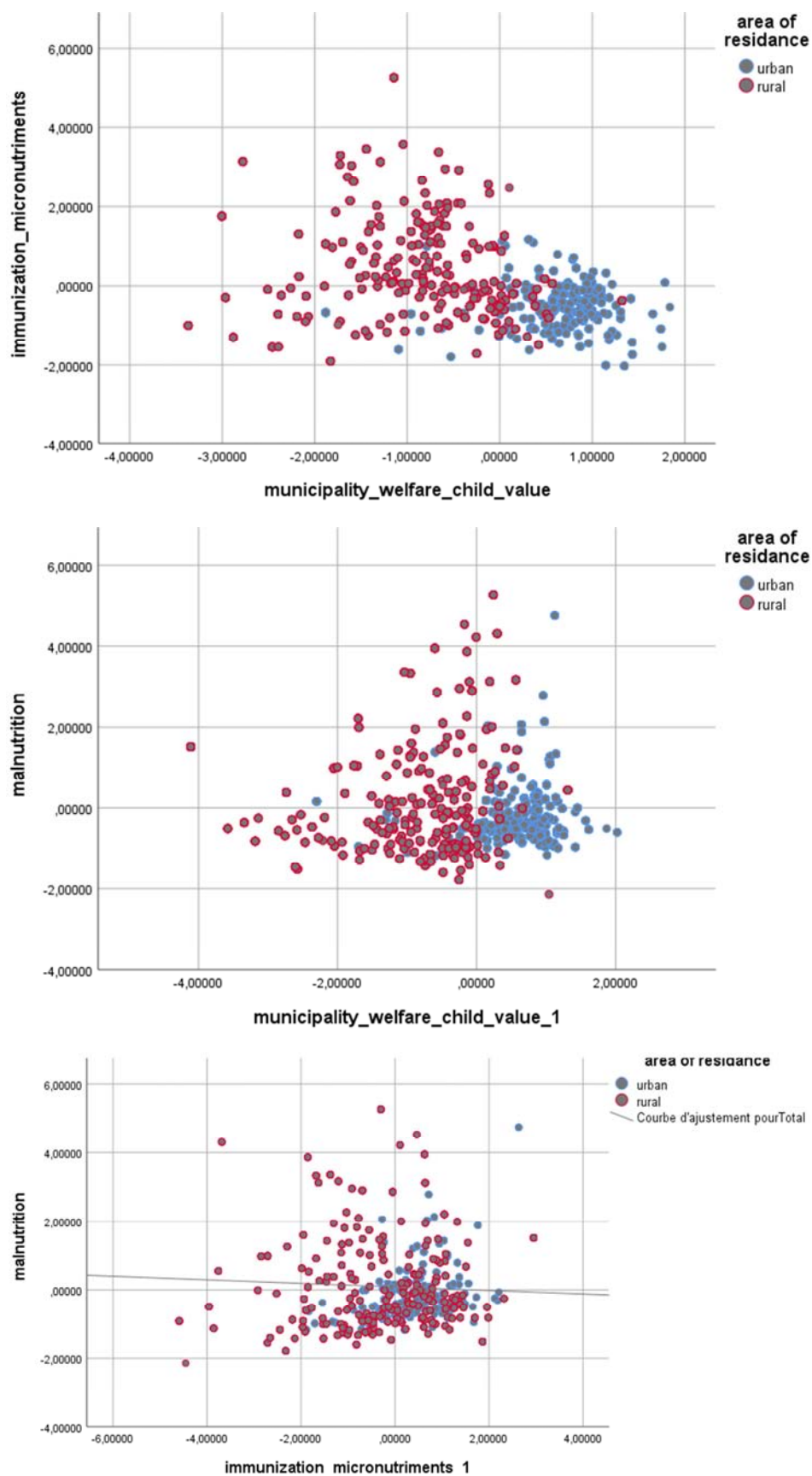
The distribution of municipalities according to the area of residence and the category of the index of well-being shows for example that 26 percent of rural municipalities among the one hundred ninety three studied have a level of the well-being of children in the period infant-child on the first factorial axis qualified as unsatisfactory (7.5 percent very unsatisfactory and 18.5 percent unsatisfactory).

These exploratory analysis is enriched by the analysis of the scores of the first and the second factorials axis. Therefore, the authors have transformed these scores into a categorical variable measuring the level of well-being of under-five children: very unsatisfactory ( $<-2$ ); unsatisfactory

(between -2 and -1), Medium (between -1 and 0); satisfactory (between 0 and 1) and very satisfactory (1 and +). For the third factorial axis: very unsatisfactory ( $>=2$ ); unsatisfactory (between 1 and 2), Medium (between 0 and 1); satisfactory (between 0 and -1) and very satisfactory ( $<= -1$ ).

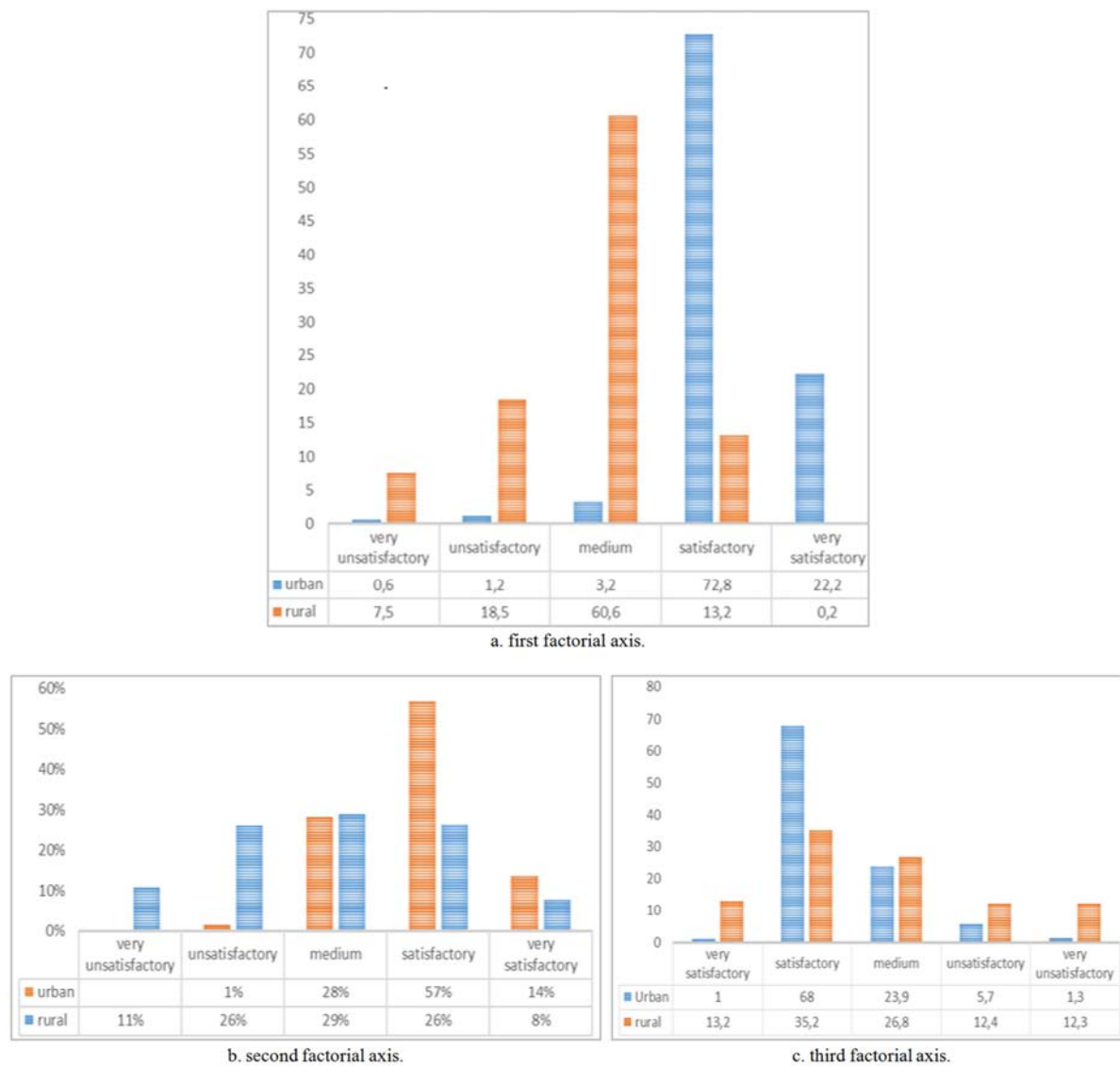
As a result, just 0.2 percent of rural municipalities ranked into the category “very satisfactory level of child well-being” and 13.2 percent in the “satisfactory” category (figure 3a). the authors have also defined the index of children well-being according to the second and the third factorial axis (figures 3b; 3c). Nevertheless, several municipalities, which classified in the categories “very satisfactory” and “satisfactory” according to the first factorial axis, are not in this category according to the others factorials axis. In other words, if the children of these municipalities enjoy a very satisfactory/satisfactory well-being related to access to schooling; equipped house with drinking water, electricity and sanitation; well-being of household; qualified prenatal consultation; supervised childbirth; child and social interest, they appear to be at greater risk of having some form of malnutrition (figure 4). However, several municipalities (4%) are in the “very unsatisfactory” category according to the first component are well ranked under the third component (44% satisfactory and 45.6% medium). Furthermore, many municipalities have a very satisfied level of the three indexes and therefore their children benefit from well-being measured by the various indicators previously defined (3%). Further details concerning the relationship between the level of fertility and the various indices of child well-being are presented in the appendix C.



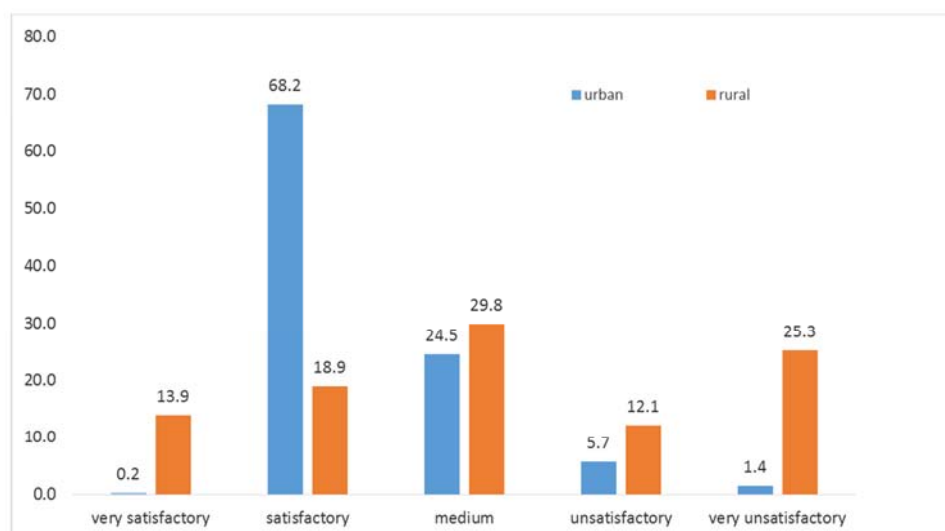


Source: developed by us on the basis of ENPSF-2011 and RGPH\_2014 data

**Figure 2.** Distribution of municipalities according to their scores on the factorials axis by area of residence, Morocco 2014.



**Figure 3.** Distribution of under-five children according to their well-being index on the factorials axis.



**Figure 4.** Distribution of children with a very satisfactory or satisfactory index of well-being at the first factorial axis according to their index of well-being on the third factorial axis.

### 4.3. Explanatory Analysis

Admittedly, the exploratory analysis is very interesting. It has permitted to highlight the differences in the terms of child well-being existing between municipalities by using relevant indicators. However, its explanatory contribution remains limited. It doesn't allow us to meet with certitude the net link between the level of fertility and the physical well-being of the child. That's why the authors have recourse to a multidimensional analysis based on explanatory models. It allowed us to complete this exploratory analysis and to point out, among all the aforementioned indicators, the indicator which seems to explain the most this variation in child well-being.

The more adapted explanatory model to the quantitative nature of ours indicators is the multiple regression. The regression coefficients inform us about the degree to which each explanatory variable (influence physical child well-being (Child score on the first factorial axis resulting from the PCA process). The sign of the coefficient indicates the direction of this relationship and its standard error provides information on the variability of the coefficient in the population. This error also makes it possible to calculate the value of "t" whose level of significance allows us to decide whether the variable contributes significantly to the model. The value of the standardized Beta ( $\beta$ ) indicates the change in standard deviation of the variable to be explained for each increase of one standard deviation of the explanatory variable when all other values are constant. It thus emerges from table 3, relating to the results of the multiple regression, that the current fertility level measured by the municipality's TFR has a negative impact on child's well-

being (a regression coefficient of -0.357). In other words, the child's physical well-being seems to be reduced by one-third if the TFR increase by a point. Thus, one could support the hypothesis that a high fertility reduces the level of child well-being. Moreover and as discussed above, the area of residence affects the child well-being. Indeed, it emerges from the regression analysis that children in rural area have lower levels of well-being compared to town's children (-1.294). Similarly, a mother's level of education affects the well-being of her children. The regression coefficient corresponding to this explanatory variable shows a statistically significant increase of 0.115 going from one level to another. For instance, all other things being equal, the child whose mother has a primary education has a higher level of well-being than a child whose mother is illiterate. The other variables retained by the stepwise regression model have a low coefficient although being statistically significant. It is also important to mention that several other variables, including the mother's age and the gender of the child, were not entered into the regression model.

Of course, the authors do not intend to build a predictable model, even though the variables included in the model explain about 68% of the variability in child well-being ( $R^2 = 67.7\%$ ). These variables are: area of residence, the total fertility rate of the municipality, the highest level of education attained by the child's mother, the age at first marriage, the size of the child's household, the occupational status of the child's mother, the total number of children under five per household, the parity of the child's mother, and the child's age.

*Table 3. Summary of multiple regression findings.*

	Regression coefficient	Standard error	Beta ( $\beta$ )	t de student	Significance
(Constant)	1.022	0.107		9.538	0.000
Municipality level					
Area of residence	-0.980	0.025	-0.510	-38.861	0.000
Wealth index	0.163	0.009	0.238	18.705	0.000
Total Fertility Rate	-0.121	0.020	-0.064	-6.029	0.000
Individual level					
Age at first marriage	0.025	0.003	0.125	9.424	0.000
Household size	0.011	0.003	0.036	3.833	0.000
Woman education	-0.084	0.019	-0.045	-4.360	0.000
Woman work	0.089	0.027	0.029	3.234	0.001
Woman age	-0.014	0.002	-0.100	-5.735	0.000
Woman parity	0.042	0.008	0.082	5.027	0.000
Child age	0.001	0.000	0.022	2.222	0.026

Source: table developed by us on the basis of ENPSF-2011 and RGPH-2014 data.

## 5. Discussion

Using data from the ENPSF-2011 and RGPH-2014, the authors analysed the links between the fertility and the child well-being. Our focus was the physical component because of the lacks of information for the others dimensions. Our

results are both statistically significant and confirm that children's level of well-being depends on many factors such as fertility level. Indeed, according to the PCA, children in the municipalities having a low TFR apparently benefit more from all the aspects of well-being considered in the analysis. To enhance this explorative analysis, they applied a regression analysis considering the first factorial axis that

was generated by the PCA as the dependent variable. As described before, this variable is defined by indicators related to child's physical well-being. Many predictors are involved in the regression model. All fertility variables appear to affect child well-being significantly. This confirms the statistical links between fertility and child well-being.

In fact, these results confirm the conclusions of other similar studies from different contexts and time periods. Declining fertility enhances child well-being through several mechanisms, as documented by a large literature in this field. Indeed, fertility decline contributes to child well-being by giving parents more time and resources to devote to their children [42].

Thus, when parents have a large family, they will not always be able to invest in their children. This in turn affects the quality of nutrition, health care, and education of children [42]. The dilution of the economic resources in the family is probably one of the main causal factors. The accomplishment of parents responsibilities to their children may not escape Becker's principle of interaction between the quality and quantity of children. Indeed, human fertility experts are persuaded that there is a negative correlation between the quantity and quality of the children. The shadow price of children in relation to their number increases with their quality, according to Becker. Likewise, the more numerous the children, the higher the fictitious price of children in relation to their quality [36]. Most of the evidence from developing countries suggests that having more siblings is unfavourable for child well-being, both in terms of education and health.

Moreover, a reduced parity of women has given them more time for their children. Reference [6] demonstrated that women, before the demographic transition, used to spend 70% of their adulthood delivering and raising young children. Now, they are spending only 14% of their adulthood on such activities.

At the macro level, increasing the TFR decreases public investment per child, particularly in health, as argued by [7]. Indeed, in a study conducted between 1994 and 2004 in 19 countries, they found a negative association between the TFR and spending per child on human capital. Reducing public expenditures per infant could affect the provision of high-quality health care services to all offspring. This in turn could affect child well-being.

In addition, short birth intervals do not allow the woman to recover after childbirth, which weakens her physical and physiological health. All of these have a detrimental impact on the quality of her childcare and on her alertness to symptoms of severe disease in the child. Similarly, the possibility of neglecting her children's immunisation increases. Children with the highest rank are less likely to be vaccinated [45]. Nevertheless, our conclusions do not deviate from the results of other similar studies. Indeed and as mentioned above, high fertility has a negative impact on the nutritional status of the child [45]. Similarly, high parity

reduces the chances of vaccination of the child. Birth spacing provides the child greater opportunity to benefit from a social interest [46].

In our analysis, the regression model in particular confirms the links between fertility (measured by individual and contextual indicators) and child well-being. The regression analysis highlights also the impact of the child's mother educational level, the work status of the child's mother and the place of residency.

Have every reason to believe that the fertility level affects the child well-being. Females who have low fertility are those who have higher socio-economic status and vice versa. The relationship between maternal education and child well-being is multi-faceted. Thus, besides its impact on empowering women and improving their socio-economic status, a better level of education has a positive impact on the health of the child by providing simple health knowledge and easier access to health services. In addition, an educated woman is not passive and often has a role in decision-making within the family circle. Such changes in the family power structures enable the educated woman to do the right choices for higher quality of children [32].

## 6. Conclusion

The analysis of the link that exists between the well-being of the under-five children (the physical dimension) and the level of fertility has led to results. These are consistent with other studies conducted in a variety of socio-demographic contexts and adopting different approaches.

The analysis found a strong statistical link between fertility and the well-being of children under five. Indeed, the regression analysis confirms the statistical association between fertility and child well-being. It also highlights the impact of the education and employment status of the child's mother. The environment of residence plays a very important role in the physical well-being of children. This result is not surprising given that this environment is better endowed with basic infrastructure and facilities. Similarly, the prevalence of poverty, both monetary and multidimensional, is higher in rural areas, which has a negative impact on the well-being of rural children.

Another very important result is that the gender of the child does not affect his or her well-being. This is a valuable result that confirms the mitigation of gender discrimination in Morocco. Certainly, with the improvement in the status of women and their autonomy, there are changes in the values and norms that govern Moroccan society.

Finally, It can be noted that other indicators could be generated. Further analysis is needed to understand the nature of this link. This requires the inclusion of variables from different levels, such as the political, economic, cultural, natural and social context, the family, educational and municipal environment. In this case, a multi-level approach will be more relevant.

## Appendix

### Appendix A. Indicators Description

**Table 4.** Descriptions of the indicators used for the analysis and of the response categories selected for each variable.

Indicator	Description
Area of residence	Area of residence (urban, rural).
Child gender	The gender of the child (female, male).
Child age	The age of the child in months.
Average parity	Average parity per women 45–49 years old by municipality (contextual indicator).
Total Fertility Rate (TFR)	The total fertility rate measured at municipal level (contextual indicator).
Fertility level	The Total Fertility Rate (TFR) transformed in a categorical variable taking into account the current level of fertility in Morocco, which does not exceed 2.5 children per woman at national level. Thus, a TFR below 2 children per woman is a low fertility. Fertility is high if it the TFR exceeds 3 children per woman and medium in the others cases (contextual indicator).
Household size	The size of the child's household.
Woman parity	Number of live births given by the child's mother until the date of the survey.
Under five children	Number of under-five children per house.
Mother's age	Age of the child's mother at the time of the survey.
Mother's education	Schooling of the child's mother. The score varies between 0 (none) and 4 (graduate studies).
Mother's work	The exercise of an economic activity by the child's mother (Yes/No).
Mother's age first marriage	Age of the child's mother at the first marriage.
Prenatal care	The person consulted during prenatal consultations carried out by the child's mother when she was pregnant with him (None; Nurse/midwife; Doctor; Doctor/nurse/ midwife)
Supervised childbirth	The place where the child's birth occurred (At home; Hospital; Health center / delivery house; Clinic; Private doctor's office).
Birth certification	The registration of the child's birth at a civil register office (Yes/No/Don't know).
Social interest	Involvement of parents and other household members in child's learning and development activities (Reading books for the child; Telling stories for the child; Singing for the child; Going out with the child; Playing with the child; naming things and counting numbers for the child). Each activity has a score of 1 if the child benefits from it and 0 otherwise. The sum of the scores varies from 0 (none) to 6 (perfect).
Child protection	The number of times per week that the child is left alone at home or with another child under the age of ten (Never left alone/ Once to twice/ Three times and more).
Breastfeeding	This indicator seeks to know if the child has been exclusively breastfed during the first six months of his life as recommended by the WHO (Not breastfed/Yes but not WHO compliant/Yes with WHO compliant/ Breastfed and age<6 months).
Vitamin A intake	The number of doses of vitamin A received by the child (WHO recommends 3 doses) (None/One dose/Two doses/Three doses & +).
Vitamin D intake	The number of doses of vitamin A received by the child (WHO recommends 2 doses) (None/One dose/Two doses & +).
Immunization coverage	The child has received all the antigens according to the national immunization schedule (Full vaccinated/ Programmed to complete/ Ignorance of utility/Inaccessibility/Illness of the child)
Symptom disease severity	Child's mother degree of knowledge of the symptoms of the severity of their children's illness (six symptoms were considered: The child can not drink or suckle; The child drinks with difficulty; The child becomes increasingly ill; The child develops a fever; The child has rapid breathing; The child has difficulty in breathing; The child has blood in the stools). The score for each symptom varies between 0 and 1.
Pneumonia care	This indicator provides information on the use of care in case of suspected pneumonia (Yes/No/Not concerned).
Diarrhoea care	Use of care to treat diarrhea (Yes/No/Not concerned).
Moderate malnutrition	Three indicators to measure moderate malnutrition were calculated (Z-score weight for height <-2SD; Z-score weight for age <-2SD and Z-score height for age <-2SD) (None/One single criterion/Two or three criteria).
Severe malnutrition	Three indicators to measure severe malnutrition were calculated (Z-score weight for height <-3SD; Z-score weight for age <-3SD and Z-score height for age <-3SD) (None/One single criterion/Two or three criteria).
Wealth Index	The wealth index is an indicator of the economic situation of households that better takes into account urban-rural differences in scores and indicators of wealth. Although surveys under The DHS Program do not collect data on consumption or income, they do collect detailed information on dwelling and household characteristics and access to a variety of consumer goods and services, and assets, which together are used as a measure of economic status (Five equal parts, from quintile one (lowest poorest) to quintile five (highest wealthiest), each having approximately 20% of the population).
Poorest	Proportion (%) of poorest household in the municipality (first wealth index quintile).
Rich	Proportion (%) of wealthiest household in the municipality (last wealth index quintile).
Illiteracy rate	Proportion (%) of people over age ten who have never gone to school in the municipality.
Unemployment rate	Proportion (%) of people over age fifteen who are looking for work in the municipality.
Children schooling	Proportion (%) of children seven-twelve years old who go to school in the municipality.
W.C	Proportion (%) of households that have a water-closet in the house in the municipality.
Water	Proportion (%) of households that have a source of drinking water in the house in the municipality.
Electricity	Proportion (%) of households that have electricity in the house in the municipality.

## Appendix B. Descriptive Analysis Outcomes

**Table 5.** The descriptive statistics of the Indicators used for the analysis.

Indicator	N	Minimum	Maximum	Moyenne	Standard deviation
Area of residence	5890	1,0	2,0		
Child gender	5890	1,0	2,0		
Child age (in month)	5890	0,0	59,0	25,4	16,5
Average parity woman 45-49	5890	1,4	9,1	3,8	1,2
Total Fertility Rate (TFR)	5878	1,0	4,6	2,3	0,5
Fertility level	5878	1,0	3,0		
Household size	5878	2,8	7,3	4,8	0,8
Woman parity	5890	1,0	14,0	2,9	1,9
Under five children	5890	1,0	5,0	1,4	0,6
Woman age (in years)	5890	16,0	49,0	31,7	7,0
Woman education	5890	0,0	4,0		
Woman work	5890	1,0	2,0		
Woman age first marriage (in years)	5889	12,0	45,0	20,8	4,8
Prenatal care (%)	5890	7,1	100,0	76,4	23,4
Supervised childbirth (%)	5890	0,0	100,0	72,7	28,8
Birth certification (%)	5890	0,0	100,0	83,8	22,6
Social interest (%)	5890	0,0	100,0	35,6	20,8
Child protection (%)	5890	55,6	100,0	89,8	9,1
Breastfeeding (%)	5890	0,0	100,0	69,5	15,0
Vitamin A intake (%)	5890	0,0	100,0	36,1	20,1
Vitamin D intake (%)	5890	0,0	100,0	74,4	19,5
Immunization coverage (%)	5890	0,0	100,0	72,3	17,2
Symptom disease severity (%)	5890	0,0	33,3	2,0	4,6
Pneumonia care (%)	5890	0,0	71,4	18,5	14,2
Diarrhoea care (%)	5890	0,0	85,7	9,6	10,6
Moderate malnutrition (%)	5890	0,0	50,0	7,6	8,8
Severe malnutrition (%)	5890	0,0	25,0	2,7	4,7
Wealth Index	5890	1,0	5,0		
Poorest (%)	5890	0,0	100,0	22,9	33,1
Rich (%)	5890	0,0	100,0	16,7	20,8
Illiteracy rate (%)	5878	10,7	67,3	35,7	14,3
Unemployment rate (%)	5878	0,5	54,1	15,3	7,3
Children schooling (%)	5878	67,2	100,0	94,5	5,5
W.C (%)	5878	21,7	99,8	90,2	15,1
Water (%)	5878	0,0	98,8	64,8	35,3
Electricity (%)	5878	8,9	98,7	90,0	10,7

Source: Appendix B developed by us on the basis of ENPSF-2011 and RGPH-2014 data.

## Appendix C. Correlation Matrix

**Table 6.** Correlation matrix between the various indicators.

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14
V1 Woman_parity	1													
V2 Under_five_children	,203**	1												
V3 Household_size	,258**	,117**	1											
V4 Child_age	,129**	-,376**	-,084**	1										
V5 Woman_age	,610**	-,088**	0,014	,342**	1									
V6 Total Fertility Rate (TFR)	,151**	,148**	,183**	-,102**	-,103**	1								
V7 Average_parity woman 45-49	,246**	,199**	,202**	-,112**	-,105**	,681**	1							
V8 children scholing	-,172**	-,169**	-,105**	,098**	,051**	-,385**	-,592**	1						
V9 illiteracy rate	,190**	,168**	,179**	-,114**	-,104**	,559**	,763**	-,763**	1					
V10 unemployment rate	-,110**	-,124**	0,000	,059**	,073**	-,480**	-,531**	,422**	-,597**	1				
V11 electricity	-,082**	-,067**	-,043**	,053**	,042**	-,287**	-,319**	,641**	-,570**	,311**	1			
V12 Water	-,152**	-,130**	-,138**	,103**	,084**	-,409**	-,646**	,628**	-,766**	,508**	,535**	1		
V13 W.C	-,139**	-,120**	-,086**	,089**	,057**	-,388**	-,469**	,708**	-,675**	,360**	,713**	,516**	1	
V14 Social_interest	-,201**	-,157**	-,139**	,114**	,066**	-,462**	-,646**	,453**	-,663**	,419**	,329**	,586**	,390**	1
V15 Symptom_disease_severty	,076**	,099**	0,008	-,035**	-0,022	,189**	,228**	-,303**	,233**	,042**	-,199**	-,145**	-,245**	-,182**
V16 prenatal_care	-,245**	-,182**	-,152**	,085**	0,019	-,435**	-,654**	,563**	-,706**	,416**	,342**	,551**	,531**	,578**

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14
V17 vitamin A intake	-,167**	-,180**	-,150**	,140**	,091**	-,380**	-,558**	,423**	-,509**	,328**	,230**	,446**	,358**	,484**
V18 breastfeeding	,075**	0,022	,076**	0,001	-,029*	,302**	,268**	-,170**	,259**	-,202**	-,164**	-,113**	-,264**	-,143**
V19 vitamin D intake	-,173**	-,192**	-,157**	,144**	,075**	-,446**	-,573**	,484**	-,512**	,315**	,247**	,450**	,388**	,481**
V20 Supervised_childbirth	-,256**	-,183**	-,194**	,102**	,062**	-,491**	-,776**	,577**	-,658**	,351**	,338**	,580**	,568**	,606**
V21 Pneumonia_care	,117**	,115**	,071**	-,039**	-,031*	,123**	,346**	-,324**	,336**	-,140**	-,202**	-,272**	-,292**	-,338**
V22 Diarrhoea_care	,036**	,096**	,062**	-,049**	-,080**	0,019	,197**	-,166**	,186**	-,069**	-,038**	-,155**	-,184**	-,185**
V23 Child_protection	-,034**	-,053**	0,009	-0,008	-0,006	-,041**	-0,010	-,060**	,026*	-,041**	-,162**	-,112**	#####	0,000
V24 Birth_certification	-,070**	-,100**	-,107**	,061**	,028*	-,124**	-,180**	0,010	-,171**	,079**	-,028*	,070**	0,023	,229**
V25 Immunization_coverage	-,166**	-,190**	-,091**	,145**	,059**	-,284**	-,484**	,496**	-,470**	,252**	,222**	,408**	,406**	,476**
V26 Moderate_malnutrition	,170**	,124**	,095**	-,063**	-0,017	,264**	,411**	-,241**	,381**	-,277**	-,180**	-,270**	-,344**	-,368**
V27 Severe_malnutrition	,126**	,094**	,092**	-,061**	-0,019	,193**	,309**	-,225**	,315**	-,239**	-,113**	-,208**	-,314**	-,211**
V28 Poorest-household	,204**	,168**	,144**	-,096**	-,065**	,415**	,653**	-,541**	,691**	-,391**	-,436**	-,553**	-,604**	-,582**
V29 Rich_household	-,168**	-,113**	-,196**	,098**	,096**	-,480**	-,601**	,446**	-,714**	,362**	,375**	,564**	,422**	,663**
V30 Woman_age_first_marriage	-,272**	-0,019	-,170**	-0,004	,368**	-,195**	-,245**	,188**	-,230**	,137**	,154**	,176**	,192**	,176**

Source: Appendix C developed by us on the basis of ENPSF-2011 and RGP-2014 data.

Table 6. Continued.

	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30
V1 Woman_parity																
V2 Under_five_children																
V3 Household_size																
V4 Child_age																
V5 Woman_age																
V6 Total Fertility Rate (TFR)																
V7 Average_parity woman 45-49																
V8 children schooling																
V9 illiteracy rate																
V10 unemployment rate																
V11 electricity																
V12 Water																
V13 WC																
V14 Social_interest																
V15 Symptom_disease_severity	1															
V16 prenatal_care	-,222**	1														
V17 vitamin A intake	-,184**	,497**	1													
V18 breastfeeding	,047**	-,248**	-,052**	1												
V19 vitamin D intake	-,250**	,574**	,639**	,074**	1											
V20 Supervised_childbirth	-,261**	,719**	,554**	-,254**	,553**	1										
V21 Pneumonia_care	,131**	-,274**	-,239**	,138**	-,138**	-,432**	1									
V22 Diarrhoea_care	,044**	-,127**	-,165**	,104**	-,110**	-,266**	,505**	1								
V23 Child_protection	-0,018	,143**	,070**	-,142**	,074**	,108**	-,112**	-,146**	1							
V24 Birth_certification	-,115**	,213**	,184**	-,088**	,049**	,175**	-,246**	-,153**	,078**	1						
V25 Immunization_coverage	-,283**	,541**	,584**	,156**	,824**	,530**	-,233**	-,203**	,110**	,073**	1					
V26 Moderate_malnutrition	,208**	-,455**	-,318**	,220**	-,298**	-,451**	,295**	,184**	-,179**	-,252**	-,302**	1				
V27 Severe_malnutrition	,106**	-,398**	-,274**	,159**	-,311**	-,346**	,128**	,153**	-,179**	-,168**	-,292**	,652**	1			
V28 Poorest-household	,219**	-,713**	-,544**	,266**	-,477**	-,751**	,394**	,295**	-,124**	-,181**	-,461**	,483**	,378**	1		
V29 Rich_household	-,130**	,540**	,403**	-,281**	,366**	,538**	-,296**	-,174**	,055**	,206**	,301**	-,323**	-,268**	-,531**	1	
V30 Woman_age_first_marriage	-,058**	,163**	,175**	-,125**	,150**	,226**	-,072**	-,058**	-0,025	0,013	,113**	-,090**	-,081**	-,176**	,228**	1

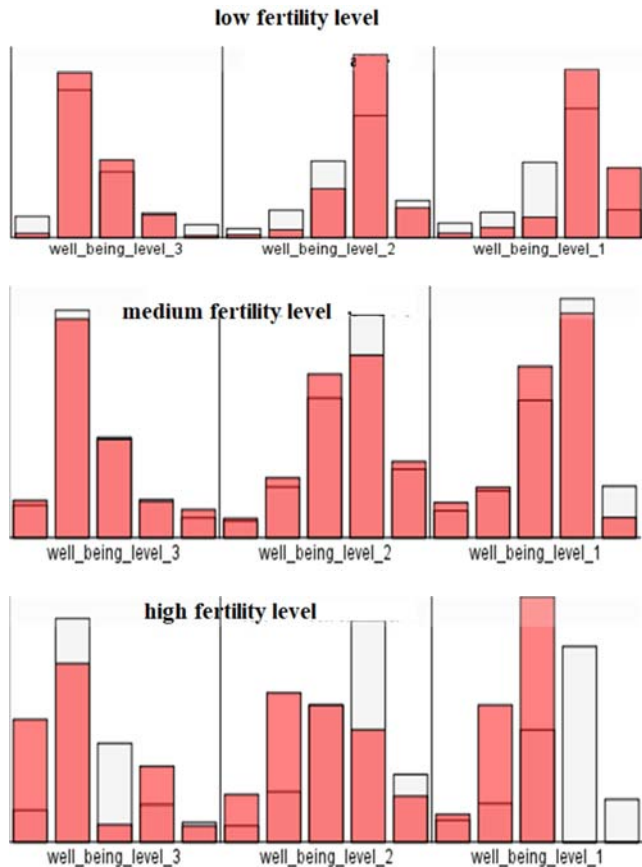
Source: Appendix C developed by us on the basis of ENPSF-2011 and RGP-2014 data.

#### Appendix D. Variation in the Level of Under-Five Child Well-being According to the Level of Fertility

Table 7. Variation in the Level of Under-Five Child Well-being According to the Level of Fertility (used in the graphics below).

Index description	Categories				
Well-being_level_1 (child's score on the first factorial axis defined by: Child schooling; water, electricity, sanitation; proportion of households belonging to the richest quintile of well-being; qualified prenatal consultation; supervised childbirth; child social interest).	Very unsatisfactory (<-2)	Unsatisfactory (between -2 and -1)	Medium (between -1 and 0)	Satisfactory (between 0 and 1)	very satisfactory (>=1)
Well-being_level_2 (Child's score on the second factorial axis defined by: Completeness of immunisation and the vitamins A and D intake).	Very unsatisfactory (<= -2)	Unsatisfactory (between -2 and -1)	Medium (between -1 and 0)	Satisfactory (between 0 and 1)	very satisfactory (>=1)
Well-being_level_3 (Child's score on the third factorial axis defined by Moderate and severe malnutrition in its different forms).	very satisfactory (<=-1)	Satisfactory (between -1 and 0)	Medium (between 0 and 1)	Unsatisfactory (between 1 and 2)	very unsatisfactory (>=2)





**Figure 5.** Variation in the Level of Under-Five Child Well-being According to the Level of Fertility.

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