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## CARIES PREVALENCE IN A FINNISH RURAL POPULATION

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### INTRODUCTION

In summer 1966 a dental and genetic study was performed among the inhabitants of the Hailuoto island. In previous reports the participation rates and methods of investigation (*Alvesalo & Ainamo, 1968a*), the periodontal conditions (*Ainamo & Alvesalo, 1968*), the frequencies of removable dentures (*Alvesalo & Ainamo, 1968b*) and the inheritance of certain morphogenetic features of upper lateral incisors (*Alvesalo & Portin, 1969*) in this population have been described. In the present article the caries prevalence on the island will be reported.

### MATERIAL AND METHODS

Of the entire population of approximately 1300 inhabitants about 50% participated in the study (*Alvesalo & Ainamo, 1968a*). The DMF-S index was registered from 268 females and 263 males aged 12 years or over. All registrations were made by one investigator (L. A.) in a well equipped dental surgery.

Clinically observed decayed (D), missing (M) and filled (F) surfaces were recorded on diagnostic charts separately for each patient. Teeth decayed down to their roots were assigned index  $D=5$  and artificial crowns were recorded with  $F=5$ . Anterior teeth were registered as if filled on one surface when the

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mesial or distal filling was extended orally or facially only for retention. Extracted teeth were assigned index  $M=4$  providing they were not extracted because of crowding or other orthodontic problems. The DMF-S index of the individual was calculated as the sum of the partial indexes for 28 permanent teeth.

The material was grouped both by sex and by age. The age groups between 20 and 60 years comprised even decades. Teenagers were further divided into those in puberty (12—15 years) and those in their late teens (16—19 years) while females and males over 60 years of age were combined to form one age group only (60—79 years). In each age and sex group the frequencies of occurrence of decayed, filled, reduced or totally extracted dentitions were first assessed in per cent of the total materials. Thereafter the development through age of the DMF-S index as well as the partial D-S, M-S and F-S index values were determined separately for both females and males.

#### RESULTS

No intact full dentitions were found in the material.

Intact, but strongly reduced dentitions were presented by 15 examinees (3%) of whom 5 were females and 10 males. The numbers of remaining teeth in these dentitions varied from 2 to 8 (mean 5.9 teeth).

Decayed, but with fillings fully restored dentitions were found in two females of the age group 20—29 years. One of these women had 7 filled surfaces in 9, the other 27 filled surfaces in 17 remaining teeth.

In all the rest of the material, free from caries were only those who already had lost all their teeth.

*Frequency of disease* The occurrences of dentitions exhibiting decay (D), fillings (F) or extracted permanent teeth (M) are shown in Table I in per cent of the total materials of each age and sex group. For comparison, the total loss of teeth ( $M_T$ ) was separately registered. In the age groups 12—15 and 16—19 years, all girls as well as boys presented carious lesions on one or several tooth surfaces while the frequencies of dental restorations in these age groups varied from 93 to 97%. From age 20 the frequencies of occurrence of both caries and fillings showed continuously decreasing values through age in both sexes. The decrease was, however, faster in females and resulted in age group 50—59 years in maximal differences between sexes of 31% for caries and 14% for fillings. In the oldest age group (60—79 years) both caries and fillings were rare in females (12% and 2%) while males still showed a caries frequency of 34%.

Table I.

Percentages of dentitions showing decayed (D), filled (F) or missing (M) teeth in females and males of the various age groups. Total edentulousness ( $M_T$ ) is extracted from group M

Age	N	Females				Males				
		D	F	M	$M_T$	N	D	F	M	$M_T$
12—15	35	100%	97%	34%	0%	32	100%	97%	25%	0%
16—19	31	100%	97%	68%	0%	30	100%	93%	50%	0%
20—29	38	79%	68%	87%	13%	28	93%	64%	89%	7%
30—39	23	70%	48%	96%	30%	29	83%	55%	97%	14%
40—49	47	28%	13%	100%	68%	30	57%	20%	93%	33%
50—59	44	20%	5%	100%	80%	47	51%	19%	100%	45%
60—79	50	12%	2%	98%	84%	67	34%	4%	100%	52%
Total	268	52%	41%	85%	45%	263	67%	42%	83%	27%

Every third girl and every fourth boy in the age group 12—15 years had lost one or more of their permanent teeth (Table I). These frequencies had increased to the double in age group 16—19 years and approached a level of 100% after 30 years of age in both sexes. Total edentulousness ( $M_T$ ) was correspondingly first met with in age groups 20—29 years. In these and all following age groups males showed lower frequencies of loss of all teeth than females who after 50 years of age reached frequencies of 80—84%. This situation is graphically presented in Fig. 1 in which the curves for decayed (D) and totally extracted ( $M_T$ ) dentitions cross at age 40 for females and at age 60 for

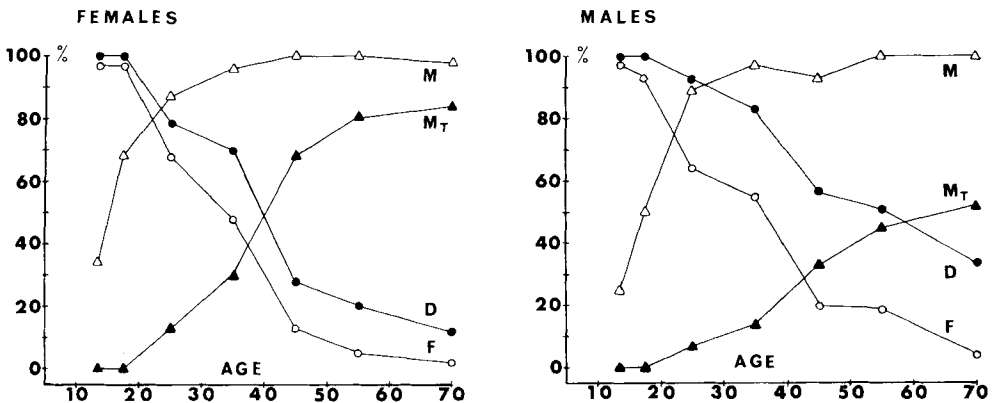


Fig. 1. Frequencies of occurrence of caries (D), fillings (F), missing teeth (M) and total edentulousness ( $M_T$ ) in females and males of various age groups.

Table II.

*Percentages of dentulous females and males showing decayed (D), filled (F) or reduced (M) dentitions in the various age groups*

Age	Females				Males			
	N	D	F	M	N	D	F	M
12—15	35	100%	97%	34%	32	100%	97%	25%
16—19	31	100%	97%	68%	30	100%	93%	50%
20—29	33	91%	79%	85%	26	100%	69%	88%
30—39	16	100%	69%	94%	25	96%	64%	96%
40—49	15	87%	40%	100%	20	85%	30%	90%
50—59	9	100%	22%	100%	26	92%	35%	100%
60—79	8	75%	13%	86%	32	72%	9%	100%
Total	147	95%	75%	73%	191	92%	58%	76%

males. The curves representing frequencies of filled (F) or reduced (M) dentitions show only minor differences between sexes.

The frequencies from Table I are shown separately for dentulous jaws in Table II. When total edentulousness was disregarded the caries frequency remained high in all age groups and in both sexes. A decrease with advancing age was, however, noticed in the frequencies of occurrence of dental restorations. Further, in controversy to Table I, dentulous females presented decay and fillings more often than males also in most age groups beyond 30 years.

*Severity of disease* Table III shows the means of the individual DMF-S index values per age and sex group. The continuous growth through age of the index values is illustrated graphically in Fig. 2 with reference to a previously published mean curve representing four studies from southern Finland. A comparison reveals that especially Hailuoto females presented above average DMF-S index values. Between the reference curve and the curves from Hailuoto there appeared, however, to be a difference not only in height level but also in form of the curves.

Table III further shows the composition of the DMF-S index values of their partial indexes D-S, F-S and M-S. The mean numbers of decayed surfaces (D-S) were highest (15.06—17.23) in both sexes of age group 16—19 years, whereafter the D-S index decreased with age faster in females than in males. In age groups past 50 years females thus presented an average of only 2—3 decayed surfaces and males an average of about 11 surfaces per person.

The greatest average numbers of filled surfaces (F-S) were found in males under 20 years of age (9.37—9.75) and in females under 30 years of

Table III.

Mean DMF-S index values and their composition of partial index values of decayed (D-S), filled (F-S) and missing surfaces (M-S)

Age	N	Females				Males				
		D-S	F-S	M-S	DMF-S	N	D-S	F-S	M-S	DMF-S
12—15	35	10.23	12.43	2.63	25.29	32	9.03	9.75	1.50	20.28
16—19	31	15.06	12.52	14.45	42.03	30	17.23	9.37	6.80	33.40
20—29	38	7.95	11.53	40.47	59.95	28	14.68	4.29	26.00	44.96
30—39	23	10.57	6.17	56.70	73.43	29	11.66	4.52	39.86	56.03
40—49	47	2.83	1.30	95.66	99.79	30	7.00	2.27	73.60	82.87
50—59	44	1.89	0.11	102.09	104.09	47	10.74	1.15	72.34	84.23
60—79	50	2.98	0.14	102.88	106.00	67	10.72	0.24	80.00	90.96
Total	268	6.47	5.51	65.35	77.33	263	11.36	3.73	49.83	64.92

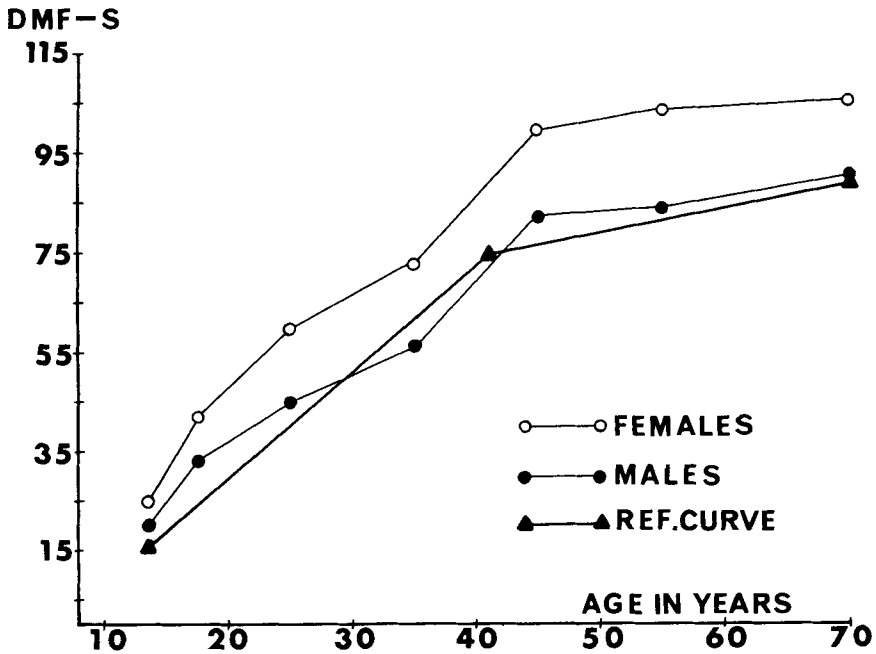


Fig. 2. The increase of DMF-S values through age in Hailuoto females and males as compared with an earlier published curve based on studies of four separate Finnish populations (Hammaslääkärikomitean Mietintö 1965).

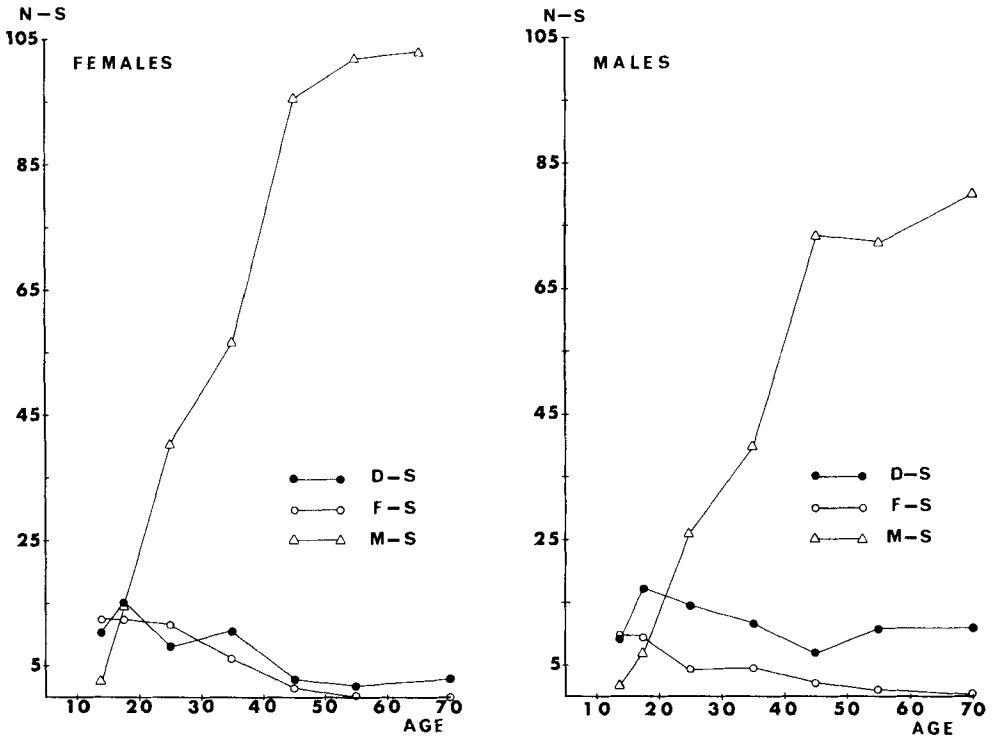


Fig. 3. Development through age of the partial index values for decayed (D-S), filled (F-S) and missing (M-S) surfaces.

age (11.53—12.52). In only one age group (females 20—29 years) the mean number of filled surfaces (11.53) was higher than the corresponding mean D-S index value (7.95). In males over 20 and in females over 30 years of age the F-S index values decreased strongly with advancing age. All age groups brought together females appeared to have almost one filled for every decayed surface while in males an average of four decayed for every one filled surface were registered (Table III).

The mean numbers of extracted surfaces (M-S) showed rapid growth in females from 2.63 in the youngest to 102.88 in the oldest age group. In all age groups males showed somewhat lower M-S index values than females. In both sexes, however, the M-S index values contributed alone to more than half of the total DMF-S index values already after 20 years of age.

The rapid growth through age of the M-S index as compared with the D-S and F-S index values is presented graphically separately for females and males

in Fig. 3. Especially in females aged 45 years and over the M-S index proved to be almost identical with the total mean DMF-S index values (see also Table III).

#### DISCUSSION

As shown in Fig. 2 the inhabitants of the Hailuoto island presented in general poorer dental conditions than earlier studied Finnish populations (Hammaslääkärikomitean Mietintö, 1965). Even in the youngest age group, after receiving free dental care in public school, 100% of both girls and boys presented a mean number of about 10 decayed tooth surfaces per individual (Tables I & III). Little interest for maintenance of their dental conditions was shown by representatives of both sexes in age group 16—19 years in which the mean D-S index values had increased 50—100% since puberty (Table III). The mean numbers of filled surfaces showed no increase during the same age period (Table III, Fig. 3).

Loss of permanent teeth was registered in 34% of the girls and 25% of the boys of the youngest age group (Table I) and already in age group 20—29 years the M-S index values contributed to about two thirds of the female and close to half of the male total DMF-S index values (Table III, Fig. 3). Paralleling a seeming decrease of decay and fillings, the frequencies of extracted teeth as well as of total edentulousness showed steadily increasing values with advancing age especially in females (Tables I & III, Figs. 1 & 3), which resulted in a total mean of about 6 times as many extracted (65.35) as decayed and filled (6.47 + 5.51) surfaces in the total female material (Table III).

The high caries frequency was no doubt the main causative factor in the continuous loss of teeth. Already in age group 16—19 years close to half of the caries susceptible tooth surfaces of girls and about two thirds of corresponding tooth surfaces of boys were either decayed, filled or extracted (Table III, Fig. 3). Also in older age groups, in which the most caries susceptible teeth presumably had been removed, the caries frequencies remained very high in those persons who still had one or more of their own teeth left (Table II). Between age groups 30—39 and 40—49 years there was noticed, however, an irrelevant increase of close to 100% in the mean numbers of extracted surfaces (Table III, Fig. 3) which also in Fig. 2 becomes visible as an abrupt increase of the total DMF-S values. This finding may partly be explained by the fact that periodontal destruction at this particular age reached a level of severity which leads to additional extractions (*Ainamo & Alvesalo, 1968*). More difficult to define is the influence of the simultaneously increasing frequency of removable dentures (*Alvesalo & Ainamo, 1968b*) which

probably includes extractions also of sound teeth on so called prosthetic indications. According to *Lundqvist* (1967) about 30% of all extracted teeth in Sweden are removed to make place for dentures while the corresponding percentage had been reported to be only 4% in Denmark (*Bay & Gad*, 1967).

The total def, DMF and DMF-S indexes have also earlier been criticized as misleading indicators of the need for caries treatment (*Kihlberg & Koski*, 1954; *Rantanen*, 1955). These indexes seem best suitable for materials comprising permanent teeth of children or dentally well informed and motivated adults of medium or high income groups. In such populations the DMF-S index in particular effectively reflects even minor changes in the caries situation. When dental care is poor the above mentioned index systems, especially in an adult rural population like the one now studied, mainly reflect the numbers of extracted teeth or dentitions (Fig. 2) and also the rate of extraction becomes in older age groups affected by causative factors other than caries. A better understanding of the need for caries treatment is reached only by frequency studies (Tables I & II, Fig. 1) and by using the partial indexes separately for decayed, filled and extracted surfaces (Table III, Fig. 3).

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#### SUMMARY

In summer 1966 the caries prevalence in a total of 531 inhabitants of the Hailuoto island were examined. All examinees were 12 years old or older, their distribution was 268 females to 263 males and only conditions of permanent teeth were registered.

Carious tooth surfaces were presented by all girls and boys aged 12—19 years. After 20 years of age a decrease of caries incidence in both sexes was registretred parallely with an increase of occurrence of tooth loss and total edentulousness. In dentulous persons the frequency of caries remained high in all age groups. Filled tooth surfaces were presented by 93—97% of all teenagers but only by 9—35% of dentulous adults over 50 years of age.

Already in age group 16—19 years the DMF-S index revealed girls to have close to half (DMF-S=42.03) and boys about one third (DMF-S=33.40) of their caries susceptible tooth surfaces either decayed, filled or extracted. In age group 20—29 years the partial index M-S constituted about two thirds of the female and over half of the male total DMF-S index values. Between age groups 30—39 and 40—49 years there was registered a twofold increase of the M-S index values of both sexes which was suggested partly to result from an increased rate of periodontal destruction at this particular age. In

females over forty years of age the mean numbers of extracted tooth surfaces ( $M-S=95.66-102.88$ ) were almost equal to their total DMF-S index values ( $99.79-106.00$ ).

The value of the DMF-S index as an indicator of the need for caries treatment was discussed. In adult rural populations like the one presently studied, the use of caries frequency analysis as well as of the partial index values D-S, F-S and M-S were recommended.

#### RÉSUMÉ

##### PRÉVALENCE DE LA CARIE DANS UNE POPULATION RURALE FINLANDAISE

Au cours de l'été 1966, la prévalence de la carie a été étudiée chez un total de 531 habitants de l'île de Hailuoto. Tous les sujets examinés étaient âgés de 12 ans ou plus, répartis en 268 sujets du sexe féminin et 263 du sexe masculin; seul l'état des dents permanentes a été enregistré.

Tous les jeunes gens et jeunes filles de 12 à 19 ans présentaient des surfaces dentaires cariées. Après l'âge de 20 ans, on enregistrerait une diminution de l'incidence de la carie dans les deux sexes, parallèlement à une augmentation du nombre de dents absentes et du nombre de cas d'édentation totale. Chez les personnes non édentées, la fréquence de la carie restait élevée dans tous les groupes d'âge. Chez 93—97 % des jeunes de 13—19 ans, on constatait des surfaces dentaires obturées, alors que la proportion correspondante pour les adultes non édentés de plus de 50 ans était seulement de 9—35 %.

Dans le groupe d'âge de 16—19 ans, l'indice CAO/f (DMF-S) révélait déjà que chez les jeunes filles presque la moitié ( $CAO/f=42,03$ ) et chez les jeunes gens environ un tiers ( $CAO/f=33,40$ ) des faces dentaires susceptibles d'être cariées étaient soit cariées, soit obturées, soit extraites. Dans le groupe d'âge 20—29 ans, l'indice partiel A/f (M-S) représentait pour le sexe féminin environ les deux tiers et pour le sexe masculin plus de la moitié des valeurs totales de l'indice CAO/f. Entre les groupes d'âge 30—39 et 40—49 ans, on constatait que les valeurs de l'indice A/f des deux sexes étaient passées du simple au double, ce qui pourrait en partie être imputé à une augmentation du degré de destruction parodontale particulièrement à cet âge. Chez les femmes de plus de quarante ans, les moyennes du nombre de surfaces dentaires extraites ( $A/f=95,66-102,88$ ) atteignaient presque les valeurs totales de leur indice CAO/f ( $99,79-106,00$ ).

La valeur de l'indice CAO/f en tant qu'indicateur du besoin de traitements de la carie fait l'objet d'une discussion. Dans des populations rurales adultes

telles que la population étudiée ici, l'utilisation conjuguée d'analyse de la fréquence des caries et des valeurs des indices partiels C/f, O/f et A/f est recommandée.

#### ZUSAMMENFASSUNG

##### KARIESBEFALL BEI DER LANDBEVÖLKERUNG EINES FINNISCHEN DISTRIKTS

Im Sommer 1966 wurde der Kariesbefall von insgesamt 531 Bewohnern der Hailuoto Insel untersucht. Alle Probanden waren 12 Jahre oder älter, darunter 268 weiblichen und 263 männlichen Geschlechts. Dabei wurde nur der Zustand der bleibenden Zähne registriert.

Kariöse Zahnflächen zeigten sich bei allen Mädchen und Jungen im Alter von 12—19 Jahren. Nach dem 20. Lebensjahr wurde eine Abnahme des Kariesbefalls bei beiden Geschlechtern festgestellt, wobei sich parallel dazu Zahnverlust und völlige Zahnlosigkeit häuften. Bei Personen mit vollbezahntem Gebiss blieb die Kariesfrequenz in allen Altersgruppen hoch. Gefüllte Zahnflächen fanden sich bei 93—97 % aller Probanden bis 20 Jahren, aber nur bei 9—35 % der vollbezahnten Erwachsenen über 50 Jahren.

Schon in der Altersgruppe von 16—19 Jahren erwies der DMF-S-Index, dass bei Mädchen nahezu die Hälfte (DMF-S = 42,03) und bei Jungen über ein Drittel (DMF-S = 33,40) der kariesanfälligen Zahnflächen entweder kariös, gefüllt oder extrahiert waren. In der Altersgruppe von 20—29 Jahren machte der Teilindex M-S über zwei Drittel der Total-DMF-S-Indexwerte bei Frauen und über die Hälfte bei Männern aus. Zwischen der Altersgruppe 30—39 und 40—49 Jahre wurde eine Verdoppelung der M-S-Indexwerte beider Geschlechter gefunden, was zum Teil darauf zurückgeführt werden könnte, dass die Rate der parodontalen Zerstörung besonders in diesem Alter ansteigt. Bei Frauen über 40 Jahren waren die Durchschnittszahlen extrahierter Zahnflächen (M-S = 95,66—102,88) fast gleich ihren Total-DMF-S-Indexwerten (99,79—106,00).

Es wurde der Wert des DMF-S-Index als Indikator für die Notwendigkeit der Kariesbehandlung diskutiert. Bei der erwachsenen Landbevölkerung wie der gerade untersuchten wurde die Anwendung der Kariesfrequenzanalyse sowie der Teilindexwerte D-S, F-S und M-S empfohlen.

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