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After lunch naps reduce the afternoon motor activity of 4-5-year old enrolled in full-time childcare

Cochilos reduzem a atividade motora de crianças de 4-5 anos que frequentam creches em período integral

Eduardo Furtado Magalhães[1]

RESUMO

Objetivo. Determinar a relação entre os cochilos após o almoço e a atividade motora no período da tarde em crianças do ensino infantil. **Método**. Participaram do estudo, 42 crianças saudáveis com idade entre 4 e 5 anos de dois Centros Municipais de Educação Infantil (CMEIs) da cidade de Curitiba, Paraná. Em um deles (CMEI I), as crianças tinham a opção de cochilar ou não após o almoço enquanto no outro (CMEI II), todas as crianças eram estimuladas a cochilar. Cada participante usou um actígrafo por sete dias e sete noites para que seu ciclo vigília/sono e sua atividade motora no período da tarde fossem objetivamente mensurados. A fim de se comparar a atividade motora média das crianças após cochilarem ou não, todos os participantes foram mantidos acordados após o almoço em ao menos um dos dias da semana. **Resultados**. A atividade motora média das crianças correlacionou-se negativamente com a média de duração de seus cochilos (r=-0,46; p<0,05). A atividade motora média após as crianças cochilarem foi menor do que após ficarem acordadas no CMEI II (t=-2,33; p<0,03) mas não no CMEI I (t=0,96; p=0,35). **Conclusão.** Cochilos após o almoço diminuem a atividade motora de crianças de 4-5 anos de idade que frequentam Centros de Educação Infantil em período integral.

Unitermos. Crianças, Educação infantil, Cochilos, Atividade motora, Actigrafia.

Citação. Magalhães EF. Cochilos reduzem a rtividade motora de crianças de 4-5 anos que frequentam creches em período integral.

ABSTRACT

Objective. To determine the relationship between napping and the afternoon motor activity of preschool-aged children. **Method**. Participants were 42 healthy 4-5-year olds from two child care centers (CCCs) - one where children could choose whether or not to nap after lunch (CCC I) and another one where all children were encouraged to do so (CCC II). Each participant wore an actigraphy watch for seven days so that their sleep/wake cycle and afternoon motor activity were objectively measured. In order to compare the children´s mean afternoon motor activity on napping and non-napping days, all children were required not to nap on at least one weekday. **Results**. The children´s mean afternoon motor activity was negatively correlated to their mean nap duration (r=-0.46; p<0.05). The mean motor activity was smaller on nap days compared to non-nap days for the CCC II (t = -2.33; p<0.03) but not for the CCC I (t=0.96; p=0.35). **Conclusion**. After lunch naps reduce the afternoon motor activity of 4-5-year olds enrolled in full-time child care.

Keywords. Children, Preschool, Sleep, Motor activity, Actigraphy.

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INTRODUCTION

Today´s children seem to have difficulty to balance the amount of motor activity they perform. On the one hand, modern lifestyle has made them more sedentary, which is evidenced by the global epidemic of infant obesity[1,2], but on the other hand, the number of children under medication for hyperactivity has been constantly increasing[3,4].

Although the home/family environment is greatly responsible for determining how physically active children are[5], the child care center (CCC) they attend is also of supreme importance in that matter. Research has shown that factors such as time spent outdoors at the CCC as well as the playground size and equipment influence preschoolers` physical activity levels[6]. Moreover, these levels may vary even within the same institution according to the teachers` willingness to take the children outdoors[7].

Another factor which influences children`s motor activity is their sleep duration. Sleeping too much might not be appropriate, since children who spend less time awake tend to present smaller spontaneous physical activity8. However, sleeping too little is not recommended either. Research has shown that short sleep duration is associated with symptoms of hyperactivity observed in children[9,10].

Children who attend CCCs have to wake up very early and are usually sleep deprived. Night sleep deprivation makes children feel sleepy during the day[11] and tends to disrupt their school achievement[12], since sleeping plays an important role in the memory consolidation process[13,14]. It has recently been found a positive association between sleep duration and the volume of healthy children´s hippocampus[15], which is the center of memory of the brain.

Given the importance of sleep in children´s development[16], full time CCCs usually have an after lunch nap scheduled. Researchers observed that most preschoolers in fact take a nap at that time when they have the opportunity[17]. According to them, napping makes children relax and recover from morning activities.

Infants` memory also seems to benefit from napping[18]. Nevertheless, some authors found a negative correlation between nap duration and the performance of 3-5-year olds in neurocognitive tests[19]. Although there has been interest in the effects of napping on children`s cognition, the influence of naps on preschoolers` motor activity is unknown.

The purpose of the present study was to examine the relationship between napping and the subsequent motor activity in healthy children aged 4 to 5 years. We hypothesized that children`s motor activity would be smaller on days they napped compared to the days they did not nap.

METHOD

Participants

Forty-two 4-5-year-old children (50% male) enrolled in full-time daycare and declared healthy by their parents participated in the study. Nineteen participants attended one Child Care Center (CCC) and the remaining twenty-three attended a second CCC, both of them were public and located in the city of Curitiba-PR, Brazil. The study was approved by the Federal University of Paraná Ethics Committee (CEP/SD 1092.017.11.03; CAAE 0022.0.091.000-11) and the Department of Education of Infants of Curitiba allowed the research to be conducted in the CCCs.

Procedures

The researcher visited the centers to meet the directors, explain to them the aim and methods of the study, obtain the institution and parents` consent and observe the children´s routines, such as arrival, departure, meals and napping schedules.

Then, invitation letters were sent to the parents of all 4-5-year-old children enrolled in those CCCs. In the first Child Care Center (CCC I), the data collection happened from September to October of 2011. In the second Child Care Center (CCC II), the data were collected in November and December of the same year.

Centers` Routines and Napping Policy

The starting time was 8:00 AM for both CCCs. The meals and their times were also the same for both CCCs. The children had breakfast when they arrived, another light meal at 10:00 AM and then lunch at about 11:30 AM. After nap time, which was from noon to 2:00

PM, they had a snack. Finally, before leaving the CCC at 5:00 PM, the children had some soup.

Although the times scheduled for napping were the same in both CCCs, they had different nap policies. In CCC I, the children could choose whether to stay in their room doing calm activities such as drawing and listening to stories or go to another room and nap. Differently, in CCC II, mattresses were placed in the children's classroom, the lights were turned off and they were all encouraged to nap.

Napping x Non-napping

In order to obtain all the children's afternoon motor activity in the napping and non-napping conditions, it was tried to make every participant nap at the CCC on at least one day as well as not nap on at least one day out of the five week days during which they wore the actigraphs.

On the days the children stayed awake, they were kept drawing, listening to stories or watching cartoons and then joined their colleagues at the end of the nap time. On the days the participants were encouraged to nap, the researcher visited the napping room thirty minutes after the nap start time and checked if the children were actually asleep.

It was considered as napping days, the ones on which the participant napped for at least half an hour, confirmed later by means of actigraphy.

Actigraphy

Actigraphy was performed using Octagonal Basic/Light actigraph watches (Ambulatory Monitoring, Inc., Ardsley, NY, USA). The devices were set to record activity in 1-minute epochs, in the zero-crossing mode. Each study week, actigraph watches were fit into a group of, in average, seven participants. The children wore the actigraphs on their non-dominant wrist for seven consecutive days, removing them only for taking showers or swimming.

The registers were then downloaded into a computer and the sleep/wake cycle and motor activity data were generated using the ActionW 2.6 software (Ambulatory Monitoring, Inc., Ardsley, NY, USA). Sleep was scored using the Sadeh algorithm[20], previously validated for this age. In addition, parents were asked to complete daily sleep logs with the times children went to sleep, awoke and did not wear the actigraphs.

The variables were defined as follows:

Napping afternoon motor activity - Mean number of counts from 2:00 PM to 4:00 PM on the week day(s) the participant napped at the CCC.

Non-napping afternoon motor activity - Mean number of counts from 2:00 PM to 4:00 PM on the week day(s) the participant did not nap at the CCC.

Nap frequency - Percentage of days the participant napped out of the days they attended the CCC at the week they wore the actigraph.

Nap duration - (Mean) Number of minutes scored as sleep during the participant´s nap(s).

Nap sleep efficiency - (Mean) Percentage of minutes scored as sleep out of the total napping time.

Week days sleep onset - Mean time at which the child fell asleep at the nights of Sunday to Thursday.

Weekend sleep onset - Mean time at which the child fell asleep at the nights of Friday and Saturday.

Week days awaking time - Mean time at which the child awoke in the mornings of Monday to Friday.

Weekend awaking time - Mean time at which the child awoke in the mornings of Saturday and Sunday.

Week days night sleep duration - Mean number of minutes scored as sleep at the nights of Sunday to Thursday.

Weekend night sleep duration - Mean number of minutes scored as sleep at the nights of Friday and Saturday.

Week days night sleep efficiency - Mean percentage of minutes scored as sleep out of the total time the child stayed in bed at the nights of Sunday to Thursday.

Weekend night sleep efficiency - Mean percentage of minutes scored as sleep out of the total time the child stayed in bed at the nights of Friday and Saturday.

Week days total sleep duration - Mean 24-hour total sleep duration (from 12:00 PM to 12:00 PM of the following day) for Sunday to Thursday.

Weekend total sleep duration - Mean 24-hour total sleep duration (from 12:00 PM to 12:00 PM of the following day) for Friday and Saturday.

Anthropometry

The participants had their weight and height

measured without shoes and in light clothes by means of a digital scale and a stadiometer, respectively. The measures were all made by the same evaluator, always in the morning.

Then, the children´s body mass indexes (BMI) were calculated by dividing their weight in kilograms by the square of their height in meters. Afterwards, each child´s BMI was classified into normal or overweight/obesity according to the World Health Organization´s guidelines (BMI Classification 0-5 years old: WHO, 2006; BMI Classification 5-10 years old: WHO, 2007)[21].

Data Analyses

The normal distribution of the data was verified using Shapiro-Wilk`s W test. Then, mean values and standard deviations of all variables were calculated for the whole sample and for each CCC. T-tests were used to compare napping to non-napping afternoon motor activity and CCC I to CCC II. To assess the relationship between nap duration and the participants´ afternoon motor activity, Pearson correlations were used. Significance was set at $p < 0.05$.

RESULTS

Table 1 shows the values for anthropometry, night sleep and napping variables for the total sample and for each Child Care Center. Two girls and a boy did not attend the CCC II on the measuring days. Therefore, the anthropometry data are limited to thirty-nine children.

Children from CCC II were older, heavier and taller compared to the ones from CCC I (p=0.00). The mean BMI did not differ between the two CCCs, however, the prevalence of overweight/obesity was greater in CCC II (50%) than in CCC I (21%).

Participants who did not wear the actigragh at a minimum of three nights (including one weekend night) were excluded from the analyses of the night sleep variables. For that reason, these data are based on forty children; Eighteen from CCC I (nine boys) and twenty-two from CCC II (eleven boys).

On week days, the mean sleep onset was later for children from CCC II (22:58± 0:48) than from CCC I (22:17±0:58; p=0.02). However, awaking time (7:04±0:25; p=0.78) and night sleep duration (449.7±55.9min; p=0.57) did not differ. At weekends, there was no difference between the sleep onset time (23:07±1:03; p=0.40), awaking time (8:23±0:52; p=0.08) or night sleep duration (495.8±64.6min; p=0.28) presented at the two CCCs. They also presented equivalent mean total sleep durations (i.e. night sleep plus naps) on week days (495.6±50.3min; p=0.42) and weekends (528.2±62.8min; p=0.07).

Out of the forty-two participants, four (from CCC I) did not nap on any of the week days. Consequently, the nap duration and nap sleep efficiency variables presented in Table 1 refer to a total of thirty-eight children, fifteen from CCC I and twenty-three from CCC II. As expected because of the different napping policies, children from CCC II napped more frequently (73% of school days) than children from CCC I (50% of school days; p=0.00). Nevertheless, the duration (82.14±20.6min; p=0.06) and sleep efficiency (97%; p=0.31) of naps in the two CCCs were correspondent.

Figure 1 presents the participants` mean afternoon motor activity in the napping and non-napping conditions. Besides the four children who did not nap, previously mentioned, there was one (from CCC II) who napped every week day. Therefore, these values are based on a sample of thirty seven children, fifteen from CCC I (nine boys) and twenty-two from CCC II (ten boys).

For CCC I, the mean afternoon motor activity was the same in the napping (258,92±20.45 counts) and non-napping conditions (254.48±23.72 counts). Differently, in CCC II, the motor activity was greater in the non-napping (245.94±34.85 counts) than in the napping condition (231.20±20.91 counts; p=0.03). Comparing the two CCCs, the motor activity in the napping condition was significantly smaller for children from CCC II (p=0.0003). However, with the increase of their motor activity in the non-napping condition, it reached the same level as the ones registered in CCC I.

Figure 2 shows the relationship between the participants` mean nap duration and their mean afternoon motor activity on the days they napped. There was a moderate negative correlation between the two variables for the total sample (r=-0.46; p<0.05) and for CCC I (r=-0.56; p<0.05). That is, the longer children napped, the smaller their afternoon motor activity was. Although the

Table 1.

Values for anthropometry, night sleep and napping variables for the total sample and for each Child Care Center.

	TOTAL		CCC I		CCC II		*I x II*
	n	**Mean±SD**	**n**	**Mean±SD**	**n**	**Mean±SD**	**p**
Age (years)	42	5.23±0.44	19	4.90±0.36	23	5.51±0.29	0.00
Weight (kilos)	39	21.06±4.64	19	19.01±2.52	20	23.02±5.36	0.00
Height (meters)	39	1.10±0.05	19	1.06±0.04	20	1.13±0.05	0.00
BMI	39	17.38±2.60	19	16.81±1.82	20	17.92±3.12	0.19
Overweight/Obese (%)	14	36%	4	21%	10	50%	-
Week days sleep onset	40	22:39±0:56	18	22:17±0:58	22	22:58±0:48	0.02
Weekend sleep onset	40	23:07±1:03	18	22:58±1:09	22	23:15±0:58	0.40
Week days awaking time	40	7:04±0:25	18	7:03±0:21	22	7:05±0:28	0.78
Weekend awaking time	40	8:23±0:52	18	8:08±0:49	22	8:36±0:51	0.08
Week days night sleep duration (minutes)	40	449.7±55.9	18	455.3±50.6	22	445.1±60.74	0.57
Weekend night sleep duration (minutes)	40	495.8±64.6	18	483.6±70.2	22	505.8±59.42	0.28
Week days night sleep efficiency (%)	40	90±7.68	18	88±8.07	22	92±7.02	0.10
Weekend night sleep efficiency (%)	40	90±7.6	18	89±7.06	22	90±8.07	0.44
Week days total sleep duration (minutes)	40	495.6±50.3	18	488.5±51.4	22	501.5±49.74	0.42
Weekend total sleep duration (minutes)	40	528.2±62.8	18	508.3±66.3	22	544.5±56.24	0.07
Nap frequency (% of school days)	42	62	19	50	23	73	0.00
Nap duration (minutes)	38	82.14±20.6	15	74.32±13.9	23	87.24±22.79	0.06
Nap sleep efficiency (%)	38	97	15	96	23	97	0.31

BMI = body mass index; SD = standard deviation.

correlation was not significant for CCC II, it pointed in the same direction.

DISCUSSÃO

The aim of this study was to analyze the association between napping and motor activity in preschoolers. Our hypothesis was that napping would decrease the participants` subsequent motor activity.

The research hypothesis was confirmed by the following findings: At CCC II, the children's mean motor activity in the napping condition was smaller than in the non-napping condition; for the total sample and for CCC I, the mean motor activity of the participants on napping days correlated negatively to their mean nap duration.

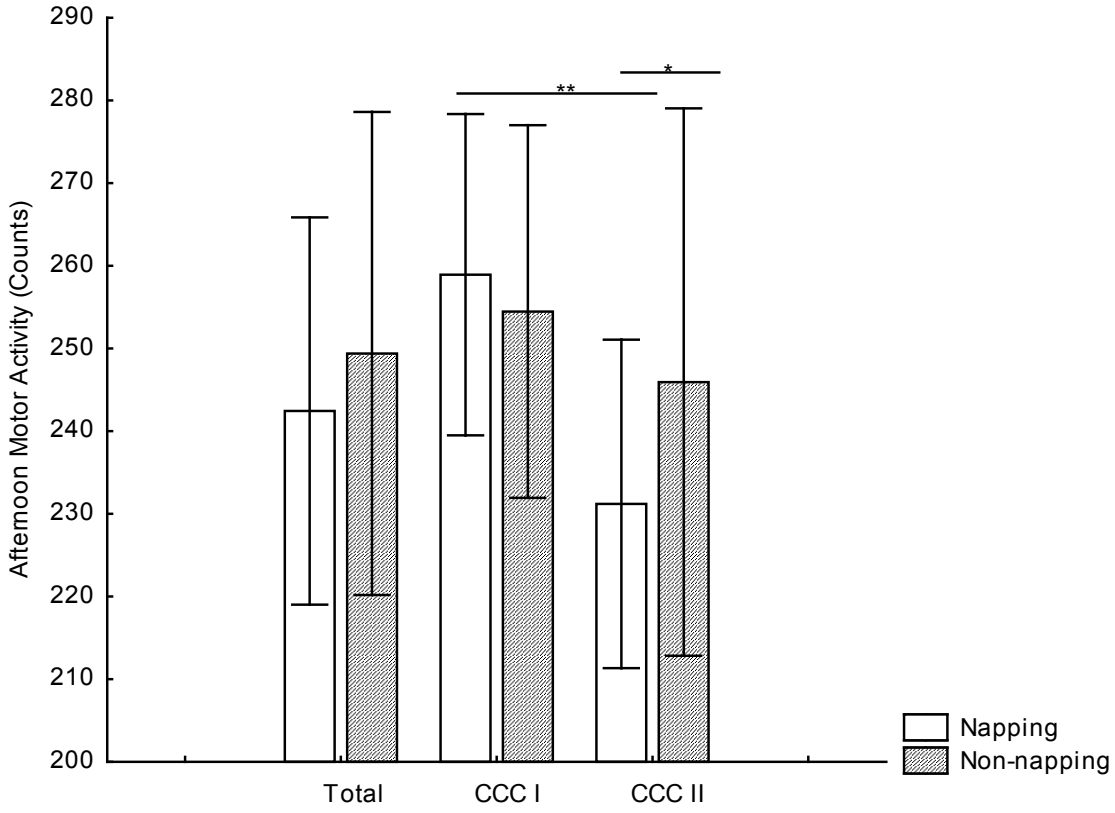
It is worth note that some differences between the two samples might have accounted for the motor activity of children from CCC II in the napping condition being smaller than the motor activity of children from CCC I. These differences are discussed below.

Firstly, the mean age of participants from CCC I was lower, and, younger children tend to be more active. For instance, actigraphic registers of three-year-old preschoolers showed less sedentary behavior and more physical activity in comparison to the ones of their four and five year old peers[22].

Secondly, according to previous studies[23,24], preschool boys are usually more active than the girls. In the samples considered to compare the motor activity in the CCCs, the boys were majority in CCC I (9/15) but minority in CCC II (10/22). Therefore, gender differences may have contributed to the smaller motor activity in CCC II.

Thirdly, the different motor activities registered in the two CCCs might be associated to their prevalence of overweight/obesity. The cross-sectional character of our study does not allow us to determine a cause-effect relation between the two variables. Nevertheless, the fact

Figure 1. Mean afternoon motor activity in napping and non-napping conditions for the total sample (n=37), for CCC I (n=15) and for CCC II (n=22).



*p<0.05; **p<0.001

is that in the CCC where the motor activity was smaller, the overweight/obesity prevalence was higher. The association between overweight and low levels of physical activity in preschoolers, measured by means of actigraphy, has been verified elsewhere[25].

Finally, the smaller motor activity of children from CCC II in the non-napping condition may be related to their tendency of taking longer naps than children from CCC I (p=0.06). Although this difference was not statistically significant, it has been demonstrated that an increase of only ten minutes in the duration of a nap augments the time required to dissipate sleep inertia after awaking[26], due to the greater amount of slow wave sleep during longer naps[27].

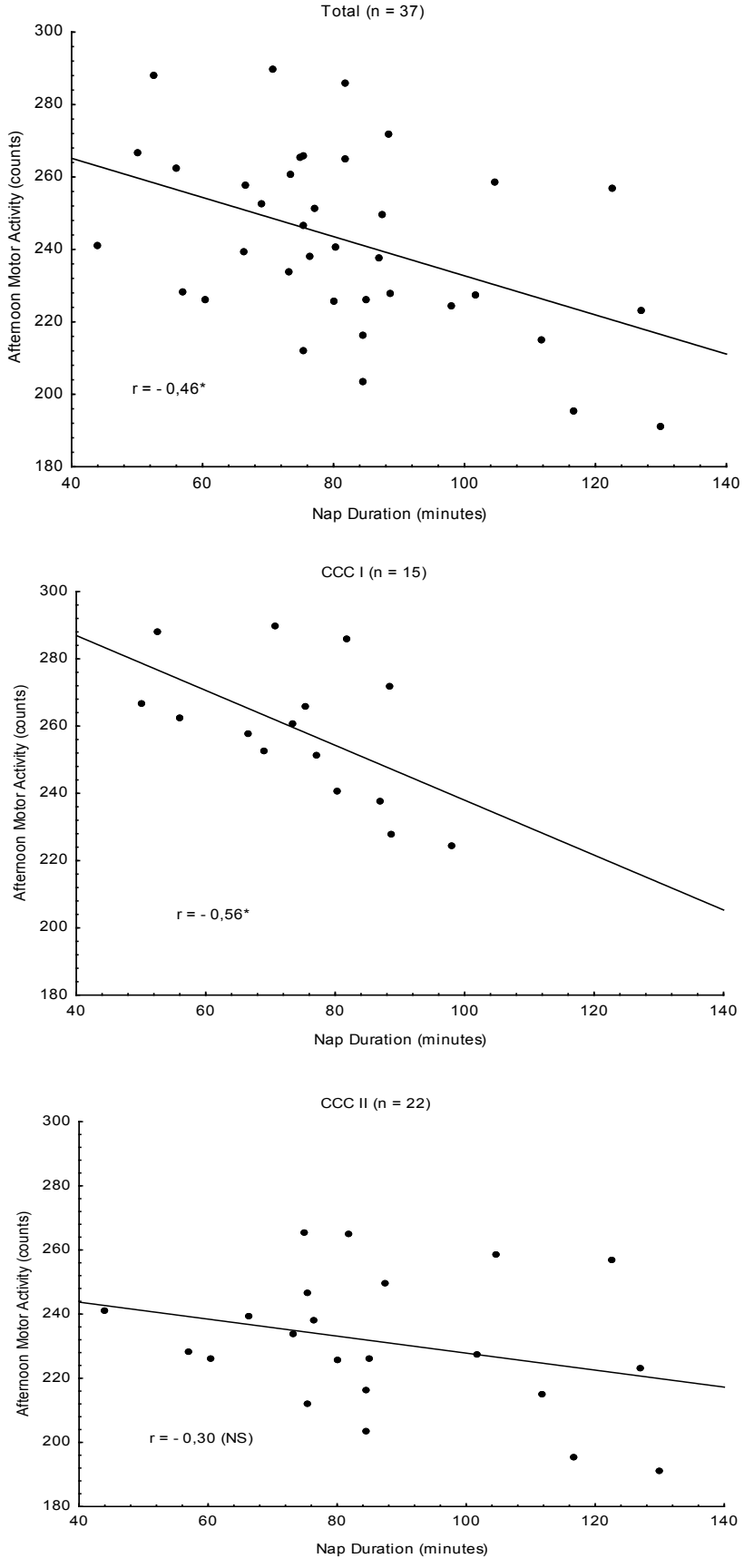
However, rather than motor activity differences between the CCCs, what is of greatest interest to our study is the way children from the same CCC behaved in the napping and non-napping conditions. While at CCC I napping did not influence the participants` motor activity, children from CCC II significantly increased their motor activity in the non-napping condition.

To try to understand why the condition variation affected the two groups differently, it is important to remember that the CCCs had different napping policies. At CCC I, children had the choice to stay awake at the time scheduled for napping. At CCC II, on the other hand, they were encouraged to always take a nap.

The frequency someone naps interferes in the sleep architecture of their naps. Individuals who nap less often sleep more deeply and, consequently, experience greater sleep inertia when they awaken[28]. The correlations between nap duration and the motor activity on nap days established here (Figure 2) are in consonance with these presumptions: Longer naps were significantly associated to a reduction in the subsequent motor activity only for children from CCC I, who napped less often than the ones from CCC II.

Our data suggest that previous exposure to nap

Figure 2. Relationship between nap duration and napping afternoon motor activity for the total sample and for each Child Care Center.



deprivation also interfered in the motor activity in the non-napping condition. Children who were not used to being nap deprived (CCC II) had a greater motor activity in this condition. In contrast, the ones more accustomed to not napping (CCC I) did not seem so affected by the deprivation since their motor activity was the same in both conditions.

Among the study limitations, it is the fact that nap duration was not standardized, which makes its replication and future comparisons difficult. Also, our results are only attributable to after lunch naps. For instance, previous studies have shown that effects of napping at noon[29] differ from the ones of napping in the mid-afternoon[30].

However, this design provided important data such as the real nap duration in the CCCs and the relationship between this variable and the subsequent motor activity of the participants.

Another limitation was that we only analyzed the participants` motor activity in the two-hour period following each condition. In future studies, it would be interesting to verify if napping influences children`s motor activity for longer (e.g. until bed time).

Finally, since our sample was limited to children in full-time child care, it is not clear whether our findings apply to children in different settings. In conclusion, napping reduced the motor activity of the participants and it may be a positive factor in the fight against infants` hyperactivity.

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