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The approach to beautiful Loetschental Valley, Switzerland. The inhabitants of the valley until recently have been isolated from access to modern foods, and have had almost complete immunity to tooth decay.

Beginning In This Issue: **WHY DENTAL CARIES WITH MODERN CIVILIZATION?**  
By Weston A. Price, D.D.S., M.S., F.A.C.D.

# WHY DENTAL CARIES WITH MODERN CIVILIZATIONS?\*

## 1. FIELD STUDIES IN PRIMITIVE LOETSCHENTAL VALLEY, SWITZERLAND

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ARE our modern civilizations worth the price we pay for them in loss of teeth and impaired health? Is it necessary? These questions have suggested the desirability of adding to our studies of modern civilizations the study of remnants of primitive civilizations for the secrets underlying their freedom from tooth decay and their admirable physiques. To the dental profession the concern is primarily for the development and continued efficiency of the dental organs. To humanity at large and all health interests the concern is for the development and preservation of the body in a state of high efficiency. In researches in all fields of biology which relate directly to human needs, the ultimate control is always provided in the great human clinic.

Just as generations come and go, so do civilizations. Each succeeding civilization has laid away records of physical development and skeletal perfection which can be exhumed thousands of years after they were made. No part of our ancestral bodily fitness has been so carefully preserved for our inspection as the quality of the teeth, the most permanent of all the body structures. Their resistance to disintegration constitutes the most important single factor underlying the science of anthropology. Just as obtains today, these prehistoric peoples and their teeth were the products of their foods. But what did they eat? This is the question with which we are profoundly concerned since they were able to develop teeth of perfection in form and structure, supported in arches of uniform symmetry and stability, such as to make our modern civilizations appear in comparison far less efficient in the matter of body building.

In practically all parts of the world one of the first effects of our so-called modern civilizations is to destroy the efficiency of the teeth. Whereas our primitive ancestors with their primi-

tive diets were capable of developing and maintaining teeth almost 100 per cent free from dental caries, our modern civilizations completely fail in this regard, since nearly 100 per cent of the people suffer more or less from rampant tooth decay in certain periods of life. It is strange that so little effort has been made to inquire of remaining primitive peoples as to their habits of living and the selection of foods as standards of comparison; instead, the research has been largely conducted by searching the disintegrated tooth for the causative factors, which, alas, are not there. It is as though we would find the nature of lightning by studying the tree that had been killed by a bolt.

My approach to this problem has placed much emphasis on the direct effects of foods as made possible by the newer knowledge of vitamins and minerals as essential factors in nutrition. These effects have recently been made measurable with improved chemical procedures. The advance made possible by these methods has included clinical demonstrations that the control and prevention of dental caries are now possible by these means.<sup>1</sup> It remained, however, to be demonstrated that these vitamins and minerals were the controlling factors in the efficient diets of primitive people living on primitive foods.

Accordingly I undertook to study primitive peoples and their foods. This study included first an extended correspondence and search of the literature followed by field studies to find, if possible, remnants of those stalwart specimens of human development whose isolation has been their preservation. When the skulls of a group of 20,000 persons who were buried in a single valley were exhumed and examined, the teeth showed a remarkable freedom from decay, whereas the people living in that valley today have practically all suffered from dental caries and many

of them in its most rampant form. Something has radically changed.

In my studies of the vitamin content in food, as emphasized in several research reports,<sup>2</sup> I found the vitamin content of milk and butter-fat to vary through a wide range in different places at the same season of the year and at different seasons of the year in the same places, and further, that the health levels of these places as indicated by morbidity and mortality data were practically always in the opposite phase with the vitamin levels as shown in this butter-fat product of grazing animals, thus seeming to be directly related to vital phenomena. While this vitamin factor tended to be higher in the summer than in the winter, it clearly did not follow the sunshine curve but did follow the quality of the pasturage or available food of the dairy animals. Rapidly growing young grass was practically always found to be the characteristic of the nutrition of the animals giving the high vitamin dairy products.

Some of the best samples of dairy products come from mountain valleys in the summer season or from the far north and far south latitudes. If milk and milk product vitamins as provided in various dairy products can be an important contributing factor to physical well-being, including dental health and freedom from caries for persons making dairy products an

<sup>2</sup>Price, W. A.: Calcium and Phosphorus Utilization in Health and Disease: I. The Role of the Activators for Calcium and Phosphorus Metabolism. II. The Nature and Source of Calcium and Phosphorus Activators. III. Seasonal Variations in Butter-Fat Vitamins and Their Relation to Seasonal Morbidity (102).<sup>\*</sup> *Certified Milk*, October, November, December, 1929. Some Contributing Factors to the Degenerative Diseases, with Special Consideration of the Role of Dental Focal Infections and Seasonal Tides in Defensive Vitamins (107).<sup>\*</sup> *Dental Cosmos* 72:1049 (October); 72:1119 (November) 1930. New Light on the Control of Dental Caries and the Degenerative Diseases (108).<sup>\*</sup> *J. A. D. A.* 18:1189 (July) 1931. Some Means of Improving Human Life by Increasing the Vitamin Content of Milk and Its Products (110).<sup>\*</sup> *Bull. Internat. Assn. Milk Dealers*, January 29, 1931. New Light on Some Relationships Between Soil Mineral Deficiencies, Low Vitamin Foods and Some Degenerative Diseases, Including Dental Caries with Practical Progress in Their Control (123).<sup>\*</sup> *Bull. Indiana State Dent. Assn.*, September, 1932.

<sup>\*</sup>These numbers given in parenthesis are the author's personal serial references for the convenience of those desiring reprints of these articles.

<sup>1</sup>Price, W. A.: Control of Dental Caries and Some Associated Degenerative Processes Through Reinforcement of the Diet with Special Activators (118).<sup>\*</sup> *J. A. D. A.* 19:1339 (August) 1932.

<sup>\*</sup>These reports are complementary to a detailed study, to be published in book form, which will deal with the etiology and control of dental caries and associated degenerations.

important part of the diet, people sufficiently dependent on this product might be found to have high immunity. Similarly if native natural foods, including entire cereals, contain something unique and fundamental for the development of animal life, including human beings, this could also be studied in such communities.

With vitamins and minerals as the clue we went to Enrope in 1931 and 1932 to search for groups of people situated in isolated districts who were sufficiently protected from modern civilization to compel them to eat only the natural foods and prevent them from substituting modern commercial foods. If these conditions could be found there would be provided a basis for a critical analysis of the controlling factors in primitive life in such a community. Mrs. Price has assisted splendidly in these field studies, both in the capacity of a dental assistant in sterilizing instruments and keeping records and especially in managing the groups of frightened children in such a way as to win their confidence. A shining coin always went a long way as a reward to those who gave good cooperation.

Officials of the Swiss government were accordingly consulted relative to the possibility of finding people in Switzerland whose physical isolation provided an adequate protection. We were told that the very physical conditions that would prevent such people from getting out to obtain modern foods or would prohibit commercial invasion would also prevent us from reaching them without hardship. However, owing to the completion of the Loetschberg tunnel, eleven miles long, and a railroad that crosses the Loetschental valley at a little less than a mile above sea level, as a part of a shortened railroad route to Italy, a group of about 2,000 people have recently been made easily accessible for study. Practically all the human requirements of the people in that valley, except a few items like sea salt, for centuries have been produced in the valley.

A bird's eye view of the Loetschental valley, looking toward the entrance, is shown on the front cover. The people of this valley have had a history covering more than a dozen centuries. The architecture of their wooden buildings, some of them several centuries old, indicates a love for simple stability, always adapted to expediency and efficiency, but not of the skyscraper variety. Artistically designed mottoes, many of them centuries old, are seen carved deeply into the heavy supporting timbers,

both within and without the buildings, and are always expressive of devotion to cultural and spiritual values rather than material values. These people have never been conquered although many efforts have been made to invade their valley. Except for the rugged cleft through which the river descends to the Rhone valley, the Loetschental valley is almost completely enclosed by three high mountain ranges which are usually snow-capped. This pass could always be guarded by a small band against all possible attacking forces since artificial landslides could easily be released. The natural occurrence of these landslides has made the passage through the gorge hazardous, if not impossible, for months of the year. According to early legends of the valley, these mountains were the parapets of the universe, and the great glacier of the valley, the end of the universe. This glacier is a branch of the great ice field that stretches away to the west and south from the ice-cap of the Jungfrau and Monch. These mountains, however, are seldom approached from this direction because of these hazardous ice fields. The gateway to them with which the traveling world is familiar is from Interlaken by way of the Lauterbrunnen or Grindelwald valleys.

At the altitude of the Loetschental valley the winters are long and the summers short but beautiful and accompanied by extraordinarily rapid and luxuriant growth. The meadows are fragrant with Alpine flowers, with violets like pansies which bloom all summer in deepest hues.

The people of the Loetschental valley are a community of two thousand who have been a world unto themselves with neither physician nor dentist because they have so little need for them; nor do they have a policeman or a jail, nor need for them. The clothing has been the substantial homespuns made from the wool of their sheep. The valley has produced not only everything that is needed to wear but practically everything that is needed to eat. It has been the achievement of the valley to build some of the finest physiques in all of Europe. This is attested by the fact that many of the famous Swiss guards of the Vatican at Rome, who are the admiration of the world and the pride of Switzerland, have been selected from this valley, and it is every Loetschental boy's ambition to be a Vatican guard. Notwithstanding the fact that tuberculosis is the most serious disease of Switzerland as stated to me by a government official, a recent report of inspection of this

valley did not reveal a single case. This was also told to me by the physician who made the inspection.

The people live largely in a series of villages dotting the valley along the river banks. The land that is tilled, chiefly for producing hay for feeding the cattle in the winter and rye for feeding the people, extends from the river and often rises steeply toward the mountains which are wooded with timber so precious for protection that little of it has been disturbed. Fortunately, there is much more on the vast extent of the mountain sides than is needed for the relatively small population. The forests have been jealously guarded since they are so greatly needed to prevent slides of snow and rocks which might engulf and destroy the villages. The valley has a splendid educational system of alternate didactic and practical work, which requires all children to attend school six months of the year and the other six months aid with the farming and dairying industry in which young and old of both sexes take part. The school system is under the direct supervision of the Catholic church, and the work is well done. The girls are also taught weaving, dyeing, and garment making. The manufacture of wool and clothing is the chief homework in the winter for the women.

No trucks or even horses or wagons, let alone tractors, are available to bear the burdens up and down the mountain sides. This is all done on human backs for which the hearts of the people have been made specially strong.

We are primarily concerned here with the quality of the teeth and the development of the faces that are associated with such splendid hearts and unusual physiques. I made studies of both adults and growing boys and girls, during the summer of 1931, and arranged to have samples of food, particularly dairy products, sent to me about twice a month, summer and winter. Since that time these products have been tested for their mineral and vitamin contents, particularly the fat-soluble activators. These samples are found to be high in vitamins and much higher in comparison than the average samples received from sources of commercial dairy products in American and European places.

Hay is cut for winter feeding of the cattle, and this hay grows rapidly. The hay proved on chemical analysis, which was made at my laboratory, to be far above the average for pasture and storage grasses. Almost every household has goats or cows or both. In the summer the cattle seek the

higher pasturage lands and follow the retreating snow which leaves the lower valley free for the harvesting of the hay and rye and the turning of the soil by hand, since there are neither plows nor draft animals to drag the plows, in preparation for the next year's rye crop. A limited amount of garden stuff is grown, chiefly green foods for summer use. While the cows spend the warm summer on the verdant knolls and wooded slopes near the glaciers and fields of perpetual snow, they have a period of high and rich productivity of milk. The milk constitutes an important part of the summer's harvesting. While the men and boys gather in the hay and rye the women and children go in large numbers with the cattle to collect the milk and make and store cheese for the following winter's use. This cheese contains the natural butter-fat and minerals of the splendid milk and is a virtual storehouse of life for the coming winter.

I have been fortunate in having a helpful and happy contact with the distinguished prior of the valley who has been one of my principal interpreters. From him I have been able to learn much about the life and customs of these people. He has told me how they have recognized the presence of divinity in the life-giving qualities of the butter made in June when the cows have arrived for pasturage near the glaciers; how he gathered the people together to thank the kind Father for the evidence of his Being in the life-giving qualities of the cheese made when the cows ate the grass near the snow line. This worshipful program included the lighting of a wick in a bowl of the first butter made after the cows have reached the luscious summer pasturage. This wick is permitted to burn in a special sanctuary built for this purpose. The natives of the valley, without understanding its scientific significance, are able to recognize the superior quality of their June butter, and, without knowing exactly why, pay it due homage.

In one of our favorite childhood stories, we are told of the almost supernatural restoration of the little, sick and crippled heroine, for whom the book is named, Heidi, who was carried to the lovely mountainside cottage to drink the milk of the goats that feed on the luxuriant pasture and to eat the bread made of the whole rye of these fertile valleys. This is an event of frequent experience in the local legendary of the valley.

The nutrition of the people of the Loetschental valley, particularly that

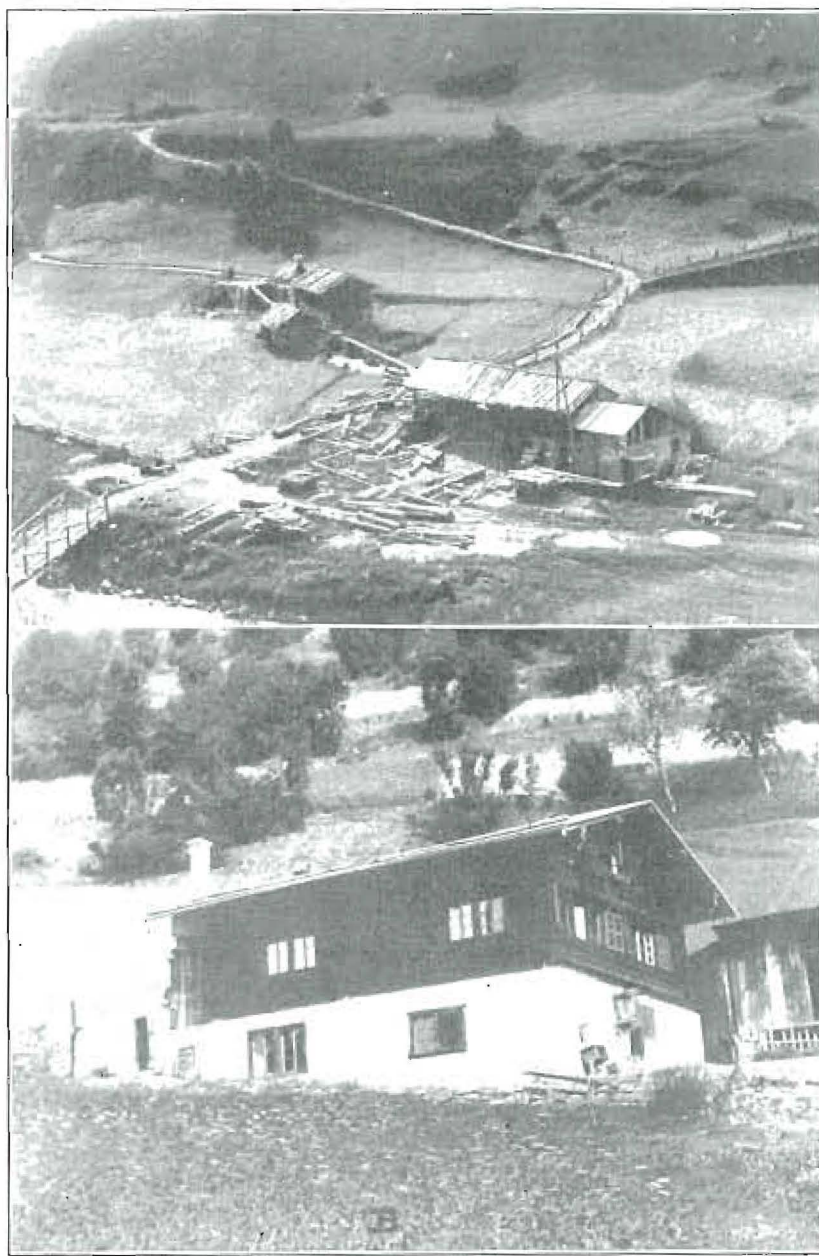


Fig. 5—Important factors in primitive immunity and modern susceptibility to dental caries. A, The water-driven municipal plants of Kippel, Loetschental, including, from left to right, the laundry, the grist mill producing entire grain flour and meal, the saw mill and the electric light plant. B, The new bakery, providing white breads and cakes to the valley, located at Kippel.

of the growing boys and girls, consists largely of a slice of whole rye bread and a piece of the summer-made cheese, about as large as the slice of bread, which are eaten with fresh milk of goats or cows. Meat is eaten about once a week. In the light of our newer knowledge of activating substances, including vitamins, and the relative values of food for supplying minerals for body building, it is clear why they have such healthy bodies and sound teeth. The average total fat-soluble activator and mineral intake of calcium and phosphorus of these children would far exceed that of the daily intake of the aver-

age American child. The sturdiness of the childlife permits them to play and frolic bareheaded and barefooted even in water running down from the glacier in the late evening's chilly breezes, in weather that made us wear our overcoats and gloves and button our collars. Some of these sturdy children are shown in Fig. 3 dressed in their homespuns. Of all the children in the valley still using the primitive diet of whole rye bread and dairy products the average number of cavities per person was 0.3, or three persons would have to be examined on an average to find one defective deciduous or permanent



Fig. 1—Peaceful Kippel, the principal village of the beautiful valley of Loetschental, looking eastward.



Fig. 2—The dairy cows and goats provide the fat-soluble vitamins in the Alps. They seek the rapidly growing young grass near the melting snows. This grass is richer in both minerals and vitamins.



Fig. 3—Typical child life of the Loetschental valley.

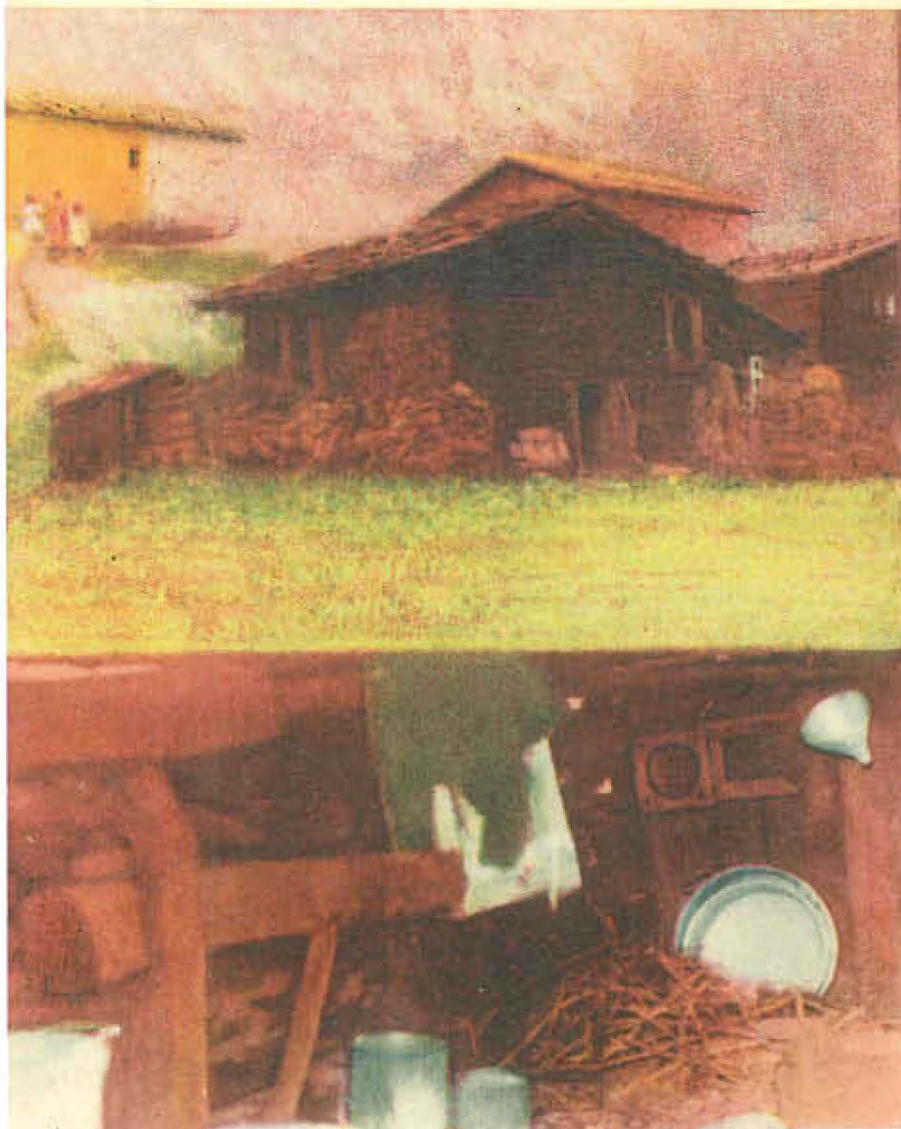


Fig. 4—A typical home in Fafleralp, Loetschental valley, near the glacier. Only natural foods are used, and these are chiefly dairy products and rye. The people of the valley have high immunity to dental caries.

tooth. The children examined were between 7 and 16 years of age.

The evening light of the valley varies according to the position and altitude, from rapidly darkening shadows in the deeper glades between the mountains, comparable to early evening darkness of the winter season on the plains, to the long brilliant twilight of summer of northern latitudes on the higher sides of the valley. Long after the lights in the cottages in the lower valley have been lighted the sun may be seen shining on the great snow-capped domes of the surrounding mountains, gilding the fringes of the snowy ramparts and bathing the parapets, which are buttressed by these ramparts, until they gleam like massive searchlights throwing their reflected shafts of dazzling light into nooks and corners of the forest glades of the mountain side. Then, as the sun passes below the distant horizon and lights the west with a crimson brilliance, these watch-towers change in color reflecting the glory of various cloud banks which are flinging back the rainbow hues of the sunset. This is the majesty of the Alpenglüh. Far into the night these beacons signal to the dwellers of the valley their message of peace that all is well, that they are on guard, and promise them, "Tomorrow you too will be guardsmen."

If one is fortunate enough to be in the valley in early August and witness the earnestness with which the people celebrate their national holiday he will be privileged to see a sight long to be remembered. These celebrations close with the gathering together of the mountaineers on various crags and prominences where great bonfires are lighted from fuel that has been accumulated into an enormous mound to make a huge torch-light. These bonfires are lighted at a given hour from end to end of the valley throughout its expanse. Every mountaineer on a distant crag seeing the lights knows that the others are signaling to him that they, too, are making their sacred consecration in song which is *one for all and all for one*. This motive has been crystallized into action and has become a part of the very souls of the people. One understands now why doors do not need to be bolted in the Loetschental valley. How different the level of life and horizon of such souls from those in many places in the so-called civilized world in which people have degraded until life has no interest in values that cannot be expressed in gold or pelf, which they would obtain even though the life of the person being cheated or robbed would there-

by be crippled or blotted out. One immediately wonders if there is not something in the life-giving vitamins and minerals of the food that builds not only great physical structures within which their souls reside but builds minds and hearts capable of a higher type of manhood in which the material values of life are made secondary to individual character.

Our quest has been for information relative to the health of the body, the perfection of the teeth, and the normality of development of faces and dental arches in order that we might through an analysis of the foods learn the secret of such splendid body building and learn from the people of the valley how the nutrition of all groups of people may be reinforced so that they too may be free from mankind's most universal disease, tooth decay and its sequelae. These studies included not only a physical examination of the teeth, the photographing of subjects, the recording of voluminous data, obtaining samples of food for chemical analysis with detailed information regarding daily menus but also the collecting of samples of saliva for chemical analysis to test out my newly developed procedure for estimating the levels of immunity to dental caries of a person at a given time as outlined in recent research reports.<sup>3</sup> In addition bacterial cultures were made from the mouths. The saliva samples were preserved by

<sup>3</sup>Price, W. A.: *The Experimental Basis for a New Theory of Dental Caries, with Chemical Procedures for Determining Immunity and Susceptibility* (124). *Dental Cosmos* 74:1139 (December) 1932. *New Light on the Cause and Control of Tooth Decay in Man, from Field Studies of Primitive Districts Providing Immunity* (132). Read before the American Association for the Advancement of Science, December 30, 1932, to be published.

an addition of formalin equivalent to 1 per cent.

These children will be reexamined in succeeding years for making comparative studies to observe particularly the effect of the changes in the local nutritional programs. Some of these changes are already in progress as illustrated in Fig. 5, in which will be seen a modern bakery dispensing white bread and many white flour products, which I found in full operation when I returned for further studies in 1932.

In Fig. 2 is shown a typical scene of the dairy herds pasturing in contentment on the luscious grass near the glaciers. They typify a familiar inscription found in a chalet at Weitzalp which reveals the recognition of the life-giving qualities of the highest verdure which during its limited period of growth has greatest acceleration. Translated, it reads as follows:

*Whence comes the longing for the Alp? Who is able to tell it?*

*Why are the swallows drawing to the fresh north in the spring?*

*Why are the woodpeckers ascending with the greening boughs of*

*Larch trees to the limit of the forest?*

*Why even the domestic animals are seeking in summer the highest pastures near the glaciers?*

In the center of the picture between the cows and the glacier is seen a group of homes of mountaineers. A closeup of one of these homes is shown in Fig. 4 in which will also be seen two of the children residing therein. They, like the others of the Falferalp



Fig. 6—Mothers and children work in the fields.

community, have a high immunity to dental caries and fine physical development. They clearly are the product of their food which is almost entirely whole rye bread and dairy products.

A view of the valley looking east from our boarding house window at Kippel is shown in Fig. 1. The glacier is seen in the distance and the valley dotted with villages.

The hardihood of the peasants of all ages is well illustrated in Fig. 6 which shows a picture of an elderly

mother with two children as they return home after their harvesting in the fields.

This brief account of the people of this district, the Loetschental valley in the Bernes Oberland, Switzerland, is one of several studies. The next installment will be a study of isolated groups in the canton of Wallis (Valais) south of the Rhone valley toward the Italian frontier. I will later undertake to interpret the nutritional programs and foods both for communities providing high levels of immunity and for those communities

where immunity has been lost, often situated near one another.

*(End of First Installment)*

COMING:

- II. Field Studies in Primitive Valais Districts, Switzerland
- III. Field Studies in Modernized St. Moritz and Herisau, Switzerland
- IV. Field Studies in Primitive and in Modern Outer Hebrides, Scotland
- V. Practical Procedures for the Nutritional Control of Dental Caries